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Financial incentives and job choice

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Marloes Lammers

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Chapter 1

Introduction

A typical individual searches for a (new) job multiple times during his working career. During this search process, he decides how much effort to put into the search for a new job. And when a job offer is made, he decides whether or not to accept the offer. This thesis highlights some financial incentives influencing this search process. Chapter 2 and 3 consider unemployed individuals and their search for jobs, whereas Chapter 4 considers the job transition decision of employees.

A first set of factors influencing the time and effort that individuals put into the search for a job are individual and household characteristics, such as health, family composition, gender and non-labour income. The amount of savings in a household is important as well: wealthy individuals can use their assets to add to their income during a period of unemployment, thereby decreasing the need for a job. A household's asset holdings is of increasing importance as a determinant of search, as in many countries the maximum potential benefit duration of unemployment benefits decreased in the period 2002-2012 (OECD, 2004; OECD, 2014). Households therefore increasingly rely on their individual wealth holdings in order to overcome a spell of unemployment. Chapter 2 examines to what extent unemployed individuals postpone their (re-)entrance to the labour market as a consequence of high wealth holdings. A theoretical model predicts that wealth increases unemployment duration by influencing search effort negatively, and reservation wages positively.[1] These theoretical results are empirically tested by estimating reduced form

[1] The reservation wage is the minimum wage at which the individual will accept the job offer.

equations for reservation wages and search intensity using Dutch survey data. It is shown that higher wealth holdings indeed increase the reservation wage and decrease the number of times that individuals apply to jobs within two months. Both effects are small but significant. Policy makers designing policy which affect the savings decisions should be aware of the negative effects of savings on unemployment duration. For example, suppose a policy maker would like to decrease unemployment duration by decreasing unemployment protection. It is important to realize that decreased unemployment protection leads to a higher probability of getting fired and risk-averse individuals will therefore start to save more in periods of employment. This in turn results in higher reservation wages (and less search) at the moment an individual enters unemployment. The net effect of the decrease in unemployment protection on unemployment duration is unsigned.

The search for a job is not only determined by factors at the individual level, but also by the characteristics of Unemployment benefit program. There exists a large strand of literature examining the effects of changes in the Unemployment Insurance benefit system on unemployment duration. Most of these papers are concerned with effects of sanctions or training programs, changes in potential unemployment benefit duration or the level of unemployment benefits. However, unemployment insurance systems usually not only consist of a simple benefit payment accompanied by a training program. Usually an unemployed individual has to apply to jobs and formally report their job search effort to the unemployment office or risk a cut in their benefit payment. Chapter 3 studies the effect of such a search requirement for older unemployed making use of a policy change in the Netherlands. Until January 1^{st} 2004, unemployed individuals aged 57.5 or above did not need to actively search for a job in order to receive full unemployment insurance benefits. From this date onwards, older individuals needed to apply for at least 4 jobs in every 4 weeks of unemployment. The results of the study show that for all groups of treated individuals, the stricter search requirements strongly and significantly increase the number of individuals that find a job after a maximum of two years in unemployment. For instance, unemployed males aged 57.5-59.5 have a more than 20 percent (6.5 percentage points) higher probability of finding a job within 24 months (37.8% instead of 31.3%) due to imposition of the new rules. However, it is also shown that a large number of individuals

start receiving disability benefits instead of unemployment benefits when the new search requirements are enacted. Costly substitution between income insurance programs that insure different risks is an unwanted side-effect of the policy change and should be taken into account when estimating the welfare effects of policy changes.

Financial incentives also play a role in the decision to switch from one job to another. The most obvious financial incentive is the wage offered in the old job and in the new job, but other (fringe) benefits offered by the employer might also matter. Chapter 4 considers the effect of financial incentives embedded in the pension system on the number of job-to-job transitions of individuals. Previous work shows that individuals are less likely to leave jobs that offer a(ny) pension plan. This can be the case when jobs which offer a pension plan are generally more attractive, when jobs with pensions attract less switch-prone individuals or because job transitions lead to pension capital losses. However, not much is known about the impact of the type of pension scheme on job mobility. Theoretically, a DB-final salary scheme can lock individuals in their job since they will suffer a loss in pension wealth when switching to another job. The potential loss in pension wealth is increasing in the (expected) future salary increases of the individual. Chapter 4 shows that in the year that the two largest pension funds in the Netherlands started offering a DB-average salary pension instead of a DB-final salary pension, the number of yearly job switches of employees covered by one of these two funds increased. However, it could not be confirmed that those who switched jobs were the ones for whom the DB-average salary system was least attractive. Job switch behaviour of employees therefore does not seem to be driven by the details of the pension scheme by which they are covered.

Chapter 5 concludes with a summary of all chapters.

Chapter 2

The Effects of Savings on Reservation Wages and Search Effort*

2.1 Introduction

With the curtailment of social security systems in most countries, individuals have to rely more and more on their individual savings. In particular, the aging of society is a well-known problem that puts pressure on the welfare state. As individuals see governmental generosity decline, it becomes vital to accrue wealth by themselves, for example in order to save up for early retirement, or to overcome a spell of unemployment. It is therefore of increasing importance to allow for effects of savings in theoretical and empirical models of the labor market. However, job search models usually fail to take the savings decision into account. In a standard job search model there is no need for savings since individuals are assumed to maximize *income*, implying workers to be risk neutral. If instead, as is standard in virtually all other fields in macro- and microeconomics, it is assumed that risk-averse individuals try to smooth consumption over their lives, savings do become an essential part of the job search model.

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Danforth (1979) is the first to consider the effect of a savings decision in a model where a utility-maximizing agent engages in costly search. He shows that in the case of a decreasing absolute risk aversion (DARA) utility function, wealthy unemployed individuals have higher reservation wages, thereby decreasing the probability that they are employed the next period. Mortensen (1986) shows that reservation wages decline with time spent in unemployment, as a liquidity constraint becomes more binding. Recently, there have been some advances in studies of search that include a savings decision. These models either focus on the effect of assets on reservation wages (Berloffa and Simmons, 2003; Blundell et al., 1997; Rendon, 2006), or they abstract from a reservation wage decision and focus on the choice of search effort only (Lentz and Tranaes, 2005a). In the latter paper, the negative effect of wealth on the probability of transiting to employment is driven by a decreased willingness to search. Lise (2011) allows individuals to choose both their reservation wage and search effort. However, since in his model the reservation wage is equal to unemployment benefits and therefore assumed constant, there is no scope for any effect of wealth on reservation wages.

In this paper, a theoretical model describes the relations among wealth, search, and reservation wages. The model makes it possible to disentangle the various effects of savings on reservation wages and search intensity: wealth affects reservation wages positively and search effort negatively.

The theoretical predictions are used to guide the empirical analysis in this paper. Specifically, the reduced form empirical models allow wealth to affect both the reservation wage and search effort. The estimation uses survey-data from a Dutch panel of households which contains detailed information on the key variables of the empirical model. A measure of search intensity is available: individuals are asked for the number of job applications they made in the two months prior to answering the questionnaire. Subjective information on reservation wages is available, such that there is no need to rely on theoretical restrictions to generate reservation wages. The results can therefore be interpreted generally. Moreover, detailed information on wealth and income of individuals is documented in the survey. These data therefore provide the means to study the interrelations among wealth, income, reservation wages and search behavior empirically.

The empirical analysis starts by estimating two single equations: one for the reservation wage and one for search effort. Subsequently, a three-equation simultaneous equation model allows for error correlation between wealth, the reservation wage and search effort. The simultaneous estimation does not improve on the single equation estimates, so the single equation estimates are the preferred ones. It is found that wealth has a significantly positive effect on reservation wages for both household heads and spouses. Specifically, at the mean value of wealth a 100% increase in wealth increases reservation wages by around 2.9% for household heads, and 3.7% for spouses. The estimated effect is between the 1.1% (heads) and 7.2% (spouses) found by Bloemen and Stancanelli (2001) who use the Dutch Socio-Economic Panel, but much less than the 12.6% (heads) increase in reservation wages found by Alexopoulos and Gladden (2004) who use U.S. data. The effect of wealth on search effort is negative, but only significant for household heads. At the 10th percentile of the wealth distribution household heads (spouses) on average apply for 4.95 (2.09) jobs in two months, whereas at the 90th percentile heads (spouses) on average apply for 4.33 (1.71) jobs in two months. Alexopoulos and Gladden (2004) also find a negative effect of wealth on search effort, though this effect is insignificant in all of their estimations.

The paper is set up as follows. Section 2.2 develops the theoretical model and provides a discussion of the sensitivity of the theoretical model's predictions to the model specification. A data-description can be found in Section 2.3. Section 2.4 presents an overview of the main estimation results, and Section 2.5 concludes.

2.2 Theoretical Model

This section presents the theoretical background on which the empirical models in Section 2.4 are based. Along the same lines as Lentz and Tranaes (2005a) the theoretical model considers a risk averse individual who maximizes lifetime utility, which depends on the choice of consumption c_t and search effort s_t. The utility function $v(c_t, s_t)$ is assumed to be additively separable in its arguments, i.e. $v(c_t, s_t) = u(c_t) - e(s_t)$. In each period, the individual determines the optimal consumption, or equivalently the stock of wealth in the next period A_{t+1}. Savings earn interest at rate r. When unemployed, a worker also

chooses optimal search intensity s_t, which influences the probability of getting a job offer that period $\lambda_t s_t$.[1] There is no on-the-job search and jobs are destroyed at an exogenous rate η. Irrespective of the state, a worker receives non-labor income μ. Apart from that, an individual receives unemployment benefits b when unemployed. These benefits include the value of household production and the value of leisure. An employed individual works at wage w, drawn from a wage distribution $f(w)$. This implies that, in contrast to Lentz and Tranaes (2005a) who assume a degenerate wage distribution such that a job offer will always be accepted, the model allows the individual to choose a reservation wage every period.

The formal problem facing the individual is:

$$\max_{\{A_{t+1},s_t\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - e(s_t)\right] \tag{2.1}$$

$$\text{subject to } A_{t+1} = A_t(1+r) + I_U b + I_E w + \mu - c_t \tag{2.2}$$

and subject to the job offer arrival and job destruction processes. The indicator I_U (I_E) takes on the value 1 if the worker is unemployed (employed) at the beginning of the period. Otherwise, it takes on the value 0. The choice of A_{t+1} is restricted by an upper and lower wealth bound, i.e. $A_{t+1} \in [\underline{A}, \overline{A}]$. This assumption is made only in order to ensure that the problem is bounded. The model further assumes a risk averse individual, i.e. $u'(.) > 0$ and $u''(.) < 0$ and increasing marginal costs of search: $e'(.) > 0, e''(.) > 0$ and $e(0) = 0$. The Bellman equation for the value of unemployment at time t can be written as a function of wealth at the beginning of the period:

$$V^U(A_t) = \max_{\left\{A_{t+1}^U \in [\underline{A},\overline{A}], s_t\right\}} \left\{ \begin{array}{c} u(A_t(1+r) + b + \mu - A_{t+1}^U) - e(s_t) \\ +\beta\lambda_t s_t \int_0^{\infty} \max[V^E(A_{t+1}^U, w), V^U(A_{t+1}^U)] dF(w) + \beta(1-\lambda_t s_t) V^U(A_{t+1}^U) \end{array} \right\} \tag{2.3}$$

[1] As in Mortensen (1986), λ_t can be considered a market-determined search efficiency parameter or 'potential' offer arrival rate. In general, λ_t depends on macro-economic conditions and is therefore non-constant.

While the Bellman equation for the value of employment reads:

$$V^E(A_t, w) = \max_{\left\{A^E_{t+1} \in [\underline{A}, \overline{A}]\right\}} \left\{ \begin{array}{c} u(A_t(1+r) + w + \mu - A^E_{t+1}) \\ +\beta[(1-\eta)V^E(A^E_{t+1}, w) + \eta V^U(A^E_{t+1})] \end{array} \right\} \tag{2.4}$$

Rewriting and taking first order conditions w.r.t. s_t, A^U_{t+1} and A^E_{t+1}:

$$\begin{aligned} e'(s_t) &= \beta\lambda_t \int_{R_t}^{\infty} [V^E(A^U_{t+1,} w) - V^U(A^U_{t+1})] f(w) dw, \quad \text{if } s^*_t(A_t, f(w)) > 0 \\ e'(s_t) &\geq \beta\lambda_t \int_{R_t}^{\infty} [V^E(A^U_{t+1,} w) - V^U(A^U_{t+1})] f(w) dw, \quad \text{if } s^*_t(A_t, f(w)) = 0 \end{aligned} \tag{2.5}$$

$$\begin{gathered} u'(c^U_t) = \beta\lambda_t s_t \int_{R_t}^{\infty} \left[V^{E\prime}(A^U_{t+1}, w) - V^{U\prime}(A^U_{t+1})\right] f(w) dw + \beta V^{U\prime}(A^U_{t+1}) + \rho_U \\ \rho_U[A^U_{t+1} - \underline{A}] = 0 \end{gathered} \tag{2.6}$$

$$\begin{gathered} u'(c^E_t) = \beta[(1-\eta)V^{E\prime}(A^E_{t+1}) + \eta V^{U\prime}(A^E_{t+1})] + \rho_E \\ \rho_E[A^E_{t+1} - \underline{A}] = 0 \end{gathered} \tag{2.7}$$

where R_t denotes the reservation wage in period t, and ρ_U and ρ_E are the lagrange multipliers on the constraint that wealth cannot be smaller than a lower bound $\underline{A}$. The model has three state variables, namely current period wealth, the wage (distribution) and employment status. Given the value of these variables, the individual chooses next period wealth $A^E_{t+1}(A_t, w, f(w))$ or $A^U_{t+1}(A_t, f(w))$. An unemployed worker also decides on current period search effort $s_t(A_t, f(w))$ and the current period reservation wage $R_t(A_t, f(w))$.

2.2.1 Theoretical Relation between Wealth and Search Effort

Equation (2.5) shows that the optimal amount of search effort is determined by the values of A_t and $f(w)$ which equate the marginal costs with the marginal benefits of search. In the model, wealth does not affect the cost of search, but it does affect the (marginal) benefits of search. Therefore, search effort is decreasing in wealth whenever the marginal benefits of search are decreasing in wealth. The following proposition demonstrates that the marginal benefits of search are indeed decreasing in wealth under fairly weak conditions:

Proposition 1 *Under the assumptions that the value functions V^U and V^E are strictly concave in A, and $\lambda_t s_t[1-F(R_t)] \leq [1-\eta]$, it holds that $\frac{\partial}{\partial A}\int_{R_t}^{\infty}[V^E(A,w)-V^U(A)]f(w)dw < 0\ \forall A$. That is: the marginal benefits of search effort are decreasing in wealth. As a consequence, search effort is decreasing in wealth.*

Proof. The proof is presented in Appendix A. ■

The intuition behind this result is as follows: an individual with high wealth holdings can keep consumption during low income (unemployed) periods at a reasonable level by using wealth as an addition to income from unemployment benefits. It is therefore less urgent to put a lot of costly effort into the search for a new - high wage - job. In contrast, an individual with low wealth holdings who becomes unemployed cannot compensate for the loss in income with income from assets. He or she will put more effort into searching for a new job such that a satisfactory level of consumption can once again be obtained. One of the conditions for the marginal benefits of search to be decreasing in wealth is that $\lambda_t s_t[1 - F(R_t)] \leq [1 - \eta]$, i.e. an employed worker has a higher probability than an unemployed worker to be employed in the next period. Under this condition, an unemployed individual finds it useful to exert search effort since it limits the time spent in unemployment.

2.2.2 Theoretical Relation between Wealth and the Reservation Wage

Existence of a reservation wage is established in the following proposition.

Proposition 2 *For any value of wealth A_t there exists a unique reservation wage $R_t = R(A_t, f(w))$ such that $V^E(A_t, R_t) = V^U(A_t)$*

Proof. $V^U(A_t)$ is independent of w and $V_t^E(A_t, w)$ is monotonically increasing in w (for a given A_t), which follows directly from the assumption that $u'(.) > 0$. Hence, there exists a unique value of w for which $V^E(A_t, w) = V^U(A_t)$. ■

From the definition of the reservation wage, it is clear that the reservation wage will be increasing in wealth if and only if higher wealth holdings are more valuable when

being unemployed than when being employed at a wage equal to the initial value of the reservation wage (i.e. $\frac{\partial}{\partial A}[V^E(A, R(A, f(w)) - V^U(A)] < 0 \; \forall \; A$). The following proposition demonstrates that under some conditions additional wealth is indeed more valuable in times of unemployment:

Proposition 3 *Under the assumptions that the value functions V^U and V^E are strictly concave in A, and $\lambda_t s_t[1 - F(R_t)] << [1 - \eta]$, it holds that $\frac{\partial}{\partial A}[V^E(A, R(A, f(w)) - V^U(A)] < 0 \; \forall \; A$. That is: an increase in wealth is more valuable while being unemployed than while being employed at a wage equal to the reservation wage. As a consequence, the reservation wage is increasing in wealth.*

Proof. The proof is presented in Appendix B. ■

The intuition behind this result is as follows: an individual with high wealth holdings can keep consumption during low income (unemployed) periods at a reasonable level by using wealth as an addition to income from unemployment benefits. It is therefore less urgent to accept a job with a relatively low wage: the unemployed individual has some time to wait until a better job offer comes by. In contrast, an individual with low wealth holdings who becomes unemployed cannot compensate for the loss in income with income from assets. He or she will be more likely to accept a job offer - even a low wage job offer - such that a satisfactory level of consumption can once again be obtained. One of the conditions for the reservation wage to be increasing in wealth is that $\lambda_t s_t[1 - F(R_t)] << [1 - \eta]$, i.e. an employed worker has a much higher probability of being employed in the next period than an unemployed worker. Under this condition, an unemployed individual - and especially an unemployed individual with low asset holdings - finds it useful to accept a low wage job offer since it is unlikely that another job offer will arrive any time soon.

2.2.3 Theoretical Relation between Other Variables and Search Effort/the Reservation Wage

Factors which have a larger (positive) effect on the value of employment than on the value of unemployment will increase the marginal benefits from search and thereby increase

search effort and decrease the reservation wage (from the definition of the reservation wage). These factors therefore have opposite effects on search effort and the reservation wage. For example, an increase in the unemployment benefits level b raises the value of unemployment more than the value of employment[2], leading to an increase in reservation wages and a decrease in search effort.

On the other hand, factors shifting up the cost of search will decrease both search effort and the reservation wage. These factors therefore affect search effort and the reservation wage in the same direction. From equation (2.5) it can readily be seen that an increase in search costs - causing the function $e(.)$ to shift upward - directly decreases search effort and the value of unemployment V^U. The drop in the value of unemployment V^U causes the value of employment V^E to decrease as well. Because the decrease in V^E takes place only indirectly, the drop in V^E is smaller than the drop in V^U.[3] Intuitively, employed individuals care less about an increase in search costs, which they incur only if unemployed. As a result, an increase in the cost of search will decrease the reservation wage.

2.2.4 Theoretical Relation between Wealth and Search Effort/the Reservation Wage from Other Models

The theoretical model outlined above assumes that search costs are measured as a utility loss and that this loss is additively separable from the utility gain associated with a rise in consumption. In general the relation between wealth and search effort in any model is influenced by (Lentz and Tranaes, 2005a):

- search costs specified either in the utility function or as monetary costs
- in the case of search costs in the utility function: separable or nonseparable from consumption

[2]Because of discounting, a sufficient condition for V^U to decrease more than V^E is $1 - \eta \geq s\lambda_t(1 - F(R_t))$, i.e. employed individuals have a higher probability to be employed.

[3]Again, a sufficient condition for V^U to decrease more than V^E is $1 - \eta \geq s\lambda_t(1 - F(R_t))$, i.e. employed individuals have a higher probability to be employed.

- the functional form of the utility function (CARA, DARA)
- the existence of a liquidity constraint.

In the model presented above, search costs are considered exogenous. In particular, they are not affected by wealth. However, consider the case where search costs enter the budget constraint (i.e. monetary search costs). Wealthier individuals are able to consume more. Since search costs are measured via a consumption loss in the budget constraint, wealthier individuals face lower marginal search costs (under the common assumption that the utility function is concave in consumption), and so their search intensity increases. This mitigates the negative relation between wealth and search effort. However, since a decrease in marginal costs of search raises the reservation wage, the positive relation between wealth and reservation wages will be stronger in the case of monetary search costs. In reality search costs are likely presented by a mix of time and monetary investments.

Nonseparable search costs specified in the utility function have a similar effect as monetary search costs: an increase in wealth increases consumption, which decreases marginal search costs. Note that this is true whenever $v''_{cs} > 0$ i.e. for high values of c, the marginal disutility associated with search decreases (Lentz and Tranaes, 2005a). Separable search costs induce only an income effect of a wealth increase: individuals search less since they can increase consumption also in the unemployment state. With nonseparable search costs, the substitution effect also plays a role: since higher wealth holdings make it less costly to 'buy' search, search effort increases.

Apart from separability or nonseparability of the utility function in its arguments, the relation between wealth and search effort/reservation wages is also affected by risk aversion. In particular, Flemming (1978) presents a model which assumes a CARA utility function and monetary search costs. In this case, search effort is not affected by wealth since the effect of wealth on the marginal benefits of search and marginal costs of search exactly cancel. Note again that when search costs are specified in the budget constraint, search costs are measured as a loss in consumption. The choice of search effort can therefore be regarded as a gamble: an individual needs to give up some consumption now in order to get a higher chance to increase consumption in the future. From Arrow (1971)

and Pratt (1964) it is known that the risk premium (i.e. the amount of consumption you are willing to give up now) is independent of the initial consumption level (i.e. wealth) in the case of a CARA utility function. The results in Flemming (1978) can be considered an application of this general result. Berloffa and Simmons (2003) prove that in the case of a CARA utility function and no search costs, the reservation wage is unaffected by wealth.[4] However, Blundell et al. (1997) show that the reservation wage is increasing in wealth in the case of any concave utility function and no search costs. The predictions of the model in Blundell et al. (1997) diverge from the predictions in Berloffa and Simons (2003) because Blundell et al. (1997) include a liquidity constraint at the terminal period T in their model. Since the borrowing constraint is more binding in the unemployment state, a wealth increase is more valuable in the case of unemployment than in the case of employment. Consequently, the increase in wealth causes a rise in the relative value of unemployment versus employment, such that the negative (positive) relation between wealth and search effort (reservation wages) is magnified. In Lise (2011), the reservation wage is always equal to unemployment benefits b and therefore unaffected by wealth. This result directly follows from the assumption that on-the-job-search is just as efficient as unemployed search in his model, i.e. $\lambda^U = \lambda^E$.

Table 2.1 gives an overview of known theoretical and simulation results. Over all different model specifications, search effort is nonincreasing in wealth and the reservation wage is nondecreasing in wealth. The conclusion that arises from the theoretical models is that if there is any effect of wealth on search effort it should be negative, whereas if there is any effect of wealth on reservation wages it should be positive. In the next two sections these theoretical predictions are empirically tested.

[4] Again, this is a result specific to their model and the use of a CARA utility function. Without a decision on search, the gamble is to continue in unemployment (with a probability of getting a better wage/higher wealth in the future) versus accepting the value of employment at the offered wage. With a CARA utility function, initial wealth does not influence the decision whether or not to gamble. Therefore the reservation wage is independent of wealth in their model.

Table 2.1. Review of theoretical literature

	liquidity constraint	search costs	functional form of u(.)	reservation wage	end. search	conclusion
Danforth (1979)	yes	monetary	DARA	reservation wage	no	reservation wage increasing in wealth
Rendon (2006)	yes	no	CRRA	reservation wage	no	reservation wage increasing in wealth
Algan et. al (2003)	yes	in nonseparable utility function	CRRA	reservation asset level	no	reservation wage increasing in wealth
Blundell et al. (1997)	yes - at time T	no	(strictly) concave	reservation asset level	no	reservation wage increasing in wealth
Berloffa and Simmons (2003)	no	no	CARA	reservation wage	no	reservation wage not influenced by wealth
Lentz and Tranaes (2005a)	yes	in separable utility function	(strictly) concave	no	yes	search effort increasing in wealth
Flemming (1978)	no	monetary	CARA	no	yes	search effort not influenced by wealth
Lise (2011)	no	in separable utility function	concave	reservation wage	yes	search effort decreasing in wealth, reservation wage constant

Note: CRRA implies DARA

2.3 Data

I use data from the DNB Household Survey (DHS, formerly known as the CentER Savings Survey and as the VSB Panel) collected by CentERdata in Tilburg, the Netherlands, during the period 1993-2008. Once a year an Internet panel of about 2800 households is asked questions regarding work, pensions, accommodation, mortgages, income, assets, liabilities and health.[5] Within the households, every member of at least 16 years of age is interviewed. The advantage of using this particular dataset is that it contains subjective information on reservation wages, a proxy for search intensity, and detailed information on wealth components. These data therefore provide me with the means to study the interrelations among wealth, income, reservation wages and search behavior empirically.

In 1993, about 1900 out of 2800 households form the representative panel of the DHS. The other 900 households represent the so called 'high income panel'. These are households sampled from the top 10% of the Dutch income distribution. This sampling scheme is chosen since several papers using American data show that an overrepresentation of rich households is necessary to get a truthful representation of the actual wealth distribution (e.g. Avery and Kennickell, 1991; Sheiner and Weil; 1992). However, in the year 2000 no new members enter the high-income panel anymore. From that year onwards, the number of individuals taken from the high end of the income distribution decreases. In order to take into account that wealthy individuals are overrepresented in early waves, I include year dummies in the empirical model specification. These year dummies are also meant to correct for differences in the design of the questionnaire across waves, and (together with a variable indicating regional unemployment rates) to capture macro-economic effects on reservation wages and search intensity. In terms of the theoretical model of Section 2.2, the time dummies capture the variation over time in the parameter λ_t. The members of the high-income panel comprise only 5% of the final sample. Excluding these observations in the empirical estimations does not change signs or significance levels of the estimates, and they are therefore included.

[5] It is not required for the panel members to have Internet access or even a computer. For households that do not own a computer, CentERdata installs a Net.Box, which makes connection to the Internet via the television set possible. For households without a television, CentERdata installs one.

Table C.1 in Appendix C gives an overview of the sample selection process. Non-employed individuals are selected when they report to be actively searching for a job, and when they report reservation wages and other relevant background characteristics.[6] Starting with a sample of 33,734 household heads and 24,614 spouses, only those individuals that were non-employed and searching for a job are selected.[7] I also exclude individuals over 65. This leaves 739 observations on heads and 694 observations on spouses for analysis, which is about 2.5% of the initial sample.[8] After dropping observations for which not all relevant background characteristics are observed, 699 observations on heads and 652 observations on spouses remain. Of this sample, 37 observations on household heads and 35 observations on spouses had missing or extreme values of the reservation wage. Six more observations are dropped after inspection of the studentized residuals from the reservation wage regression specified in Section 2.4. Unfortunately, information on income and wealth variables is quite often missing. Around 100 observations on income-variables used in the empirical analysis are therefore imputed. The imputation process uses a flexible regression equation on the logarithm of the income variable. The regressors in the imputation equation include a polynomial in age, the year of the survey, the individual's education, gender, marital status, family size, and interaction effects of gender with the age and education variables. A regressor indicating whether the individual came from the high income panel and individual random effects are also included. The distribution of

[6] I follow Schweitzer (2003) by selecting individuals that are looking for a job instead of individuals receiving unemployment benefits. Blackaby et al. (2007) find that those traditionally labeled as inactive react to benefit increases in the same way as the unemployed.

[7] In determining whether an individual is the head of a household or his/her spouse, I rely on self-reported data. In case the question regarding position in the household is not answered, the answer to the same question from other years of the questionnaire is used. In case the question is never answered, the oldest male is taken to be the household head.

[8] The retained percentage of individual differs somewhat from the aggregate unemployment statistics. During the period 1993-2008, an average of 3.3% of the total population aged 15 and older was registered at the unemployment office (CWI) as looking for a job. There are two reasons why our unemployed sample comprises only 2.5% of the population. First, I only select household heads and spouses. Second, the aggregate unemployment statistics also contain individuals who are employed (for less than 12 hours per week).

the predicted values and the distribution of the actual (non-imputed) values look similar, providing some confidence in the imputation process. The final sample consists of 572 (heads) and 483 (spouses) observations of unemployed job searchers, over a period of 16 years. These observations are pooled together for analysis. The sample therefore contains multiple observations for some of the individuals. Table C.2 presents information on the number of individuals with more than 1 observation. As is shown, around 5% of the individuals included in the sample are observed more than three times. Excluding individuals that are observed more than three times or limiting the number of observations per individual to a maximum of three does not change sign or significance of the reported results. In the regression analysis in Section 2.4, all standard errors are adjusted for clustering of individuals.

2.3.1 Descriptive Statistics

Means, medians and standard deviations of the income and wealth variables are shown in Table 2.2 for household heads and in Table 2.3 for spouses. Wealth is defined on the individual level, and constructed by adding several categories of assets and liabilities. The asset categories included are: balance on checking, savings and deposit accounts; deposit books and savings certificates; single premium annuity insurance policies and savings of endowment insurance policies; the value of options, bonds and shares; money lent out; and the value of cars, motorbikes, boats, and caravans. The categories of liabilities included are private loans and loans from family or friends; extended lines of credit; outstanding debts on hire-purchase contracts or from shops; credit card debt; study loans and other loans. The alternative wealth measure, total net worth, includes all before-mentioned asset and liability components, and also adds the value of the respondent's house(s) and other real estate, and subtracts the value of mortgage(s). In the main empirical analysis described in Section 2.4, the wealth variable is defined as the total (individual) net worth. The wealth data is further examined in Table C.3, which shows that the 10% quantile of the wealth distribution is negative for both the full sample and for household heads. This is unlikely to be due to underreporting: Bloemen and Stancanelli (2001) find not only a negative 10% quantile, but also a negative 25% quantile of the wealth distribution

for Dutch household heads in their sample based on the Dutch Socio-Economic Panel. For example, individuals with a mortgage which is higher than the value of their house can have negative wealth holdings. Table C.3 also reports the quantiles of the individual wealth distribution for all spouses and heads in the full DNB data (employed, unemployed and out-of-the-labor-force). Not surprisingly, the wealth level of unemployed individuals is lower as compared to the full sample. Including the value of houses and other real estate shifts the wealth-distribution to the right.

Table 2.2. Wealth, incocme and reservation wages, heads

Variable	Number of observations	Median	Mean	Std. Dev.	Min	Max
Wealth	572	837.1	7016.9	17095.5	-10648.8	180235.6
Total net worth	572	1773.8	24196.5	47570.8	-38100.7	498383.4
Reservation wage, hourly	572	6.7	7.3	3.0	2.2	27.7
Reservation wage, monthly	572	1155.3	1271.8	528.1	379.6	4807.3
Unemployment benefits, net	572	716.4	749.8	580.6	0.0	4349.7
Unemployment* benefits, net	479	810.2	895.4	521.5	2.1	4349.7
Other income	572	0.0	136.2	624.0	-1115.3	7313.1
Other income*	186	82.1	419.0	1040.6	-1115.3	7313.1
Spouse's income	572	0.0	372.6	761.9	0.0	5827.1
Spouse's income*	192	837.1	1107.3	957.4	0.3	5827.1
Age	572	46.0	44.3	10.9	20.0	65.0

Note: Income variables are given in euros per month, real terms at 1992 prices. Price indices are obtained from Statistics Netherlands' yearly statistics, available from http://statline.cbs.nl/statweb/. * Indicates the figures recomputed excluding the zero observations. Wealth variables are calculated at the individual level, the construction is explained in the text. Total net worth= wealth+value of house(s) and other real estate-value of mortgage(s).

Unemployment benefits (b) consist of all income components that are lost when a person accepts a job, including social insurance and social assistance. Other income (μ) denotes the state-independent income of the household: it adds interest on real estate

Table 2.3. Wealth, income and reservation wages, spouses

Variable	Number of observations	Median	Mean	Std. Dev.	Min	Max
Wealth	483	338.0	2953.4	9155.5	-9574.4	96862.0
Total net worth	483	10092.6	17714.2	33509.4	-8082.5	462489.4
Reservation wage, hourly	483	6.2	6.5	2.1	2.0	17.3
Reservation wage, monthly	483	1078.2	1125.6	366.3	345.2	2998.0
Unemployment benefits, net	483	494.9	490.0	387.3	0.0	3377.1
Unemployment* benefits, net	366	614.9	644.9	312.1	21.1	3377.1
Other income	483	0.0	14.5	82.8	-70.7	1286.3
Other income*	58	50.5	120.9	211.9	-70.7	1286.3
Spouse's income	483	1670.4	2075.3	1615.6	0.0	11239.5
Spouse's income*	471	1691.7	2128.2	1601.2	0.0	11239.5
Age	483	40.0	41.0	8.8	21.0	62.0

Note: Income variables are given in euros per month, real terms at 1992 prices. Price indices are obtained from Statistics Netherlands' yearly statistics, available from http://statline.cbs.nl/statweb/. * Indicates the figures recomputed excluding the zero observations. Wealth variables are calculated at the individual level, the construction is explained in the text. Total net worth= wealth+value of house(s) and other real estate-value of mortgage(s).

and bank accounts, alimony, pension benefits, subsidies on renting or buying a house and social security benefits not lost when accepting a job offer. Mortgage interest payments are subtracted in the construction of this income variable. Spouse's income indicates

monthly (wage) income of the spouse of the unemployed individual.

Table 2.4 shows statistics on the discrete background variables used in the empirical analysis. Education is defined in 4 levels, from lowest (level 1, no or primary education) to highest (level 4, higher vocational training or University). As can be seen from the table, there are more male than female household heads and more couples than singles in the sample. Most heads report not having any children in their household. In contrast, those identifying themselves as being a spouse are almost all female and most have children. This indicates that separate regression equations for household heads and spouses might be necessary.

Search effort is proxied by the number of job applications made in the two months prior to filling in the questionnaire. Table C.4 shows the frequency distribution of search effort. About one third of the household heads made no job applications, as opposed to over half of the spouses. Around 8% of heads and 2% of spouses made more than 15 applications. Spouses might have the opportunity to be more selective in the kind of job they apply to, since they are less likely to be the main income provider.

Table 2.4. Discrete background variables

Variable	% of heads	% of spouses
Education level 1	8.4	5.8
Education level 2	30.2	34.8
Education level 3	33.4	37.9
Education level 4	28.0	21.3
Female	33.7	92.5
Single	33.7	0.0
Any children	35.0	70.8

2.3.2 Reliability of Reservation Wage Data

This study relies on subjective data on reservation wages. The answer to several questions in the survey can be combined to construct the (log) hourly reservation wages as

a dependent variable in the regressions of Section 2.4. First, individuals are asked how many hours a week they would be willing to work at a new job. Then they are asked what would be the minimum net wage for which they would be willing to work, if a job with the preferred number of hours is offered to them. Finally, individuals are asked to indicate if this minimum wage was meant to be received per week, per 4 weeks, per month or per year. The three questions needed to construct the (log) hourly reservation wage are listed on a single screen to the respondents. Hourly reservation wages are constructed by taking the net wage and converting it to an hourly reservation wage.

A number of critiques on the use of subjective data for the calculation of reservation wages have been put forward in the past (e.g. Hofler and Murphy, 1994). Response bias could arise because individuals do not have clear ideas of what the 'right' answer is to a question asking them about the minimum wage for which they would accept a job offer. Alternatively, it can be unclear to an individual which kind of job they should be thinking of: a person imagining himself in his or her preferred job might report a lower reservation wage than an individual having a less preferred occupation in mind. Moreover, individuals might answer differently according to whether they think the answer to the question will affect their taxes or credit. This could be the case, for example, when the questionnaire is set up by a government agency. This sort of bias does not greatly affect results in an independent Internet Panel like the one used here. A fourth and final source of bias in subjective (reservation wage) data is non-response bias. In our sample, non-response on reservation wages is probably of minor concern: only 37 (35) out of 572 (483) individuals that are looking for work and for whom the relevant background characteristics are observed either did not report a reservation wage, or reported an unreasonable value for this variable.[9] The procedure outlined in Bloemen and Stancanelli (2001) is used to further check the reliability of the reservation wage data. First, unless on-the-job-search is more efficient than searching for a job while unemployed, reservation wages should in theory be higher than unemployment benefits. Table 2.2 shows that mean unemployment

[9] A reservation wage is considered unreasonable when two conditions are fulfilled: (1) the reservation wage is below 1.5 euros or above 40 euros an hour, and (2) the reservation wage is out of line with the reservation wages reported by the same individual in other years of the survey.

benefits for household heads are 895 euros per month, whereas monthly reservation wages average at 1272 euros. For spouses, these figures are 695 and 1126 euros respectively. Moreover, the median monthly unemployment benefits are 810 (615) euros, whereas the median for reservation wages is quite a bit higher: 1155 (1078) euros per month. This gives a first indication that reported reservation wages are in accordance with theoretical predictions.

Second, I compare the distribution of reservation wages for the unemployed with the distribution of wages for the employed. Because the reservation wage is defined as the lowest wage for which an individual would be willing to accept a job offer, the wage distribution should first-order stochastically dominate the reservation wage distribution. The value of every quantile of the wage distribution should be higher than the corresponding value of the reservation wage distribution. Tables C.6 and C.7 show that this is true for both household heads and spouses. Of course it could be argued that unemployed individuals are facing a less favorable wage distribution since workers tend to experience wage growth over time. This will lead to an overestimation of the wage distribution faced by the unemployed job searchers, thereby biasing the comparison in the direction of finding favorable results. It is therefore reassuring that the difference between reservation wage and observed wage is at least 30% for all quantiles of the wage distribution.[10]

As a final check the individual reservation wages are compared with respectively the wage earned before the unemployment spell and the accepted wage after the unemployment spell ends (See Table C.5). Theoretically, the accepted wage should always be greater than the reservation wage. However, since accepted wages are observed a year later than the reported reservation wages, not all reservation wages need to be lower. This is the case when reservation wages have the tendency to decline as the unemployment spell progresses, for example because a decline in wealth during the period of unemployment decreases the reservation wage over time. Alternatively, declining reservation wages over

[10]In contrast to Bloemen and Stancanelli (2001), I choose not to split the sample according to education, age *and* year, since that results in a number of observations that is too small to get an accurate view of the reservation wage distribution. However, splitting the sample only by year, the result that the distribution of reservation wages is first order stochastically dominated by the wage distribution is retained.

time could be the consequence of a depreciation of human capital during an unemployment spell, discouraged individuals (Calmfors and Lang, 1995) or stigma. Despite these counteracting forces, 60% of accepted wages are higher than the previously reported reservation wage. Both the median and mean of the difference between accepted wage and the reservation wage are positive. Repeating the analysis for the difference between the wage a year before the reservation wage is observed and the reservation wage, similar conclusions can be obtained. Both the mean and median differences are positive, and 70% of individuals report a reservation wage that is lower than their previously earned wage. Although in theory, there is no reason to believe that a previously earned wage should be higher than the reservation wage while looking for the next job, the result does strengthen faith in the reliability of the reservation wage data.

The conclusion from comparing wage, unemployment benefits, and reservation wage data in the various ways outlined above is that the reservation wage data used is at least not subject to response biases in a way that make the data violate logical and theoretical restrictions.

2.4 Estimation Results

This Section presents estimation results from regressions on reservation wages and on search effort. It starts by estimating single equation regressions for reservation wages and search effort. Subsequently a joint model for wealth, reservation wages and search effort is estimated by Maximum Likelihood. This model corrects and tests for possible correlation between the error terms in the wealth, reservation wage and search equation. Since no significant error correlation is found, the single equation estimates are the preferred ones.

2.4.1 Single Equation Estimates on Reservation Wages

The theoretical model of Section 2.2 postulates that the reservation wage $R_t(A_t, f(w))$ is a function of current period's wealth A_t and the wage distribution facing the individual $f(w)$. The reservation wage is also affected by the other variables in the model: the magnitude of unemployment benefits b, other non-labor income μ, the discount factor β

and interest rate r, the cost of search function $e(s)$, the basic probability of finding a job λ and the probability of getting fired η. The reduced form regression equation for reservation wages therefore reads:

$$\ln(R_{it}) = f(A_{it})'\gamma + K_{it}'\eta + \varepsilon_{it} \tag{2.8}$$

Where A_{it} indicates the wealth of individual i in period t, and K_{it} are other factors that affect the value of the reservation wage $(b, \mu, \beta, r, e(s), f(w), \lambda, \eta)$. The function f allows wealth to affect the reservation wage in a nonlinear way. In the empirical specification $f(A_{it})$ is assumed to be quadratic. For the OLS estimate γ to be unbiased A_{it} needs to be exogenous. In the theoretical model presented in Section 2.2, wealth holdings in period t are predetermined. That is: at the moment the reservation wage and search effort are determined, individual wealth holdings are taken as given. In the empirical equation (Eq. (2.8)) wealth holdings A_{it} are determined at the 31st of December year $t-1$ and the reservation wage R_{it} is determined at the moment the questionnaire is filled in (usually April or May of year t). Wealth holdings in the empirical equation are therefore theoretically exogenous.

The other regressors included in the empirical specification aim to take the factors $b, \mu, \beta, r, e(s), f(w), \lambda$, and η of the theoretical model into account. The value of unemployment benefits b is included directly, as well as a variable indicating whether the individual receives unemployment insurance benefits. Other income and income of the spouse are components of non-labor income μ. Moreover, other income includes interest income from wealth holdings which depends on the interest rate r. Most of the remaining regressors, such as age, educational level and an indicator for having kids in the household, are added to control for individual differences in the discount factor β, the differences in costs of search $e(.)$ and the wage distribution facing the individual $f(w)$. Year dummies and yearly regional unemployment rates are included in order to account for differences in the basic probability of a job offer λ_t over time and place of residence.

Estimation results are presented in Table 2.5.[11] A Chow test indicates that the dif-

[11] The presented model specification is the preferred one, based on theoretical considerations, (individual) significance and overall model fit.

Table 2.5. Reservation wage equation, estimation by OLS

	Full sample	SE	Heads	SE	Spouses	SE
wealth	0.016**	(0.006)	0.012*	(0.007)	0.021**	(0.010)
wealth^2/100	-0.029**	(0.015)	-0.017	(0.017)	-0.051**	(0.024)
other income	0.054**	(0.024)	0.051**	(0.023)	-0.060	(0.089)
receives unemployment insurance	-0.010	(0.029)	0.009	(0.035)	-0.054	(0.049)
unemployment benefits	0.025	(0.015)	0.008	(0.016)	0.033	(0.045)
income spouse	0.006	(0.007)	0.034*	(0.020)	0.016	(0.008)
log age	0.178***	(0.062)	0.218***	(0.084)	0.080	(0.089)
education levels 2 and 3	0.016	(0.044)	0.035	(0.052)	0.020	(0.083)
education level 4	0.244***	(0.053)	0.296***	(0.064)	0.198**	(0.095)
any kid	0.133***	(0.046)	0.156***	(0.042)	-0.130	(0.188)
female	-0.054	(0.037)	-0.016	(0.053)	-0.042	(0.093)
female×any kid	-0.070	(0.058)	-0.062	(0.075)	0.185	(0.194)
regional unemployment rate	-0.018	(0.013)	-0.033*	(0.017)	-0.004	(0.018)
constant	1.282***	(0.240)	1.212***	(0.320)	1.512***	(0.369)
N	1055		572		483	
adj. R^2	0.221		0.282		0.105	

Note: heteroscedasticity robust and clustered standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the log of the (net) hourly reservation wage in real terms, 1992 euros. Wealth and income variables given in real terms (1992) in 10,000 euros and 1000 euros respectively. Data on regional unemployment rates is obtained from Statistics Netherlands: www.statline.nl. Coefficients on year dummies suppressed.

ferences between household heads and spouses cannot be captured by the same model (F=1.97, p=0.02). Therefore the results are presented separately for the two groups. Specifying one model for males and females is not rejected (F=1.55, p=0.13). The findings indicate that reservation wages are increasing in wealth, as predicted by theory. Table 2.6 shows that a 100% increase in wealth increases reservation wages by about 2.9% for heads, and 3.7% for spouses at the mean value of wealth. The results are between the 1.1% (heads) and 7.2% (spouses) increases at the mean value of wealth found by Bloemen and Stancanelli (2001) in their single equation estimation,[12] but much lower than the 12.6% (heads) increase in reservation wages at the mean value of wealth found by Alexopoulos and Gladden (2004) using U.S. data. Although for household heads the squared term on wealth is not significant by itself, a test on the joint significance of wealth and squared

[12]Part of this difference can be due to the fact that Bloemen and Stancanelli (2001) do not include the value of the house and mortgages in their wealth measure.

Table 2.6. Percentage increase in reservation wage from a rise in wealth

Wealth distribution	Full sample	Heads	Spouses
10%	0.02	0.03	0.00
25%	0.02	0.00	0.39
50%	0.11	0.21	2.10
75%	3.50	3.62	4.44
90%	6.46	8.96	7.99
mean	3.00	2.87	3.67
N	1055	572	483

Note: The given wealth effect is calculated as a percentage increase in the reservation wage upon a 100% rise in wealth

wealth shows that these variables are jointly significant at the 5% level (F-test, p=0.02).

The other regression coefficients also show plausible signs. The results are very similar to the ones found in Bloemen and Stancanelli (2001). For heads, a higher non-wage income and a higher income of the spouse influence reservation wages positively. For spouses, unemployment benefits or other income does not seem to affect the reservation wage. The height of unemployment benefits does not seem to have a significant effect on the reservation wage for household heads either, though the point estimate has the expected positive sign. Higher educated individuals have higher reservation wages, which is plausible since education is expected to influence the (expected) wage distribution and the discount factor positively.

Age also affects the reservation wage positively. In theory, age has an ambiguous effect on the reservation wage: on the one hand, older individuals might face a better wage distribution, increasing their reservation wage. Moreover, older individuals may have longer unemployment benefit entitlements, also leading to a rise in the reservation wage. On the other hand, if older individuals have a lower probability of getting a job offer, they are willing to accept lower wages. Also, older people are left with less future (working) periods so they will be less picky about which wage to accept: the effect of reaching a terminal retirement period T is analogous to a decrease in the discount factor.[13]

[13]For example, Berloffa and Simmons (2003) prove that "in general, the individual is less willing to work if the number of periods over which a certain income gain can be spread increases." Less willing to

This decreases reservation wages for the elderly. In the data, the first group of factors seems to dominate. A squared term on age was not included, since it was not (jointly) significant. Marital status is also not included since all spouses are married by definition, and since it was not significant and did not affect other estimation results in the model for household heads. After individuals are classified into household heads and their spouses, females and males have similar reservation wages. Having a child increases the reservation wage for male household heads. For female household heads, having a child increases the reservation wage as well, but less than for men. For spouses, having a child or not does not significantly influence reservation wages. A higher regional unemployment rate (λ_t) has the expected effect: individuals adjust their reservation wage downwards in times and places of higher unemployment.

2.4.2 Single Equation Estimates on Search Effort

The theoretical model of Section 2.2 postulates that search effort $S_t(A_t, f(w))$ is a function of current period's wealth A_t and the wage distribution facing the individual $f(w)$. Search effort is also affected by the other variables in the model: the magnitude of unemployment benefits b, other non-labor income μ, the discount factor β and interest rate r, the cost of search function $e(s)$, the basic probability of finding a job λ and the probability of getting fired η. The reduced form regression equation for search effort therefore reads:

$$S_{it}^{*} = g(A_{it})'\alpha + H_{it}'\beta + \tau_{it} \tag{2.9}$$

Where A_{it} indicates wealth of individual i in period t, and H_{it} are other factors that affect search effort $(b, \mu, \beta, r, e(s), f(w), \lambda, \eta)$. Since these are the same factors that affect the reservation wage, the regressors included in the equation for search effort (2.9) are very similar to the regressors included in the empirical specification for the reservation wage (2.8). The function $g(A_{it})$ allows wealth to affect search effort in a nonlinear way. In the empirical specification g is assumed to be quadratic.

Search effort is not directly observed and is therefore treated as a latent variable. It is

work is captured by an increase in the reservation wage in their model, since they do not consider search effort.

proxied by the number of job applications made in the two months prior to filling in the questionnaire. The number of job applications S_{it} is assumed to be related to unobserved search effort S_{it}^* by means of V threshold values, in the sense that:

$$\begin{aligned} S_{it} &= 0 \quad if \quad -\infty < S_{it}^* \leq v_1 \\ S_{it} &= j \quad if \quad v_j < S_{it}^* \leq v_{j+1} \qquad j = 1, ..., V-1 \\ S_{it} &= V \quad if \quad v_V < S_{it}^* \leq \infty \end{aligned}$$

In the empirical estimation, $V = 8$ in order to keep a sufficient number of observations per category. The definition of the search categories is shown in Table C.4.[14] Assuming a normal distribution on the error term $\boldsymbol{\tau}_{it}$, an ordered probit model can be estimated by Maximum Likelihood. Since the proxy for search effort is a count data variable, the search equation can alternatively be estimated using negative binomial regression. Use of a negative binomial distribution shows very similar results in terms of sign, significance, and magnitude of the coefficient estimates. The preponderance of zeros in the empirical distribution does not impose a problem: adjusting for the skewness of the search variable by applying an inverse hyperbolic sine transformation[15] did not affect sign or significance of the results. These alternative estimations therefore provide an indication that the results presented here are not very sensitive to the distributional specification. Table C.4 shows the average predicted probabilities of applying 1,2,...n times for a job in the previous two months (in parentheses). The predicted probabilities follow the empirical distribution closely.

The effect of wealth and its square on search effort is jointly significant for household heads (F-test, p=0.02). Wealth also has the expected negative effect on search effort for spouses, though it is insignificant in the estimation. Table 2.8 shows the expected number of job applications for various values of wealth. Almost all control variables show the expected signs. The effects of age and education are positive. This supports the presumption that both age and education proxy for a right shift in the wage distribution

[14] The point estimates are not sensitive to this specific distribution of classes: similar results are obtained using 15 categories.

[15] The inverse hyperbolic sine transformation is similar to the log-transformation and can be written as: $\sinh^{-1}(applications) = \ln(applications + \sqrt{applications^2 + 1})$, see e.g. Burbidge et al. (1988).

Table 2.7. Search equation, ordered probit estimation by ML

	Full sample	SE	Heads	SE	Spouses	SE
wealth	-0.030	(0.021)	-0.022	(0.032)	-0.034	(0.042)
wealth^2/100	0.048	(0.058)	-0.080	(0.133)	0.101	(0.092)
other income	-0.042	(0.078)	-0.026	(0.080)	-0.012	(0.499)
receives unemployment insurance	0.661***	(0.101)	0.758***	(0.122)	0.483***	(0.185)
unemployment benefits	-0.004	(0.061)	-0.069	(0.069)	0.053	(0.131)
income spouse	-0.160***	(0.061)	-0.071	(0.073)	-0.242*	(0.132)
female×income spouse	0.119*	(0.070)			0.258*	(0.136)
log age	9.62	(5.402)	17.49**	(6.457)	-0.596*	(0.347)
(log age)^2	-1.343*	(0.738)	-2.372**	(0.880)		
education levels 2 and 3	0.251	(0.197)	0.380	(0.258)	0.108	(0.310)
education level 4	0.392*	(0.213)	0.486*	(0.274)	0.309	(0.332)
any kid	0.439***	(0.159)	0.330**	(0.168)	0.389	(0.439)
female	-0.261**	(0.137)	-0.101	(0.159)	-0.006	(0.372)
female×any kid	-0.848***	(0.195)	-0.873***	(0.289)	-0.712	(0.466)
unemployment rate	-0.047	(0.043)	0.043	(0.059)	-0.140**	(0.058)
N	1055		572		483	
Log Likelihood	-1812.5		-1080.7		-694.0	

Note: heteroscedasticity robust and clustered standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the number of job applications made in the past two months. Wealth and income variables given in real terms (1992) in 10,000 euros and 1000 euros respectively. Coefficients on year dummies suppressed.

$f(w)$. Females exert lower search effort, especially those with at least one child. For male household heads, search effort is higher when they have at least one child (See Table 2.7).

The dummy variable on whether or not the person is receiving social insurance benefits has a significant positive effect on search effort. Individuals in the Netherlands can receive social insurance (unemployment) benefits for a limited period of time. After that, they need to resort to social assistance (welfare) which is means-tested. Individuals that are unemployed for a short period and therefore still enjoy their social insurance benefits, therefore face the possibility that they need to live off their private wealth in the near future when they do not find a job. These individuals have a higher motivation to search for a job. Moreover, these individuals are probably less discouraged in their quest for a job than individuals who have been unemployed for a longer time period.

An interesting result of this regression is that, whereas income of the spouse influences search effort for male spouses negatively, it has practically no effect for female spouses.

Table 2.8. Predicted mean number of job application in 2 months

Wealth distribution	Full sample	Heads	Spouses
10	3.63	4.95	2.09
25	3.62	4.95	2.09
50	3.55	4.89	2.04
75	3.38	4.71	1.90
90	3.09	4.33	1.71
mean	3.41	4.75	1.93
N	1055	572	483

Note: Calculated using observed values of covariates, only varying the value of wealth

This suggests that male spouses search longer when their spouse has a high income.These results contradict the results in Lentz and Tranaes (2005b), who find that unemployment duration is decreasing in spouse's income for males (and increasing for females).

2.4.3 Simultaneous Estimation

As described in Section 2.2, the individual choices for search effort and reservation wages are strongly interrelated. Although the regressors in the single equation estimates try to correct for all theoretically relevant variables, it is therefore likely that there are some unobservables in equations (2.8) and (2.9) that cause a correlation between the error terms. On the one hand, if these unobservables affect only the absolute difference between the value of employment and unemployment, the error terms will be negatively correlated. On the other hand, if the unobservables primarily have a large effect on search costs, the error terms will be positively correlated. Simultaneous estimation of both equations takes this possible error correlation into account.

Although wealth is a predetermined variable in the theoretical model outlined in Section 2.2, empirically it is possible that some unobserved variable which affects the reservation wage and/or search effort also affects wealth holdings. In order to test whether all relevant variables are accounted for in the single equation estimates I estimate a system of equations consisting of the reservation wage equation (2.8), the search equation (2.9) and an equation for wealth:

$$A_{it} = Q'_{it}\kappa + \omega_{it} \tag{2.10}$$

Assuming joint normality of the error terms, the three equations are jointly estimated using Full Information Maximum Likelihood. In the wealth equation (Eq. (2.10)), the wealth variable has undergone an inverse hyperbolic sine transformation. This transformation makes the normality assumption on the error terms in the regression more plausible since the wealth distribution is right-skewed.

An example of an unobservable variable that can simultaneously affect the level of wealth, the reservation wage and search effort is unemployment duration.[16] Individuals who have been unemployed for a longer period of time are more likely to have run down their wealth reserves. Moreover, results from the empirical literature suggest that a longer unemployment duration could cause a decline in the reservation wage and/or search effort following a depreciation of human capital, discouragement of the individual or stigma. Not including unemployment duration as a regressor in the estimations will therefore cause an overestimation of the wealth effect on the reservation wage γ, and an underestimation of the wealth effect on search effort α. On the other hand, a higher reservation wage and/or lower search effort causes individuals to be unemployed for a longer time period (Mortensen and Pissarides, 1999) and therefore have lower wealth reserves. This reverse causality causes both the wealth effect on the reservation wage γ and the wealth effect on search effort α to be underestimated. In sum, the (positive) effect of wealth on reservation wages could either be overestimated or underestimated, whereas the (negative) effect of wealth on search effort is likely to be underestimated. In other empirical work it is found that the wealth-effect does not significantly change when dummies for unemployment duration are included in the reservation wage equation (Bloemen and Stancanelli, 2001). Omitted variable bias and reverse causality bias cancel out approximately.

[16] If available, information on unemployment duration could correct for the before-mentioned biases. Unfortunately, the number of months in unemployment could not be determined for 570 of our of 1055 individuals and is therefore not included in the empirical specification.

Table 2.9. System of equations for the full sample, estimation by ML

	Ln rwage	SE	Search effort	SE	Wealth	SE
wealth	0.016***	(0.006)	-0.021	(0.113)		
wealth^2/100	-0.031**	(0.015)	0.028	(0.222)		
other income	0.053**	(0.024)	-0.058	(0.383)	1.744***	(0.641)
other income^2					-0.220**	(0.105)
female×other income					0.312	(0.548)
receives unemployment insurance	-0.010	(0.029)	0.654***	(0.140)		
unemployment benefits	0.024	(0.015)	-0.016	(0.189)	0.297	(0.235)
income spouse	0.006	(0.007)	-0.047	(0.046)	0.316***	(0.108)
log age	0.176***	(0.062)	10.35***	(2.679)	5.236***	(0.915)
(log age)^2			-1.428	(0.536)		
education levels 2 or 3	0.015	(0.044)	0.332	(0.293)	2.203***	(0.727)
education level 4	0.243***	(0.053)	0.387	(1.917)	2.308***	(0.813)
female	-0.053	(0.037)	-0.339**	(0.134)	0.019	(0.489)
any kid	0.134***	(0.045)	0.384	(1.142)		
female×any kid	-0.072	(0.057)	-0.763	(0.763)		
unemployment rate	-0.018	(0.012)	-0.040	(0.157)	-0.222	(0.197)
home owner					6.986***	(0.921)
home owner×housing index					-0.021*	(0.012)
constant	1.290***	(0.238)			-16.729***	(3.855)
$\rho_{\omega\epsilon}$	-0.025	(0.040)				
$\rho_{\epsilon\tau}$	-0.127	(2.188)				
$\rho_{\tau\omega}$	0.135	(0.114)				
σ_ϵ	0.301***	(0.011)				
σ_ω	4.713***	(0.213)				
Log Likelihood	-4290.3					
N	1055					

Note: heteroscedasticity robust and clustered standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ω refers to the wealth equation, ϵ refers to the reservation wage equation, τ refers to the search equation. The dependent variable on the reservation wage equation is the log of the (net) hourly reservation wage in real terms, 1992 euro's. The dependent variable on the search equation is the number of job applications in the last two months. The dependent variable on the wealth equation is an inverse hyperbolic sine transformation of total net worth. Wealth and income variables given in real terms (1992) in 10,000 euros and 1000 euros respectively. Coefficients on year dummies suppressed.

An exclusion restriction needs to be imposed in order to be able to identify the three-equation system. I assume that home ownership and an index for yearly regional housing prices only affect wealth, but not the reservation wage or search effort. The information on regional housing prices was taken from the index of housing wealth ('Woningwaardeindex') of the Dutch land register ('Kadaster') and is shown in Table C.8. Contrary to

Table 2.10. System of equation for heads, estimation by ML

	Ln rwage	SE	Search effort	SE	Wealth	SE
wealth	0.012*	(0.007)	-0.019	(0.061)		
wealth^2/100	-0.016	(0.016)	-0.087	(0.140)		
other income	0.051**	(0.022)	-0.026	(0.254)	1.375**	(0.634)
other income^2					-0.160	(0.102)
female×other income					0.409	(0.619)
receives unemployment insurance	0.009	(0.034)	0.759***	(0.127)		
unemployment benefits	0.008	(0.016)	-0.068	(0.078)	0.370	(0.226)
income spouse	0.034*	(0.020)	-0.068	(0.173)	0.789***	(0.250)
log age	0.219***	(0.082)	17.51***	(5.603)	7.148***	(1.221)
(log age)^2			-2.372***	(0.898)		
education levels 2 or 3	0.035	(0.051)	0.391	(0.319)	2.314**	(0.977)
education level 4	0.296***	(0.063)	0.496	(1.444)	2.805**	(1.104)
female	-0.017	(0.052)	-0.100	(0.178)	0.283	(0.687)
any kid	0.156***	(0.042)	0.333	(0.791)		
female×any kid	-0.060	(0.074)	-0.875**	(0.410)		
unemployment rate	-0.033*	(0.017)	0.043	(0.170)	-0.189	(0.282)
home owner					6.185***	(1.321)
home owner×housing index					-0.013	(0.016)
constant	1.208***	(0.311)			-23.90***	(5.267)
$\rho_{\omega\epsilon}$	0.015	(0.054)				
$\rho_{\epsilon\tau}$	-0.004	(1.424)				
$\rho_{\tau\omega}$	0.020	(0.220)				
σ_ϵ	0.298***	(0.016)				
σ_ω	5.005***	(0.225)				
Log Likelihood	-2452.7					
N	572					

Note: heteroscedasticity robust and clustered standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ω refers to the wealth equation, ϵ refers to the reservation wage equation, τ refers to the search equation. The dependent variable on the reservation wage equation is the log of the (net) hourly reservation wage in real terms, 1992 euro's. The dependent variable on the search equation is the number of job applications in the last two months. The dependent variable on the wealth equation is an inverse hyperbolic sine transformation of total net worth. Wealth and income variables given in real terms (1992) in 10,000 euros and 1000 euros respectively. Coefficients on year dummies suppressed.

intuition, higher regional housing prices tend to decrease wealth for individuals owning a house.[17] An explanation for the negative sign on the housing price index is as follows:

[17]The negative effect of housing prices for home owners remains if a level effect for housing prices is included. The interaction therefore does not pick up some regional or time-specific economic conditions that are not taken into account by the year dummies, the unemployment index and the polynomial in other income.

Table 2.11. System of equations for spouses, estimation by ML

	Ln rwage	SE	Search effort	SE	Wealth	SE
wealth	0.027***	(0.010)	-0.034	(0.053)		
wealth^2/100	-0.063***	(0.023)	0.100	(0.117)		
other income	-0.065	(0.088)	0.020	(0.495)	3.682	(3.002)
other income^2					-3.828	(2.661)
female×other income					3.457	(2.802)
receives unemployment insurance	-0.050	(0.047)	0.489***	(0.182)		
unemployment benefits	0.033	(0.043)	0.046	(0.126)	-0.266	(0.772)
income spouse	0.015**	(0.008)	-0.238**	(0.131)	0.206**	(0.103)
female×income spouse			0.254*	(0.137)		
log age	0.066	(0.087)	-0.578	(0.361)	2.519**	(1.162)
education levels 2 or 3	0.020	(0.082)	0.128	(0.333)	2.152**	(1.009)
education level 4	0.196**	(0.092)	0.298	(0.367)	1.519	(1.197)
female	-0.036	(0.091)	0.007	(0.376)	-0.906	(0.791)
any kid	-0.123	(0.182)	0.429	(0.458)		
female×any kid	0.173	(0.188)	-0.748	(0.474)		
unemployment rate	-0.004	(0.017)	-0.139**	(0.059)	-0.225	(0.239)
home owner					7.355***	(1.400)
home owner×housing index					-0.032*	(0.017)
constant	1.553***	(0.360)			-5.779	(4.617)
$\rho_{\omega\epsilon}$	-0.083	(0.067)				
$\rho_{\epsilon\tau}$	-0.050	(0.216)				
$\rho_{\tau\omega}$	0.037	(0.143)				
σ_ϵ	0.292***	(0.012)				
σ_ω	4.151***	(0.389)				
Log Likelihood	-1750.9					
N	483					

Note: heteroscedasticity robust and clustered standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ω refers to the wealth equation, ϵ refers to the reservation wage equation, τ refers to the search equation. The dependent variable on the reservation wage equation is the log of the (net) hourly reservation wage in real terms, 1992 euro's. The dependent variable on the search equation is the number of job applications in the last two months. The dependent variable on the wealth equation is an inverse hyperbolic sine transformation of total net worth. Wealth and income variables given in real terms (1992) in 10,000 euros and 1000 euros respectively. Coefficients on year dummies suppressed.

the housing prices in the land register are used to determine property taxes to be paid to the municipality. When respondents do not update the value of their house according to the price changes listed in the land register when they answer the survey, but they do face increased property taxes, reported wealth declines for an increase in the list value of the house.

Results of the estimation can be found in Tables 2.9, 2.10 and 2.11. For the full sample and for household heads, the estimation of the system gives (very) similar results to the single equation estimation. In particular, wealth affects the reservation wage positively and search effort negatively. For spouses, the magnitude of the wealth-effect is also close to the single equation estimation. The influence of wealth on spouses' search effort remains insignificant. LR tests cannot reject the hypothesis that the unobservables in the three equations are uncorrelated, i.e. $\rho_{\omega\varepsilon} = \rho_{\varepsilon\tau} = \rho_{\tau\omega} = 0$. That is, from these estimations there is no support for the hypothesis that the simultaneous equation model improves on the single equation estimation for either the full sample ($\chi^2(3) = 3.81$, $p = 0.37$), household heads ($\chi^2(3) = 0.1$, $p = 0.99$) or spouses ($\chi^2(1) = 2.9$, $p = 0.40$). Correlation between omitted variables does not seem to affect the single equation estimates. The results from the single equations are therefore preferred over the results from the joint model.

2.5 Conclusions

This paper investigates the relations among wealth, reservation wages and search effort both theoretically and empirically. A theoretical model predicts that wealth influences search effort negatively, and reservation wages positively. The theoretical results are tested by estimating reduced form equations for reservation wages and search intensity using Dutch survey-data. This data provides information on individual wealth and income, subjective reservation wages and a proxy for search effort, making it possible to empirically estimate the effects of wealth on reservation wages and search intensity. The main single equation results show that wealth has a significantly positive effect on reservation wages (in particular, a 100% increase in wealth at the mean of the wealth distribution raises the reservation wage by 2.9% for household heads, and 3.7% for spouses). Moreover, wealth has a significantly negative impact on the search effort of household heads. At the 10th percentile of the wealth distribution household heads (spouses) on average apply for 4.95 (2.09) jobs in two months, whereas at the 90th percentile heads (spouses) on average apply for 4.33 (1.71) jobs in two months. A simultaneous model for wealth, reservation wages and search effort is estimated in order to test for possible error correlation between

these three variables. Since no significant error correlation can be found, the results from the single equation models are the preferred ones.

The empirical finding that reservation wages and search effort are influenced by asset holdings has some implications for policy. In general, any policy affecting savings decisions should take the negative effects of savings on unemployment duration into account. For example, suppose a policy maker would like to decrease unemployment duration by decreasing unemployment protection. It is important to realize that decreased unemployment protection leads to a higher probability of getting fired and risk-averse individuals will therefore start to save more in periods of employment. This in turn results in higher reservation wages (and less search) at the moment an individual enters unemployment. The net effect of the decrease in unemployment protection on unemployment duration is unsigned.

A venue for further research is to extend the (empirical) model to investigate the job search behavior of employed individuals. In the data at hand, there are more than 2400 observations on employed household heads that are looking for a job and who report reservation wages and the number of job applications made in the last two months. It would be interesting to empirically test whether the job-search behavior of employed and unemployed workers is affected by the same factors and, in particular, if the role of wealth on search behavior differs over the employment status of the individual.

Appendices

A Proof of Proposition 1

The proof closely follows the proof of the main result in Lentz and Tranaes (2005a). Here I repeat some equations also given in the main text.

The Bellman equation for unemployment is:

$$V^U(A_t) = \max_{\left\{A^U_{t+1}\in[\underline{A},\overline{A}],s_t\right\}} \left\{ \begin{array}{c} u(A_t(1+r)+b+\mu-A^U_{t+1})-e(s_t) \\ +\beta\lambda_t s_t \int_0^\infty \max[V^E(A^U_{t+1,}w), V^U(A^U_{t+1})]dF(w) + \beta(1-\lambda_t s_t)V^U(A^U_{t+1}) \end{array} \right\} \tag{2.11}$$

While the Bellman equation for the value of employment reads:

$$V^E(A_t,w) = \max_{\left\{A^E_{t+1}\in[\underline{A},\overline{A}]\right\}} \left\{ \begin{array}{c} u(A_t(1+r)+w+\mu-A^E_{t+1}) \\ +\beta[(1-\eta)V^E(A^E_{t+1},w)+\eta V^U(A^E_{t+1})] \end{array} \right\} \tag{2.12}$$

Taking first order conditions w.r.t. s_t, A^U_{t+1} and A^E_{t+1}:

$$\begin{aligned} e'(s_t) &= \beta\lambda_t \int_{R_t}^\infty [V^E(A^U_{t+1,}w) - V^U(A^U_{t+1})]f(w)dw, \quad \text{as } s^*_t(A_t) > 0 \\ e'(s_t) &\geq \beta\lambda_t \int_{R_t}^\infty [V^E(A^U_{t+1,}w) - V^U(A^U_{t+1})]f(w)dw, \quad \text{as } s^*_t(A_t) = 0 \end{aligned} \tag{2.13}$$

$$u'(c^U_t) = \beta\lambda_t s_t \int_{R_t}^\infty \left[V^{E\prime}(A^U_{t+1}) - V^{U\prime}(A^U_{t+1})\right] f(w)dw + \beta V^{U\prime}(A^U_{t+1}) + \rho_U$$

$$\rho_U[A^U_{t+1} - \underline{A}] = 0$$

$$u'(c^E_t) = \beta[(1-\eta)V^{E\prime}(A^E_{t+1}) + \eta V^{U\prime}(A^E_{t+1})] + \rho_E$$

$$\rho_E[A^E_{t+1} - \underline{A}] = 0$$

Where R_t denotes the reservation wage in period t, that is, the reservation wage that is decided upon in period t. Furthermore, ρ_U and ρ_E are the Lagrange multipliers on the constraint that wealth cannot be smaller than a lower bound $\underline{A}$.

Letting S denote the space of continuous and bounded functions, equations (2.11) and (2.12) together define the mapping $T : S \times S \rightarrow S \times S$, i.e. $V^U, V^E = T(V^U, V^E)$ or more explicitly: $V^U = T_U(V^U, V^E)$ and $V^E = T_E(V^U, V^E)$. Equations (2.11) and (2.12) are readily seen to be continuous and bounded functions, defined on a compact set, which implies that their solution is continuous and bounded.

It can further be proved that there is a unique solution to this set of equations by showing that T is a contraction mapping. This can be seen by checking Blackwell's sufficient conditions for a contraction mapping (see for example Stokey and Lucas, 1989). Blackwell's sufficient conditions refer to monotonicity and discounting of the mapping. The monotonicity condition states that, if I choose some $V_1^E \geq V_2^E$ and some $V_1^U \geq V_2^U$, it must be that $T(V_1^E, V_1^U) \geq T(V_2^E, V_2^U)$. This can be seen directly from equations (2.11) and (2.12). The discounting condition holds if for some $\psi \geq 0$ and some $0 < k < 1$ it is true that $T(V^E + \psi, V^U + \psi) \leq T(V^E, V^U) + \psi k$. It can be seen from equation (2.11) that $T(V^E + \psi, V^U + \psi) = T(V^E, V^U) + \psi\beta$. Similarly, equation (2.12) shows that $T(V^E + \psi, V^U + \psi) = T(V^E, V^U) + \psi\beta$. Since $0 < \beta < 1$ by definition of the discount factor, discounting also holds. This establishes $T(V^E, V^U)$ as being a contraction mapping. Being a contraction mapping, $T(V^E, V^U)$ has a unique fixed point (V^{E*}, V^{U*}).

By property of the contraction mapping, for some closed set $X_1 \subseteq X$, if $T(X_1) \subseteq X_1$then $(V^{E*}, V^{U*}) \in T(X_1)$. It will be shown that the closed set X_1

$$X_1 = \left\{ (V^E, V^U) \in X \;\middle|\; \frac{\partial}{\partial A} \int_{R_t}^{\infty} [V^E(A,w) - V^U(A)] f(w) dw \leq 0 \;\forall A \right\}$$

is mapped into the set $T(X_1)$ which has the characteristics:

$$T(X_1) = \left\{ (V^E, V^U) \in X \;\middle|\; \frac{\partial}{\partial A} \int_{R_t}^{\infty} [V^E(A,w) - V^U(A)] f(w) dw < 0 \;\forall A \right\}$$

By using Leibniz' rule and the definition of the reservation wage $V^E(A, R) = V^U(A)$ $\forall A$, I can define $\frac{\partial}{\partial A} \int_{R_t}^{\infty} [V^E(A,w) - V^U(A)] f(w) dw = \int_{R_t}^{\infty} \left[V^{E\prime}(A) - V^{U\prime}(A) \right] f(w) dw$.

That is, I will show that when $\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw \leq 0 \,\forall A$ the contraction mapping has the property that $\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw < 0 \;\forall A$.

First define the derivatives of the mapping:

$$\begin{aligned} T^{U\prime}(A_t) &= (1+r)[u'(c_t^U)] \qquad (2.14) \\ &= \beta(1+r)\left[\lambda_t s_t \int_{R_t}^{\infty} \left[V^{E\prime}(A_{t+1}^U) - V^{U\prime}(A_{t+1}^U)\right] f(w)dw + V^{U\prime}(A_{t+1}^U)\right] + (1+r)\rho_U \end{aligned}$$

$$\begin{aligned} T^{E\prime}(A_t) &= (1+r)[u'(c_t^E)] \qquad (2.15) \\ &= \beta(1+r)[(1-\eta)V^{E\prime}(A_{t+1}^E) + \eta V^{U\prime}(A_{t+1}^E)] + (1+r)\rho_E \end{aligned}$$

Now assume that $\int_{R_t}^{\infty} \left[V^{E\prime}(A_t) - V^{U\prime}(A_t)\right] f(w)dw \;\leq 0 \,\forall A$. There are two cases. First, suppose that the marginal utility of relaxing the lower bound on wealth is higher for employed than for unemployed, $\rho_E(A_t) > \rho_U(A_t)$. Since the Lagrange multiplier cannot be negative here, this implies $\rho_E(A_t) > 0$ so in the state of employment, the liquidity constraint is binding, $A_{t+1}^E = \underline{A}$. In the state of unemployment, the liquidity constraint may or may not bind: $A_{t+1}^U \geq \underline{A}$. Thus it follows that $A_{t+1}^E \leq A_{t+1}^U$, which means that $c_t^E > c_t^U$ since $w \geq R > b$. Strict concavity of u and equations (2.14) and (2.15) then imply that $\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw \;< 0 \,\forall A \in [\underline{A}, \overline{A}]$. In general, whenever $A_{t+1}^E \leq A_{t+1}^U$, it follows directly that $\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw \;< 0 \,\forall A \in [\underline{A}, \overline{A}]$.

Now consider the other case in which $A_{t+1}^E > A_{t+1}^U$ which means that $\rho_E(A_t) \leq \rho_U(A_t)$ (by negation of the logical relation $\rho_E(A_t) > \rho_U(A_t) \Rightarrow A_{t+1}^E \leq A_{t+1}^U$, which was established before). Under which condition does $\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw \;< 0$ hold? Subtracting (2.15) from (2.14) and integrating over the wage distribution:

$$\int_{R_t}^{\infty} \left[T^{E\prime}(A_t) - T^{U\prime}(A_t)\right] f(w)dw$$

$$= \int_{R_t}^{\infty} \left\{ \begin{array}{c} T^{E\prime}(A_t) - \beta(1+r)\lambda_t s_t \int_{R_t}^{\infty} \left[V^{E\prime}(A^U_{t+1}) - V^{U\prime}(A^U_{t+1})\right] f(w)dw \\ -\beta(1+r)V^{U\prime}(A^U_{t+1}) - (1+r)(\rho_U) \end{array} \right\} f(w)dw$$

$$< \int_{R_t}^{\infty} \left\{ \begin{array}{c} T^{E\prime}(A_t) - \beta(1+r)\lambda_t s_t \int_{R_t}^{\infty} \left[V^{E\prime}(A^E_{t+1}) - V^{U\prime}(A^E_{t+1})\right] f(w)dw \\ -\beta(1+r)V^{U\prime}(A^E_{t+1}) - (1+r)(\rho_U) \end{array} \right\} f(w)dw$$

$$= \int_{R_t}^{\infty} \left\{ \begin{array}{c} \beta(1+r)[1-\eta]\left[V^{E\prime}(A^E_{t+\triangle t}) - V^{U\prime}(A^E_{t+\triangle t})\right] \\ -\beta(1+r)\lambda_t s_t \int_{R_t}^{\infty} \left[V^{E\prime}(A^E_{t+\triangle t}) - V^{U\prime}(A^E_{t+\triangle t})\right] f(w)dw + (1+r)(\rho_E - \rho_U) \end{array} \right\} f(w)dw$$

$$= \begin{array}{c} \beta(1+r)[1-\eta-\lambda_t s_t[1-F(R_t)]] \int_{R_t}^{\infty} \left[V^{E\prime}(A^E_{t+\triangle t}) - V^{U\prime}(A^E_{t+\triangle t})\right] f(w)dw \\ +[1-F(R_t)](1+r)(\rho_E - \rho_U) \end{array}$$

$$\leq 0$$

Where the first strict inequality follows from strict concavity of V^E and V^U and $A^E_{t+1} > A^U_{t+1}$.[18] Finally, the weak inequality follows from our assumption that $\frac{\partial}{\partial A}\int_{R_t}^{\infty}[V^E(A,w) - V^U(A)]f(w)dw \leq 0 \ \forall A$, that $\rho_E \leq \rho_U$ and $\lambda_t s_t[1-F(R_t)] \leq [1-\eta]$. In words, the last assumption states that the time-horizon of an individual is such that the probability of being employed in period $t+1$ is regarded to be higher when the individual is employed, than when the individual is unemployed at time t.

[18] Proof of strict concavity of V^E and V^U would require inclusion of a source of randomness in the model. Lentz and Tranaes (2005a) use a wealth lottery to this aim.

B Proof of Proposition 3

In Appendix A it was established that $\frac{\partial}{\partial A}\int_{R_t}^{\infty}[V^E(A,w)-V^U(A)]f(w)dw < 0\ \forall A$ under the assumptions that the value functions V^U and V^E are strictly concave in A, and $\lambda_t s_t[1-F(R_t)] \leq [1-\eta]$. As a consequence, search effort is decreasing in wealth. This Appendix shows that $\frac{\partial}{\partial A}[V^E(A,R(A,f(w))-V^U(A)] < 0\ \forall A$ under the assumptions that the value functions V^U and V^E are strictly concave in A, and $\lambda_t s_t[1-F(R_t)] << [1-\eta]$. As a consequence, the reservation wage is increasing in wealth. Note that this condition is almost the same as the condition needed for search effort to be decreasing in wealth, the only difference is that there is no integration over the wage distribution. I can therefore apply the same reasoning as in Appendix A.

Without integration over the wage distribution, the final lines of the proof of proposition 1 in Appendix A read:

$$
\begin{aligned}
&\left[T^{E\prime}(A_t)-T^{U\prime}(A_t)\right] \\
&= T^{E\prime}(A_t)-\beta(1+r)\lambda_t s_t\int_{R_t}^{\infty}\left[V^{E\prime}(A^U_{t+1})-V^{U\prime}(A^U_{t+1})\right]f(w)dw \\
&\qquad -\beta(1+r)V^{U\prime}(A^U_{t+1})-(1+r)(\rho_U) \\
&< T^{E\prime}(A_t)-\beta(1+r)\lambda_t s_t\int_{R_t}^{\infty}\left[V^{E\prime}(A^E_{t+1})-V^{U\prime}(A^E_{t+1})\right]f(w)dw \\
&\qquad -\beta(1+r)V^{U\prime}(A^E_{t+1})-(1+r)(\rho_U) \\
&\qquad \beta(1+r)[1-\eta]\left[V^{E\prime}(A^E_{t+\triangle t})-V^{U\prime}(A^E_{t+\triangle t})\right] \\
&= -\beta(1+r)\lambda_t s_t\int_{R_t}^{\infty}\left[V^{E\prime}(A^E_{t+\triangle t})-V^{U\prime}(A^E_{t+\triangle t})\right]f(w)dw+(1+r)(\rho_E-\rho_U) \\
&\leq 0
\end{aligned}
$$

Where the first strict inequality follows from strict concavity of V^E and V^U and $A^E_{t+1} > A^U_{t+1}$. The weak inequality follows from our assumption $\frac{\partial}{\partial A}[V^E(A,R(A))-V^U(A)] \leq 0\ \forall A$, $[1-\eta]\left[V^{E\prime}(A^E_{t+\triangle t},R_t(A_t))-V^{U\prime}(A^E_{t+\triangle t})\right] \leq \lambda_t s_t\int_{R_t}^{\infty}\left[V^{E\prime}(A^E_{t+\triangle t},w)-V^{U\prime}(A^E_{t+\triangle t})\right]f(w)dw$ and $\rho_E \leq \rho_U$. With a nondegenerate wage distribution, the second assumption is stronger than the assumption needed for search effort to be decreasing in wealth, namely $[1-\eta] >>$

$\lambda_t s_t[1-F(R_t)]$. This is a direct consequence of the fact that a rise in assets is worth more for low wage workers than for high wage workers (i.e. $\frac{\partial^2 V^E}{\partial w \partial A} < 0$, the utility function is strictly concave).[19]

[19] Under the assumption that $[1-\eta] \geq \lambda_t s_t[1-F(R_t)]$ it holds that $[1-\eta]\left[V^{E\prime}(A^E_{t+\triangle t}, R_t(A_t)) - V^{U\prime}(A^E_{t+\triangle t})\right] \leq \lambda_t s_t[1-F(R_t)]\left[V^{E\prime}(A^E_{t+\triangle t}, R_t(A_t)) - V^{U\prime}(A^E_{t+\triangle t})\right]$

Strict concavity of the utility function implies that $\int_{R_t}^{\infty}\left[V^{E\prime}(A^E_{t+\triangle t}, w) - V^{U\prime}(A^E_{t+\triangle t})\right] f(w)dw \leq [1-F(R_t)]\left[V^{E\prime}(A^E_{t+\triangle t}, R_t(A_t)) - V^{U\prime}(A^E_{t+\triangle t})\right]$ such that a stronger assumption is needed in order for $[1-\eta]\left[V^{E\prime}(A^E_{t+\triangle t}, R_t(A_t)) - V^{U\prime}(A^E_{t+\triangle t})\right] \leq \lambda_t s_t \int_{R_t}^{\infty}\left[V^{E\prime}(A^E_{t+\triangle t}, w) - V^{U\prime}(A^E_{t+\triangle t})\right] f(w)dw$ to hold.

C Extra Tables and Figures

Table C.1. Sample selection

	Household heads	**Spouses**
1. all individuals	33734	24614
2. without a job	7762	7036
3. unemployed (looking for a job)	764	708
4. not self-employed, working age	739	694
5. reservation wage observed	711	666
6. covariates observed, except income, wealth	699	652
7. all covariates observed	441	386
8. imputing income variables	577	484
9. dropping outliers	572	483

Table C.2. Multiple observations on the same individual

	Household heads		**Spouses**	
	# Individuals (%)	# Obs	# Individuals (%)	# Obs
Observed once	175 (53.4)	175	186 (60.6)	186
Observed twice	95 (29.0)	190	88 (28.7)	176
Observed three times	37 (11.3)	111	19 (6.1)	57
Observed four times	13 (4.0)	52	11 (3.6)	44
Observed five times	5 (1.5)	25	1 (0.3)	5
Observed more than five times	3 (0.9)	19	2 (0.6)	15
Total	328 (100)	572	307 (100)	483

Table C.3. Distribution of wealth-variables

	All Unempl.		Unempl. Heads		Unempl. Spouses		Total DNB sample	
	Wealth	Net worth	Wealth	Net worth	Wealth	Net worth	Wealth	Net worth
10%	-274.8	-122.6	-309.4	-290.6	-43.1	0.0	0.0	19.0
25%	0	118.6	0.0	2.5	0.0	1878.8	131.1	3415.8
50%	55.3	6802.0	837.1	1773.8	338.0	10092.6	2544.6	19033.1
75%	4218.2	25367.5	6058.1	30655.5	2859.6	21482.8	8577.1	51370.4
90%	13222.9	59781.7	19963.8	77683.2	9215.9	39152.4	21565.5	106278.0
Min	-10648.8	-3800.7	-10648.8	-38100.7	-9574.4	-8082.5	-512261.5	-512261.5
Max	180235.6	498383.4	180235.6	498383.4	96862.0	462489.4	1254949.0	3088198.0
# obs	1055	1055	572	572	483	483	35840	35840

Table C.4. Specification of search categories

Category	# Job applications in the past two months	**Full sample** Fraction of Observations	**Household heads** Fraction of Observations	**Spouses** Fraction of Observations
0	0	0.41 (0.41)	0.30 (0.30)	0.55 (0.54)
1	1	0.11 (0.11)	0.10 (0.11)	0.12 (0.12)
2	2	0.10 (0.10)	0.09 (0.10)	0.10 (0.11)
3	3-4	0.09 (0.09)	0.11 (0.11)	0.07 (0.07)
4	5-6	0.06 (0.06)	0.06 (0.06)	0.06 (0.06)
5	7-8	0.06 (0.06)	0.08 (0.08)	0.03 (0.03)
6	9-10	0.07 (0.07)	0.10 (0.10)	0.03 (0.03)
7	11-15	0.04 (0.04)	0.07 (0.06)	0.01 (0.01)
8	>15	0.05 (0.05)	0.08 (0.08)	0.02 (0.02)

Note: Average predicted fraction of observations in parentheses. Number of observations is 572 for household heads, 483 for spouses. All individuals reported to be unemployed and searching for a job.

Table C.5. Reliability of reservation wage data

Difference between reported reservation wages and the wage earned before and after the unemployment spell

	Household Heads			**Spouses**		
	Number of Observations	Mean	Median	Number of Observations	Mean	Median
Previous wage-reservation wage	105	5.3	1.2	56	3.8	1.2
Fraction previous wage>reservation wage	105	0.7	0.7	56	0.7	0.7
Accepted wage-reservation wage	58	3.4	0.4	38	2.3	1.2
Fraction accepted wage>reservation wage	58	0.6	0.6	38	0.6	0.6

Note: (Reservation) wages are hourly net (reservation) wages and reported in real terms, 1992 euros.

Table C.6. reliability of reservation wage data, heads

Distribution of (reservation) wages for different ages and education categories

	Number of observations	10%	25%	50%	75%	90%
Wage, all	11894	6.7	8.1	9.9	12.4	15.7
Reservation wage, all	572	4.7	5.5	6.7	8.3	10.6
Wage, education 1	416	6.0	7.3	8.7	10.8	14.6
Reservation wage, education 1	48	4.0	5.2	6.2	7.0	9.9
Wage, education 2	2272	6.3	7.3	8.6	10.3	12.7
Reservation wage, education 2	173	4.9	5.4	6.3	7.4	8.6
Wage, education 3	3572	6.4	7.8	9.2	11.2	14.3
Reservation wage, education 3	191	4.2	5.4	6.2	7.7	10.0
Wage, education 4	5605	7.6	9.2	11.3	13.7	16.9
Reservation wage, education 4	160	5.6	6.6	8.3	10.3	12.9
Wage, age<=35	2978	5.7	6.9	8.2	9.9	12.3
Reservation wage, age<=35	142	4.2	5.2	6.1	7.0	8.7
Wage, 35<age<=45	3926	7.2	8.4	10.0	12.0	14.87
Reservation wage, 35<age<=45	143	4.7	5.4	6.2	7.7	9.8
Wage, age>45	4990	7.5	9.1	11.1	13.9	17.4
Reservation wage, age>45	287	5.2	6.0	7.4	9.1	11.7

Note: (Reservation) wages are hourly net (reservation) wages and reported in real terms, 1992 euros. Observations are pooled over all years, numbers on reservation wages reported using individuals for whom reservation wages are observed.

Table C.7. Reliability of reservation wage data, spouses

Distribution of (reservation) wages for different ages and education categories

	Number of observations	10%	25%	50%	75%	90%
Wage, all	5354	5.3	6.7	8.2	10.1	13.1
Reservation wage, all	483	4.2	5.2	6.2	7.5	9.1
Wage, education 1	278	3.8	5.8	7.3	9.1	11.8
Reservation wage, education 1	28	4.2	4.6	5.6	7.1	9.9
Wage, education 2	1398	4.4	5.9	7.4	9.1	11.5
Reservation wage, education 2	168	4.1	5.0	6.0	6.8	7.9
Wage, education 3	1812	5.5	6.6	7.9	9.7	12.3
Reservation wage, education 3	182	4.3	5.2	6.2	7.3	8.5
Wage, education 4	1855	6.3	7.9	9.3	11.3	14.2
Reservation wage, education 4	104	4.1	5.8	7.2	9.1	12.0
Wage, age<=35	1750	5.2	6.4	7.9	9.7	12.5
Reservation wage, age<=35	139	4.1	5.1	6.1	7.3	8.5
Wage, 35<age<=45	1855	5.2	6.7	8.2	10.2	13.3
Reservation wage, 35<age<=45	190	4.2	5.1	6.2	7.5	9.5
Wage, age>45	1749	5.5	7.0	8.5	10.4	13.3
Reservation wage, age>45	154	4.2	5.3	6.3	7.6	9.2

Note: (Reservation) wages are hourly net (reservation) wages and reported in real terms, 1992 euros. Observations are pooled over all years, numbers on reservation wages reported using individuals for whom reservation wages are observed.

Table C.8. Regional housing prices

	Groningen	Friesland	Drenthe	Flevoland	Overijssel	Gelderland	N-Holland	Z-Holland	Utrecht	Zeeland	N-Brabant	Limburg
1993	27.8	25.8	35.2	38.0	31.6	41.9	43.9	38.9	43.7	30.8	41.4	36.3
1994	30.5	28.6	39.0	43.4	37.4	47.8	49.4	44.2	48.8	34.2	47.0	42.3
1995	33.2	30.7	40.7	47.7	40.1	50.6	52.9	47.5	53.8	38.3	50.1	46.5
1996	35.6	38.9	45.4	51.8	44.8	58.4	58.6	51.9	59.2	39.8	56.1	49.9
1997	40.1	42.2	50.8	61.2	52.3	64.7	66.5	58.2	68.3	43.6	63.4	56.8
1998	42.0	47.2	55.8	59.9	56.6	73.8	75.3	63.8	76.0	48.9	71.9	61.9
1999	48.2	55.9	63.5	68.2	66.6	83.3	88.4	73.3	91.4	56.0	82.5	70.8
2000	58.1	65.0	76.2	82.3	79.5	98.7	106.5	83.7	107.9	62.3	96.4	82.8
2001	68.1	73.0	88.4	92.2	88.4	112.7	117.5	94.2	117.7	70.0	106.6	87.5
2002	75.7	81.1	98.6	101.4	96.7	121.6	128.1	103.0	120.3	77.3	120.6	92.3
2003	79.1	85.5	101.5	108.4	100.2	124.7	132.9	109.5	127.8	86.4	125.5	95.6
2004	83.5	95.5	109.0	105.9	103.0	128.5	136.0	114.5	136.4	93.3	131.5	99.4
2005	87.0	101.2	108.0	108.3	107.9	131.6	141.2	120.1	144.0	100.5	137.6	105.5
2006	96.0	104.1	116.4	113.3	114.3	141.1	148.7	123.1	150.7	101.4	141.9	108.8
2007	100.0	108.5	116.7	117.4	119.2	146.5	157.9	129.0	157.9	110.4	150.6	113.2
2008	102.4	110.8	115.1	122.8	122.1	148.1	168.2	134.5	161.7	117.2	154.2	111.9

Authors own calculations on basis of data from the Dutch land register, available from http://www.kadaster.nl. Indexed regional housing prices, 100=price of a house in Groningen in 2007.

Chapter 3

Job search requirements for older unemployed: transitions to employment, early retirement and disability benefits*

3.1 Introduction

How can policy raise the labour market participation rate of older workers? The combination of a low participation rate of older workers and population aging puts a strain on public finances. Raising the official retirement age to 67 and beyond has been brought forward as part of the solution in many countries. However, increasing the retirement age will only be effective when the opportunity to retire early is limited.

Not only early retirement pension payments, but also other social benefits such as disability insurance (DI) and unemployment insurance (UI) have been used as early retirement pathways. These benefit schemes have some features that make them especially attractive for older workers. First, the potential benefit duration is usually increasing in age. Second, older workers who receive unemployment benefits often do not need to report any job search effort to the unemployment office in order to retain their benefit payments. Little is known about the effect of such policies on the inflow into unemployment and the

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subsequent outflow to employment. The longer potential benefit duration and exemption of search requirements might very well contribute to the fact that the duration of unemployment for older workers is longer on average (Chan and Stevens, 2001; de Graaf-Zijl and Hop, 2007).

Intentionally or unintentionally, the policy to exempt older unemployed from job search can create an "unemployment tunnel" in which individuals receive benefit payments until they reach the official retirement age. In 2006, there were many countries in which older unemployed were not obliged to look for jobs, including Belgium, Finland, France, Germany and the United Kingdom. In other countries such as Sweden, there is no formal exemption from job search for the older unemployed. However, job search requirements are not strictly enforced on them either (OECD, 2006). In recent years many governments have raised the age from which older unemployed are exempted from job search. Some countries even equalized job search requirements for all unemployed, young or old. In Belgium, the minimum age was increased from 50 to 58 between 2002 and 2004 (Bollens, 2011). In France older unemployed are no longer exempted from the requirement to look for jobs as from January 2012.

The Netherlands also used to exempt their older unemployed (defined as being at least 57.5 years old) from the requirement to actively search for a job in order to receive full UI benefits. This situation changed on January 1^{st} 2004. From that date, the 57.5+ year olds faced the same regulations as other age groups and needed to report their (formal) search behaviour to the unemployment office. This paper exploits this policy change to examine how search requirements for the older unemployed affect the number of individuals who experience a transition to employment. Because a reduction in unemployment only raises labour force participation when early retirement benefits and disability benefits are not used as substitutes to UI, we also examine the effect of the policy change on transitions to disability payments and early retirement.

To study labour market transitions of older workers, access to a dataset with a large cross sectional dimension is needed. Labour market surveys are usually based on a representative sample of the entire working age population such that only a tiny fraction of older unemployed individuals is observed, precluding meaningful analyses of transition

behaviour for this group. The present paper contributes to the existing literature by using a large administrative database covering all registered benefit and wage receipts in the Netherlands, including UI benefits. The data provides very precise information on income and labour market status, giving us a large enough sample to analyze labour market transitions of the older unemployed in the years 2001 to 2005.

There exists a large strand of literature examining the effects of changes in the UI benefit system on unemployment duration. Most of these papers are concerned with effects of sanctions or training programs (Abbring et al. (2005), van den Berg et al. (2004), van den Berg and van der Klaauw (2006)), changes in potential unemployment benefit duration (Caliendo et al. (2009), Card and Levine (2000), Kyyrä and Ollikainen (2008), Lalive et al. (2006), Lalive (2008), van Ours and Vodopivec (2006)) or the level of unemployment benefits (Carling et. al. (2001), Røed and Zhang (2003)). Studies examining a tightening of search requirements are less common. Manning (2009) finds large flows out of claimant status upon a tightening of search requirements in the U.K. but does not find an effect on search intensity. Petrongolo (2009), studying the same U.K. reform, concludes that unemployment duration decreases, but the transition rate to disability insurance benefits increases. Our paper is closest in spirit to Heyma and van Ours (2005), who examine the effect of the same discontinuity in UI eligibility criteria for Dutch older workers. They find a substantially lower outflow to jobs for individuals that turn 57.5 and are no longer required to actively search for a job. In contrast to Heyma and van Ours (2005), our dataset follows individuals both before and after the policy change. Making use not only of variation in age, but also of variation over time, we are able to estimate treatment effects for various groups of treated individuals. Moreover, instead of focussing exclusively on unemployment to employment transitions, we also shed light on substitution between various social insurance programs by considering both DI receipt and early retirement as competing risks for the exit out of unemployment. One of the desired consequences of imposing stricter requirements for receiving UI benefits is to save on government spending by decreasing the number of individuals eligible for receipt of these benefits. This can be done directly by excluding individuals from receiving UI benefits if they do not comply with the new rules, or by making the receipt of UI benefits so unattractive that individuals

start to look for alternatives themselves. However, the alternative that the government has in mind (paid employment) might not be the most attractive alternative from the point of view of the individual. The unemployed worker can instead substitute towards other benefit types, such as disability benefits or, in case of the older workers, early retirement benefits (provided that eligibility conditions for such schemes can be met). Since costly substitution between programs that insure different risks should be avoided, spill-over effects among these government programs are an important aspect of policy evaluation. In this paper, we are able to furnish empirical evidence on the importance of the various substituting pathways.

We estimate flexible form competing risks duration models using difference-in-difference and regression discontinuity approaches and identify the causal effect of the policy change on observed labour market transitions. We show that for several groups of individuals, the stricter search requirements strongly and significantly increase the number of individuals that find a job after a maximum of two years in unemployment. For instance, unemployed males aged 57.5-59.5 have a more than 20 percent (6.5 percentage points) higher probability of finding a job within 24 months (37.8% instead of 31.3%) due to imposition of the new rules. Previous results for the Netherlands show that working individuals substitute between UI and DI benefits (Heyma, 2005; Euwals e.a. 2011; Koning and van Vuuren 2007, 2010; Vos e.a. 2011). We find evidence that substitutability of UI and DI is also relevant for unemployed individuals. A higher number of unemployed individuals receive disability benefits when search requirements are enacted, a presumably unwanted side-effect of the policy change. In contrast, no significant substitution from UI benefits towards early retirement benefits is found.

The remainder of the paper is set up as follows. Section 3.2 presents some important aspects of the Dutch UI system, with a focus on changes in the system aimed at the older unemployed. It also gives a brief description of the sickness/disability insurance benefit and early retirement systems and changes therein. Theoretical effects of an increase in search requirements are considered in Section 3.3. The empirical analysis starts out in Section 3.4 with a description of the data and the selection of treatment and control groups for analysis. Section 3.5 presents the estimation strategy and some descriptive

evidence, before continuing to estimation results given in Sections 3.6 and 3.7. Section 3.8 reports on post-unemployment job characteristics. Finally, Section 3.9 concludes.

3.2 Institutional Context

This section gives an overview of the UI benefit system in the Netherlands and reports important policy changes aimed at older workers. It also considers changes in the DI and early retirement system that could possibly affect the inflow in these social insurance schemes for older unemployed workers. Our focus is on the years 2001-2005, as the data available to us are informative on this time period.

3.2.1 The Dutch Unemployment Insurance System and Developments from 2001-2005

The Dutch Unemployment Insurance System

In the Netherlands, three types of UI benefits can be received: short-term benefits, wage-related benefits and extended benefits. In order to be eligible for short-term benefits, an individual needs to have worked at least 26 weeks out of the last 39 weeks before becoming unemployed (the 26-out-of-39 requirement) and be 'available for work' (for example, an individual is not allowed to live abroad or join an educational program). Short-term benefits can be received for at most six months and are set to 70% of the prevailing minimum wage or 70% of average last-earned wage, whichever one is less. Wage-related benefits are paid when the claimant fulfills the 26-out-of-39 requirement and in addition worked for 52 days or more in at least four out of the five (calendar) years before he became unemployed. The benefits are set to 70% of the average wage earned at the last employer, with a maximum of about €29,000 (net) a year in 2003. Extended benefits can be received after the maximum duration of wage-related benefits has expired, and have the same level as short-term benefits. An overview of the system is given in Table 3.1.

In order to be eligible for UI benefits, an unemployed job seeker needs to comply with the unemployment insurance procedure. On the first day following unemployment, an unemployed job seeker is expected to register at the unemployment office. During this

Table 3.1. Eligibility requirements, duration and height of UI benefits 2001-2005

type of UI benefit	**eligibility requirements**	**duration**	**payment**
short-term benefits	26-out-of-39 weeks requirement	6 months	70% of minimum wage or 70% of previous wage whichever is lower
wage-related benefits	26-out-of-39 weeks requirement + 4-out-of-5 years requirement	6 months to 5 years, depending on age	70% of previous wage
follow-up-benefits	26-out-of-39 weeks requirement + 4-out-of-5 years requirement	2 years if <57.5 at time of unemployment, otherwise 3.5 years	70% of minimum wage or 70% of previous wage whichever is lower

Note: benefits are granted to a maximum (about 29.000 euro per year in 2003)

first intake, the unemployment office assesses the employability of the individual. Based on characteristics such as profession, labour market experience, education, age, and the impression by the caseworker during the intake, the individual is classified to a certain 'phase'. Phase 1 individuals are assumed to be able to find work within six months without any further assistance. Other individuals (phases 2, 3 and 4) receive job search assistance and can be assigned to active labour market programs by the unemployment office.

Within a maximum of eight days following the intake the individual again needs to report at the unemployment office. During this meeting, the unemployed is informed about his rights and duties. Specifically, he is informed about the procedures regarding job search requirements. An individual needs to apply to a minimum of four 'suitable' jobs per four weeks. In the first six months of unemployment, a job is considered suitable when all of the following apply: (i) the level of education required for the job is the maximum level the individual obtained[1], (ii) earnings are not significantly below earnings in the previous job, and (iii) travel time per day is not more than 2 hours. An individual is also expected to consult a public vacancy information system. Moreover, he needs to accept any suitable jobs offered to him by the unemployment office. Apart from these job search and job acceptance requirements, an individual is expected to participate in the advised active labour market programs (if any).

In the weeks following the second intake, an individual needs to report to his caseworker

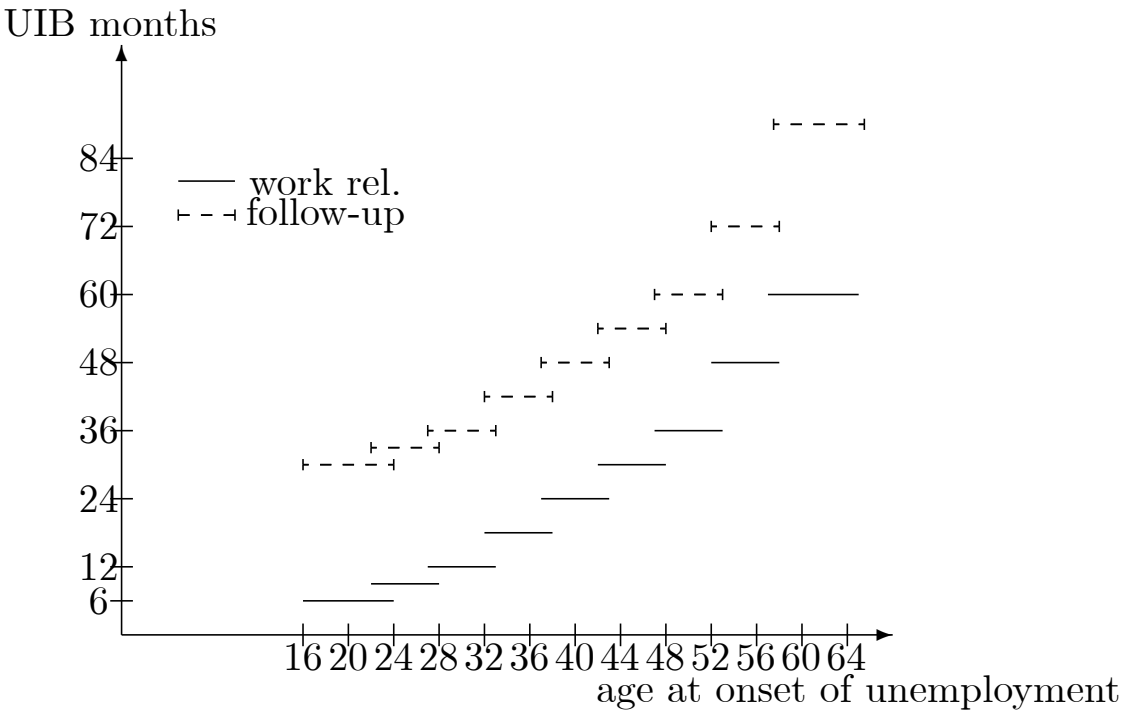
[1]Individuals with a master degree also need to accept work on the bachelor level.

at the unemployment office every four to six weeks. These meetings are primarily meant to check whether the individual complies with the job search requirements. In case the caseworker suspects that an individual did not submit enough job applications, an official at the unemployment office is informed. The official decides whether a sanction will be imposed, of which the individual is notified. The unemployed is then given the opportunity to defend his case. If it is decided that the individual is responsible for the lack of job applications, he is sent a letter in which it is explained when and with what amount his benefits will be cut. The maximum cut for a first violation corresponds to a decrease in benefits by 20 percentage points for 16 consecutive weeks (i.e. from 70% to 50% of previous wage/minimum wage) or 10 percentage points when the individual is to blame only partially. The percentage point cut is the same regardless of whether the individual receives short-term, wage-related, or extended benefits. In case of recidivism within two years, the benefit cut can be as a high as 30 percentage points.[2]

The maximum duration of wage-related benefits is a step-wise function of age. A potential employment history is calculated by adding (i) the number of years from the age of 18 until five years before unemployment starts and (ii) the four (or five) years that an individual worked just before becoming unemployed. For example, an individual who turned 18 in 1960 and becomes unemployed in 2000, would have 39 or 40 years of potential employment history: (i) 35 (1995-1960) plus (ii) four or five. A longer potential employment history implies a longer UI eligibility, with a maximum of five years for wage-related benefits. For most individuals, maximum duration for extended benefits is two years. However, if a worker aged 57.5 or above loses his job, extended benefits can be received for up to 3.5 years. A graphical representation of potential benefit durations for wage-related and extended UI benefits and their relation to age at unemployment is given in Figure 3.1.

[2]Table B.1 shows that huge cuts in benefits indeed take place in practice: noncompliers are punished with an average of 20 percentage points cut in benefits (from 70 to 50 percent of previous/minimum wage) for 14 consecutive weeks. The average duration is shorter than 16 weeks since there are some individuals who start working before the end of the sanction spell.

Figure 3.1. Potential UI benefit duration



3.2.2 Developments in the Dutch Unemployment Insurance System 2001-2005

In the period under study, a number of reforms in the UI system took place. Here we present an overview of reforms specifically aimed at (increasing the participation rate of) older unemployed.

First, from May 11th 2001 onwards employers are obliged to pay part of the UI benefits if they fire an employee aged 57.5 or above.[3] Second, for individuals becoming unemployed on or after August 11th 2003, extended benefits are abolished. Instead, those aged 50+ when becoming unemployed fall under the so-called IOAW scheme with payments that

[3]The contribution to benefit payments depends on the size of the firm, with a maximum of 30% of gross UI payments for companies with more than 50 employees. An extra restriction is that a maximum of 3% of total wages in the company may be paid as UI benefits to older ex-workers. In Section 3.7 we show that this 2001 policy change does not interfere with our main results: either selecting individuals who become unemployed in the years 2002-2004 or selecting those becoming unemployed in the years 2001-2004 gives the same results on all estimated treatment effects.

provide the household with an income of 70% of minimum wage after expiration of wage-related UI benefits. This is the same level of benefits previously provided for by extended benefits. Both extended benefits and IOAW benefits are not means-tested. The only difference between extended benefits and IOAW benefits is that IOAW benefits are tested against the income of the spouse. Finally, starting from the 1^{st} of January 2005, potential duration of wage-related benefits for new UI recipients is made (partly) dependent on actual employment history instead of merely on age. An employment history is calculated by adding the number of years actually worked between 1998 and the calendar year preceding unemployment to the number of years potentially worked before 1998 (1998-18-year of birth). The individuals selected for our analysis all become unemployed before the 1^{st} of January 2005 and are therefore unaffected by this new regulation. An overview of the developments aimed at older unemployed can be found in Table 3.2.

Table 3.2. Overview of changes in the UI-system aimed at the elderly, 2001-2005

Date	**Policy Change**
2001, May 11th	employers pay part of UI-benefits for 57.5+ year olds
2003, Aug 11th	extended benefits cancelled
2004, Jan 1st	**57.5+ year olds are (also) required to search actively**
2005, Jan 1st	max. UI duration determined partly by employment history
2006, Oct 1st	max. UI duration reduced from 60 to 38 months payments increased from 70% to 75% in first two months 26-out-of-39 becomes 26-out-of-36

Focus of the present paper is a reform which became effective from January 1^{st} 2004. Post-reform, older (57.5+) job seekers lose their special status in terms of search requirements. They are treated in the same way as all other unemployed, including regular meetings at the unemployment office to check whether they apply to at least four jobs every four weeks. Descriptive evidence on the actual imposition of sanctions on the older workers can be found in Table B.2 in Appendix B. In 2004 there is an increase of five percentage points in the share of total sanctions that is due to non-compliance with the search requirement, suggesting that sanctions are indeed also levied on older individuals (five percent of the UI population consists of older ex-employees). In the data, we un-

fortunately do not observe when and whether sanctions have been imposed, nor do we observe the actual search effort of individuals. Instead, we focus directly on the relevant policy outcome: do older individuals find jobs when they are confronted with an official requirement to search for jobs?

Not only newly unemployed are affected by this change in search requirements. For older workers that are already unemployed, a transitional arrangement is in place: the search requirement is activated on January 1^{st} 2004 for all individuals that are unemployed for less than one year at December 31^{st} 2003 and are less than 62 years and 2 months old at the 1^{st} of January 2004. Moreover, all individuals that do not reach the age of 57.5 before the 31^{st} of December 2003 also need to continue searching when turning 57.5, even if they are unemployed for more than a year. Exceptions to the obligation to search are made, among others, for individuals aged 64 or above on their first day of unemployment, for individuals starting up their own business or taking part in an educational program which is considered necessary for re-integration, and for individuals aged 57.5 or above at the 31^{st} of December 2003 who receive DI benefits right before entering UI.

3.2.3 The Dutch Disability Insurance System

Individuals who have a positive probability to be considered eligible for DI benefits have an opportunity to substitute their UI payments with DI payments. Autor and Duggan (2003) find that DI is used as a substitute for UI in the U.S., whereas Larsson (2006) documents that sick reports in Sweden increase as the UI benefit expiration date approaches. Although there is some evidence that in Germany UI and DI are not used as exchangeable pathways (Riphahn, 1997), studies for the Netherlands usually do find significant substitution: Koning and van Vuuren (2007) find that 3% of all dismissals takes place via the DI scheme. Related, Borghans et al. (2010) find that when individuals are confronted with stricter DI entrance criteria and a reduction in the replacement rate, many individuals leave DI and take up other forms of social assistance. These findings strongly suggest that individuals can to some extent choose to enter DI, and therefore adjustments in the UI system may trigger a change in DI inflow. Yet, instead of being 'pushed' from UI into DI (as is the case when search requirements for eligibility of UI increase) individuals

can also be 'pulled' into DI upon modification of the latter system. To be able to better judge the relative attractiveness of receiving DI versus receiving UI benefits, we present an overview of the Dutch DI system. Since nearly all policy changes from 2001-2005 are aimed at employers and are irrelevant to the unemployed, we defer an overview of major adjustments in the DI system to Appendix A.

In 2001 the Dutch DI System consists of two main Acts: the Sickness Act (SA) and the Disability Act (DA). The SA provides an income floor to any citizen (including UI benefit recipients) in case of sickness or disability. In most cases, UI benefit recipients who become ill or otherwise disabled receive 70% of their former wage for up to one year. Subsequently, an individual enters the Disability Act. After medical examination, a worker who is considered at least partially disabled becomes eligible for DI payments of up to 70% of last earned wage, depending on the degree of disability. Individuals aged 58 and older receive wage-related DI benefits for a maximum of six years, and individuals in the age range 53-57 for three years. After wage-related DI benefits have expired, individuals can receive an extended benefit. The extended benefit also depends on age and previous wage and can be received for as long as the disability lasts.

3.2.4 The Dutch Early Retirement System

In the Netherlands, it is possible to retire before the statutory old-age pension age of 65. The exact rules for early retirement are determined on a sectoral level by negotiations between unions and employer organisations. Up until the late 1990s most sectoral schemes encouraged individuals to retire at a focal early retirement age (usually age 59, 60 or 61, depending on the sector in which the individual was employed). Early retirement pension payments used to be a fixed percentage of last earned wage, thereby eliminating the financial incentive to continue working until age 65. From 1997, the sector for civil servants was the first to adjust their early retirement regulations. The PAYG system featuring a fixed replacement rate was replaced by an actuarially fair system. The new system also greatly reduced the replacement rate of early retirement pensions for civil servants (from 80% to 70% of last earned wage at the standard retirement age). Other sectors of industry made the transfer from a PAYG to a less generous capital funded

system in the late 1990s and early 2000s. More detailed information on the sectoral-specific transitions can be found in Euwals et al. (2010). These authors examine this change in early retirement regulations and find that the shift to an actuarially fair system with lower pension wealth induced individuals to retire later.

Within the old PAYG system, early retirees kept accruing pension rights. The switch to a capital-funded scheme implied that early retirees no longer accrued any pension rights. In contrast, individuals who are at least 40 years old at the time they become unemployed continue to build up their old-age pension rights as long as they receive wage-related UI benefits. Moreover, for individuals who are at least 57.5 years of age when they become unemployed, 'free' building up of pension rights continued until they reached the legal retirement age of 65. The introduction of the capital-funded early retirement system therefore discouraged UI benefit recipients to enter early retirement.

3.3 Theoretical Considerations

A general theory cannot predict whether search requirements will lead to an increase or a decrease of the number of individuals finding jobs. In a standard job search model in which individuals are either employed or unemployed, an increase in search requirements affects the amount of job search both directly and indirectly. First, individuals who search less than the minimum requirement run the risk of a penalty, leading to a decrease in the value of unemployment and therefore an increase in the (marginal) benefits of searching up to the minimum requirement. Individuals who in the past searched less than the newly defined threshold will therefore be induced to *increase* their search effort. On the other hand, the cost of each job application rises when an unemployed individual needs to record all search effort (such that an unemployed person can prove to the unemployment office that job search is undertaken). Increasing (marginal) costs of search (i) *decreases* search effort for individuals already conforming to the new search requirements, (ii) decreases the value of unemployment and thereby decreases reservation wages and *increases* search effort, (iii) by decreasing the value of unemployment the value of the subsequent job also diminishes and search effort *decreases* (the so-called 'entitlement effect', Mortensen

(1977)). For older workers the 'entitlement effect' is small: a possible new spell of UI benefits can only comprise a limited number of years, since from the age of 65 onwards they will receive pension payments instead. Search requirements may therefore raise the search effort of older workers substantially.

On the worker demand side, the job offer probability for the older unemployed might decrease as a result of enforcing minimum job search requirements: formal search requirements could lead to fake applications by the older workers, thereby stigmatizing job applications of older workers such that employers will be less willing to hire them. Moreover, an increase in the required amount of search effort can lead to a changing average productivity of applicants: assuming that initially only the most motivated individuals with good labour market prospects are engaged in active job search, average productivity of the applicant pool decreases when search requirements are introduced, again leading to a lower job offer probability for older unemployed. In conclusion: it is unclear from theory whether introducing formal job search as a condition for UI benefit receipt will increase the job finding rate of older workers.

Now consider a search model which adds the option to collect a type of benefit other than UI. Since formal search requirements reduce the value of receiving UI benefits, whereas the value of receiving other benefits (such as DI and early retirement pensions) remain constant, individuals can decide to forgo UI benefits and collect those other benefits instead (that is, if eligibility conditions can be met). Naturally, the substitution to another type of benefit is more likely the higher the value of receiving those benefits. The expected value of applying for DI benefits is high: the possible duration of DI benefits is six years for individuals aged 58 and older. This is longer than the maximum of five years for wage-related UI benefits. Furthermore, the total potential benefit duration of UI benefit receipt is not reduced by an intermittent spell of sickness/disability, which provides individuals with a rationale to substitute to DI (if only temporarily). A change in UI search requirements could therefore just make the required difference for DI to be a worthwhile alternative.[4] In contrast, early retirement pension payments have become less

[4]Note also that following an increase in compulsory search, the higher burden put on the elderly could cause an actual deterioration in health for some, thereby increasing the probability of receiving DI benefits directly and making substitution more likely.

attractive over time. Since in the old early retirement pension system, retirement benefits did not increase from age 59 onwards (or 60, or 61, depending on the sector of previous employment), there used to be a high incentive to switch to receipt of early retirement pensions at that age. Since with the new capital-funded scheme the old age pension replacement rate continues to increase with retirement age until an age of 65, the incentive to switch from UI to early retirement at relatively young ages is greatly reduced.

3.4 Data and Selection of Treatment/Control Groups

We make use of administrative data obtained from Statistics Netherlands. The so-called SSB (Social Statistical Files) data is obtained from municipalities, tax authorities and social insurance administrations. It contains high quality, detailed information on income variables and beginning- and enddate of benefit and wage payments for all individuals living in the Netherlands. Using this information, we can determine the status of an individual for the years 1999-2005 with daily precision. The states that we distinguish include full-time and part-time employment, being unemployed (receiving UI benefits), being ill/disabled (receiving sickness or disability benefits) and entering (early) retirement (receiving pension payments). We do not observe the number of times that an individual applies for jobs or whether a sanction is levied.

The information in the SSB is merged with information on education available from the unemployment office. Since the data on education is only available as from 2001, information on education is missing for the short-term unemployed that became unemployed in the years 1999 or 2000 and for whom we observe only one spell of employment. Since this group is likely to be selective, individuals becoming unemployed before the year 2001 are excluded.

To examine the policy change, we select groups of older individuals (55.5-59.5 at the time of inflow) becoming unemployed in 2001, 2003 and 2004. Table 3.3 shows the search requirements for all treatment and control groups. It also shows eligibility for and level of extended benefits. The 2001 inflow serves as a control group.[5] Individuals entering

[5]In Section 3.7 we conduct a sensitivity analysis using 56.5-58.5 year olds becoming unemployed in 2002 as an alternative control group. This does not affect our results.

unemployment *before* the year 2003 are unaffected by the policy change as long as they are older than 57.5 on the 1^{st} of January 2004. Since only individuals with an age at inflow of 55.5 years or older are selected for analysis, the selected unemployment spells starting in 2001 are unaffected by the change in policy. They are subject to the initial regulation: they are required to search for a job until the age of 57.5. However, if they are still unemployed when they turn 57.5, they can quit searching without consequences for their UI eligibility. Individuals that are 57.5 years or older at the time of inflow never need to report any search activities.

Table 3.3. Search requirements for treatment and control groups

Year of inflow	**Age at inflow**	**Required to search for UI?**	**Level extended benefit**	**Entitlement extended benefit**
2001 (control)	55.5-57.5	Until age 57.5	70% of minimum wage first 2 years; 0-70% of minimum wage afterwards (70% if no partner with income)	2.5-5.5 years until age 65
2001 (control)	57.5-59.5	No	70% of minimum wage	0.5-3.5 years until age 65
2003 (treatment)	57.5-59.5	From 01-01-04	70% of minimum wage	0.5-3.5 years until age 65
2004 (treatment)	55.5-57.5	Yes	0-70% of minimum wage (70% if no partner with income)	2.5-5.5 years until age 65
2004 (treatment)	57.5-59.5	Yes	0-70% of minimum wage (70% if no partner with income)	0.5-3.5 years until age 65

Extended benefits capture both extended UI benefits and IOAW benefits (which an older unemployed individual can receive up to age 65)

The first treatment group consists of individuals entering the UI benefit system in the year 2004. Unemployed aged 57.5+ and entering unemployment in 2004 need to actively search for new employment, allowing us to study the effect of *being required to search from the start of the unemployment spell* versus never being required to search. Those younger than 57.5 at time of inflow need to continue searching at the age of 57.5. Therefore we can also examine the effect of needing to *continue searching at age 57.5* versus being allowed to stop searching at that age.

The second treatment group consists of individuals entering the UI benefit system in the year 2003. The 2003 inflow is affected in a way that is different from the individuals that enter unemployment in 2004. The group of individuals aged 57.5 and over at the

time they start their unemployment spell at first instance did not need to search for a job. However, when they are still unemployed on the 1^{st} of January 2004, they are required to start searching. We drop individuals that became unemployed from the 11th of August onwards, such that the 2003 inflow sample is not affected by a cancellation of extended benefits (see Section 3.2.2). Using the 2003 treatment group, we can investigate the effect of needing to *search formally after being unemployed for 5-12 months*, versus not being required to search at all.

To sum up, we select a control group (inflow in 2001), a 'partly' treated group (inflow in 2003) and a 'fully' treated group (inflow in 2004) for analysis. Being able to study multiple treatment effects using different sources of variation in the data generated by the same policy change makes a strong case for identification of the sign and magnitude of the effect of search requirements on the number of individuals finding jobs.

We drop less than 1% of the individuals because of unobserved covariates (mainly education). Search requirements did not apply to individuals that receive DI benefits before flowing into the UI system. We therefore select only individuals that come from private sector jobs.[6] Inspecting the distribution of states of origin for the various years of inflow, we find no evidence of selectivity. The origin states for the various years of inflow can be found in Table B.3.[7] The final sample comprises 26,279 observations for analysis.

3.5 Methodology and Descriptive Statistics

3.5.1 Regression Specifications

We specify hazard models for the exit rate to a job, disability benefits and early retirement payments and adopt regression discontinuity and difference-in-difference approaches as the main identification strategies.

Let τ be calendar time and t spell duration. Then τ^I is the calendar year of inflow and a^I the age at inflow. Moreover, a_t denotes a time-varying variable indicating the age of an

[6] Another reason to exclude these individuals is that their latent probabilities to find a job or to enter another DI spell are very different from those of previously employed individuals.

[7] Inflow from DI benefits is slightly larger in 2001, following the declining trend in the number of DI recipients as a percentage of the labour force in the Netherlands (de Jong, 2008).

individual after t months of unemployment. The transition rates from unemployment to some exit state x are affected by a vector of observable characteristics X at the time an individual starts his or her unemployment spell. We assume that exit to any state can be described by a flexible proportional hazard model including piecewise constant duration dependence.

In a first regression specification, we select individuals becoming unemployed in 2001 (control) and in 2004 (treated). Then the instantaneous probability of leaving unemployment to exit state x, given that the individual is still unemployed at unemployment duration t is given by the hazard rate $\theta^x(t|X, \tau^I, a^I, a_t)$:

$$\theta^{x(t)} = \lambda(t) \exp \{X'\beta + \gamma_1 I^{04} + \gamma_2 I[a^I \geq 57.5] + \gamma_3 (I^{04} * I[a^I \geq 57.5]) + \gamma_4 I[a_t \geq 57.5] + \gamma_5 (I^{04} * I[a_t \geq 57.5])\} \quad (3.1)$$

where I^{04} is a dummy indicating whether or not the year of inflow was 2004 ($\tau^I = 2004$), $I[a^I \geq 57.5]$ is a dummy indicating whether or not an individual is at least 57.5 years old at inflow into unemployment, and the interaction effect $I^{04} * I[a^I \geq 57.5]$ picks up a first treatment effect: the need to fulfill formal search requirements from the start of unemployment when an individual is at least 57.5 years old at inflow, i.e. an 'always search' effect. The indicator $I[a_t \geq 57.5]$ is a time-varying variable equal to 1 from the time an individual turns 57.5 and the interaction $I^{04} * I[a_t \geq 57.5]$ picks up a second treatment effect: the need to continue formal search when a person turns 57.5, i.e. a 'continue search' effect.

Note that the inclusion of the parameters on this second treatment effect is also needed to correctly estimate the first treatment effect: since we are using individuals aged 55.5-57.5 as the control group to identify the 'always search' effect γ_3 (the effect on the 57.5-59.5 year olds) we need to correct for the fact that the younger individuals that became unemployed in 2004 were also treated from the age of 57.5 onwards.

A second regression takes only individuals aged 57.5-59.5, becoming unemployed either in 2003 (treatment group) or in 2001 (control group) to estimate the effect of the policy change for those that did not formally search for a job until being unemployed for 5-12

months:

$$\theta^{x(t)} = \lambda(t) \exp\{X'\beta + \delta_1 I^{03} + \delta_2 I[\tau \geq 1\ Jan\ 2004] + \delta_3 (I^{03} * I[\tau \geq 1\ Jan\ 2004])\} \quad (3.2)$$

where I^{03} indicates possibility of treatment if still unemployed on January 1^{st} 2004 (i.e. inflow in 2003), $I[\tau \geq 1\ Jan\ 2004]$ is an indicator function equal to 1 from the moment an individual reaches the 1^{st} of January 2004, and the interaction effect $I^{03} * I[\tau \geq 1\ Jan\ 2004]$ picks up a third treatment effect: the need to start fulfilling formal search requirements after 5-12 months in unemployment for individuals aged 57.5-59.5 at the start of their unemployment spell, i.e. a 'start search' effect.

The baseline hazard $\lambda(t)$ for both empirical models specifies duration dependence in the form of a flexible piecewise constant function:

$$\lambda(t) = \exp\left(\sum_{k=1}^{K} \lambda_k I_k(t)\right) \quad (3.3)$$

where $I_k(t)$ is an indicator function taking the value 1 if duration t is in interval k. We specify $K = 7$ duration intervals, defined as durations from 0-1 month, 1-2 months, 2-3 months, 3-6 months, 6-12 months, 12-24 months and 24+ months.[8] We normalize $\lambda_1 = 0$.

For both regressions, the density of total unemployment duration T for a spell with exit state x can therefore be written as:

$$f_i^x(T|X) = \theta_i^{x(t)}(T|X) \exp\left(-\int_0^T \theta_i^{x(t)}(s|X)ds\right)$$

The loglikelihood adds the contributions of noncensored and censored spells:

$$L^x = \sum_{i \in \{nc\}} \log \theta_i^{x(t)}(T|X) - \sum_i \int_0^T \theta_i^{x(t)}(s|X)ds \quad (3.4)$$

where $\{nc\}$ denotes the set of noncensored spells: all individuals that are observed to exit to state x. A spell is considered censored when still ongoing at the 31^{st} December 2005 or when an individual is observed to exit to a state other than x. Tables B.4 and

[8] Our results are not sensitive to the addition of extra intervals

B.5 in Appendix B give a schematic overview of the identification of the parameters for both regression specifications.

In order to control for observed heterogeneity, we include as background characteristics: age and its square, dummies for marital status, nationality, and whether there are any dependent children in the household. We further control for the level of education in four categories: whether the highest diploma an individual received was primary school, a low level of highschool/the lowest level of higher education, a high level of highschool/a middle level of higher education or higher professional education/university. We also include a regressor on whether the individual is on a spell with a 'revived' UI right. A right is considered revived when an unemployment spell is interrupted (for example by a job) and an individual returns to unemployment before having the chance to build up new UI rights. In this case, UI benefits can be received for the remainder of the potential benefit duration and therefore the total potential benefit duration for the individual is shortened. Two other indicators for potential benefit duration give information on whether an individual is on a spell with a long potential benefit duration (i.e. receives wage-related or extended benefits) or a short potential benefit duration (receiving short-term UI benefits for a maximum of six months). We include the quarters of the year as time-varying variables, thereby allowing for seasonal effects on outflow. In regression (3.1) for exit to early retirement, we include a number of time-varying age-regressors (turning 56, turning 57, turning 58 etc.) and interactions of these age-regressors with the year of inflow in UI. In this way we allow for a discontinuous shift in early retirement behaviour over time, following changes in the pension system described in Section 3.2.4.

In regression (3.1) we do not control for the cancellation of extended benefits on the 11th August 2003. If this policy change causes a discontinuous shift in *outflow* (e.g. to a job) for 57.5-59.5 year olds as opposed to 55.5-57.5 year olds, the point estimate on the always search effect γ_3 will be biased. Indeed, Tuit and van Ours (2010[a]) find that the *inflow* in UI benefits used to show a pronounced spike around the age of 57.5, which is more moderate after January 2004. They conclude that before the policy change in 2004, high wage workers were more likely to postpone unemployment until reaching the age of 57.5. In this case, our 2001 57.5-59.5 year olds have better characteristics than our 2004

Figure 3.2a. Inflow in UI 2001-2005

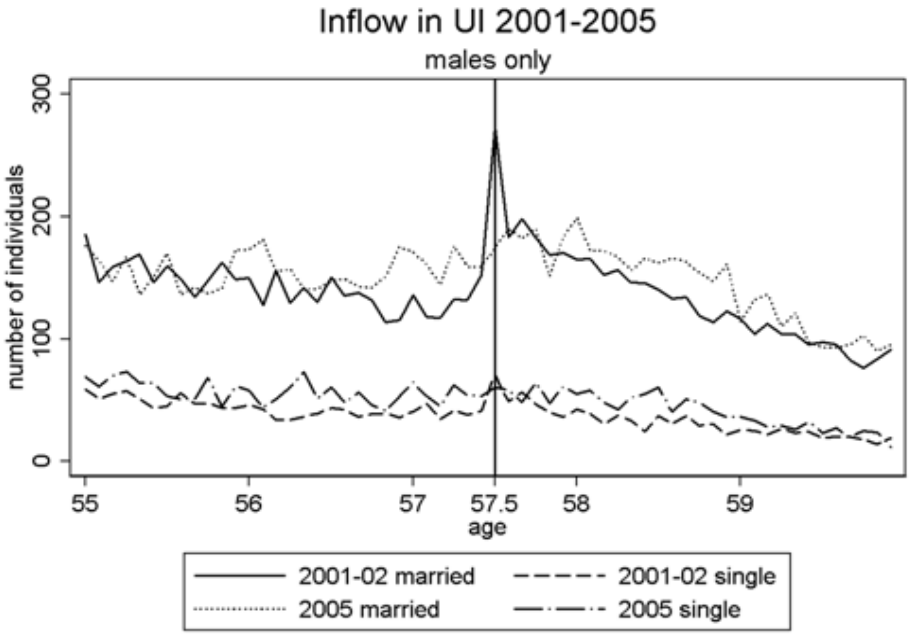
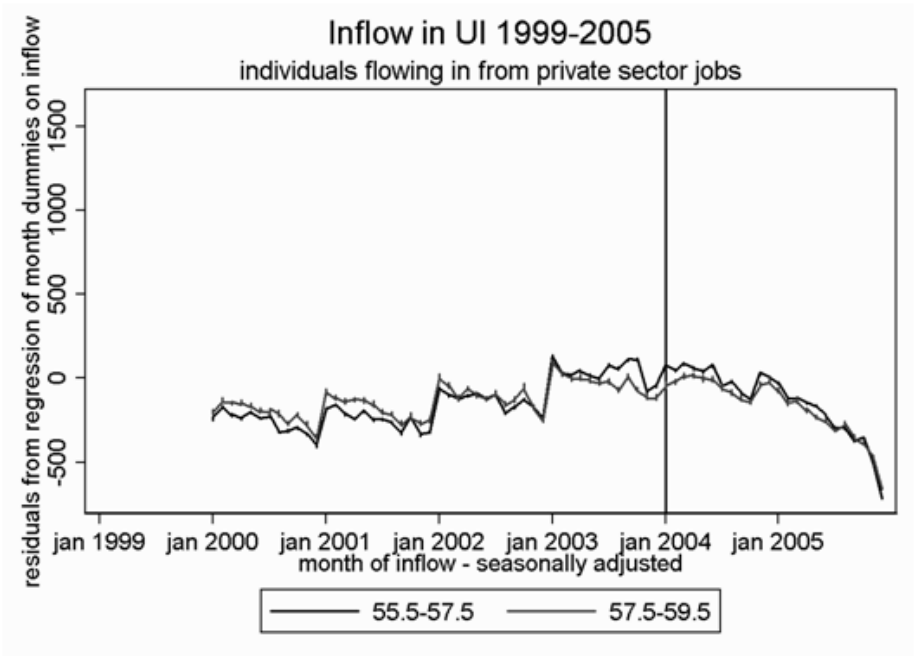


Figure 3.2b. Inflow in UI 1999-2005



inflow such that the always search effect γ_3 puts a lower bound on the effect of a search requirement change on outflow to jobs. Tuit and van Ours (2010^b) also show that the number of married individuals that postpone unemployment until the age of 57.5 is relatively large. This can be explained by the fact that after UI benefits expire, all

individuals aged 50+ at the beginning of unemployment can continue their unemployment spell in a scheme called the IOAW in which the height of the benefits is exactly the same as the extended UI benefits (i.e. 70% of minimum wage - see Table 3.3) but the receipt of these benefits is conditional on income of the partner. The relabeling of social insurance scheme therefore changes nothing for single individuals. Indeed, we plot the inflow in UI as a function of age (following Tuit and van Ours, 2010^a) but show it separately for married and single individuals.

Figure 3.2a shows that the spike around age 57.5 in the years before 2004 was driven by the behaviour of married individuals.[9] In other words, individuals that have a partner (who receives income) have a higher incentive to postpone unemployment and receive UI benefits until age 65. Discontinuation of the extended benefits on the 11th August 2003 therefore makes married individuals aged 57.5 at the start of their unemployment spell disproportionately worse off. To capture this effect, we include an interaction effect of the treatment parameter γ_3 with being married.[10] This specification provides enough flexibility to capture the effect of the abolition of extended benefits: Section 3.7 shows that estimation on singles only returns similar results.

3.5.2 Identification and Descriptive Evidence

Table 3.4 gives some insight into similarity and dissimilarity of the various treatment and control groups. Note that for an unbiased estimate of the always search effect γ_3, we assume that there is no change in some relevant characteristic for individuals becoming unemployed in 2001 versus those becoming unemployed in 2004, *that is discontinuous* at an age of 57.5 at inflow. For the continue search effect γ_5 we need a similarly weak condition: in absence of the change in search requirements, there should not be a discon-

[9] In order to keep our figure comparable to that of Tuit and van Ours (2010^a) we show inflow in UI for males only.

[10] Inclusion of this regressor generally does not affect our results. Note that this does not imply that the cancellation of extended benefits was ineffective: married individuals entering unemployment when being close to 60, turn 65 before exhausting their (3.5 instead of 2 years lasting) extended benefits and are only moderately affected. In contrast, married individuals younger than 57.5 at inflow lose a full 2 years of extended benefits. The fact that we find a zero result of the cancellation of extended benefits is therefore inherent in our choice of treatment and control groups.

tinuous change in the hazard rate into jobs (and other destination states) when *turning* 57.5 between individuals starting unemployment in 2001 versus individuals starting unemployment in 2004.[11] For the start search effect δ_3, the treatment effect is correctly identified under the assumption that individuals aged 57.5+ and starting unemployment in 2001 are a good control for the business cycle in the sense that they pick up any 'being in 2004 or beyond' effect that the inclusion of time-varying seasonal effects cannot control for.

Table 3.4. Background characteristics

Year of inflow in UI	2001		2003	2004			
Age at inflow in UI	55.5-57.5	57.5-59.5	57.5-59.5	55.5-57.5	57.5-59.5	$\Delta^{03-01}_{57.5+}$	$\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$
Search required?	until age 57.5	never	from 01-01-04	always	always		
Age	56.46	58.33	58.42	56.48	58.36	0.09***	0.01
Female	0.31	0.25	0.28	0.32	0.27	0.03***	0.01
Single	0.08	0.06	0.06	0.08	0.07	0.00	0.01
Married	0.74	0.79	0.77	0.73	0.76	-0.02*	-0.02
Divorced/widowed	0.18	0.15	0.17	0.19	0.17	0.02**	0.01
Dutch	0.85	0.86	0.84	0.83	0.85	-0.02***	0.01
Western	0.13	0.11	0.12	0.13	0.11	0.01**	0.00
Non Western	0.04	0.03	0.04	0.04	0.04	0.01**	0.01
Dependent child	0.27	0.21	0.23	0.35	0.27	0.02*	-0.02*
Education low	0.15	0.15	0.14	0.10	0.11	-0.01	0.01
Education mid1	0.35	0.37	0.34	0.32	0.33	-0.03***	-0.01
Education mid2	0.32	0.31	0.34	0.38	0.37	0.03***	0.00
Education high	0.18	0.17	0.18	0.19	0.18	0.01	0.00
Revived UI right	0.19	0.10	0.12	0.22	0.19	0.02***	0.06***
short PBD	0.10	0.05	0.05	0.07	0.05	0.00	0.03***
long PBD	0.87	0.92	0.92	0.91	0.93	0.00	-0.03***
Monthly UI benefits	1177	1316	1375	1187	1269		
# Hours in UI	32.84	33.77	33.20	32.65	33.25		
# Observations	3152	3476	3675	6270	5292		

Definition of variables is explained in the text. # Hours in UI denotes the number of hours in the previous job. The Dif-in-Dif statistic $\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$ is the parameter β_3 from a regression of the type: $y=\beta_0+\beta_1*I^{04}+\beta_2*I[a^I \geq 57.5]+\beta_3*I^{04}*I[a^I \geq 57.5]$. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01

[11] Note that there could be a general age effect, in that outflow from unemployment (into jobs) already decreases before turning 57.5. To the extent that this age effect is constant throughout the years, the age regressors are a sufficient control and our estimate of $\gamma 5$ is unbiased. Moreover, including an interaction of age and year of inflow does not change the results for outflow to jobs or DI benefits for any of the measured treatment effects.

Since both the always search effect γ_3 and the continue search effect γ_5 provide a before-during regression discontinuity design (BD-RDD) estimate (Lalive, 2008) we do *not* need to assume that the difference in characteristics between 57.5+ year olds and 57.5- year olds is the same when comparing the 2001 with the 2004 inflow. However, it is comforting to see that they do. Looking at individuals aged 57.5-59.5 in Table 3.4, we see that individuals becoming unemployed in 2004 seem to be more likely to have a child present in the household[12] and tend to be slightly higher educated as compared to the unemployed in 2001. To the extent that the increase in education for the inflow in 2004 is *both* typical for the 57.5-59.5 age group *and* discontinuous in age, the always search parameter γ_3 could be overestimating the true treatment effect on the outflow to jobs (assuming individuals with a higher education are to find jobs faster). However, since the increase in education seems to be a general phenomenon for the whole sample (aged 55.5-59.5), this effect will be picked up by the indicator for inflow in 2004. t-tests on the difference-in-difference shown in column 7 of Table 3.4 indicate that the only difference between treated and control is that in 2004 the 57.5-59.5 year olds are slightly more likely to be on short-term UI benefits or have a revived UI right. Since this change is highly unlikely to be discontinuous at age 57.5 when becoming unemployed, this development will be picked up by inclusion of a continuous age effect in the regression analysis. Moreover, Section 3.7 shows that controlling for the fact that business cycle effects might influence older age group differently does not affect the baseline results presented here.

Using the 57.5+ year old 2001 inflow as a control for the business cycle in regression specification (3.2) seems more problematic: not only is the 2003 group slightly older, they are also more likely to be female, divorced, non-dutch and relatively highly educated. Moreover, since dynamic selection is likely to add to the differences between the 2001 inflow and the 2003 inflow sample on the 1^{st} January 2004, the results of regression (3.2) need to be interpreted with some caution. However, the sensitivity analyses in Section 3.7 show that selection of a control group that becomes unemployed in 2002, or a treatment group that becomes unemployed any time in the year 2003 does not change the baseline

[12] This probably indicates a cohort effect since the fraction of the younger age group in 2001 having a dependent child is similar to the fraction for the older age group in 2004.

results. These results suggest that the treatment effect presented in the next Section is not (much) contaminated by business cycle effects.

Even though observable characteristics of treatment and control groups develop in the same way, it is instructive to consider the possibility of a discontinuity in unobservables. Anticipation of the policy change can result in selective inflow into unemployment around the time the policy was initiated. Figure 3.2b depicts the residuals of a regression of month dummies on inflow into the UI system between the years 2000 and 2005. There is no sign of an increase in discrepancy between the 57.5- and 57.5+ inflow around the 1^{st} of January 2004. The intuition for this is straightforward: since none of the individuals flowing into UI in 2003 were exempted from the new rules, there was no incentive to try to circumvent the policy change by speeding up the firing procedure. Anticipation is also largely irrelevant in regression (3.2): it is highly unlikely that an unemployed would increase search effort in December 2003 as a means to avoid the requirement to increase search effort in January 2004.

Table 3.5. Exit destinations within 2 years after entering UI

Year of inflow in UI	2001		2004		
Age at inflow in UI	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5	$\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$
Search required?	until age 57.5	never	always	always	
Job	0.45	0.31	0.40	0.28	0.02
	(0.63)	(0.50)	(0.71)	(0.56)	(-0.02)
Retirement	0.10	0.24	0.07	0.14	-0.07
	(0.14)	(0.39)	(0.13)	(0.28)	(-0.10)
DI benefits	0.16	0.07	0.09	0.08	0.08
	(0.23)	(0.11)	(0.16)	(0.16)	(0.12)
Still in UI	0.29	0.38	0.44	0.50	-0.03
# Observations	3152	3476	6270	5292	

In parentheses: as a fraction of the number of observations that exit UI within 2 years. For exit to job and DI: when $\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$ is positive, convergence between treated and control over time occured. For exit to retirement and still in UI: when $\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$ is negative, convergence between treated and control over time occured

Table 3.5 shows the proportion of individuals that two years after the start of their unemployment spell transit to a job, early retirement or DI benefits respectively. As

Table 3.6. Mean and median duration within 2 years after entering UI (days)

Year of inflow in UI	2001		2004		
Age at inflow in UI	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5	$\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$
Search required?	until age 57.5	never	always	always	
To job					
- mean	145	164	173	160	-32
- median	105	120	134	126	-23
To retirement					
- mean	243	343	126	209	-17
- median	155	334	61	184	-56
To DI					
- mean	182	262	194	174	-100
- median	128	198	160	137	-103

For all exit states: when $\Delta^{04-01}_{57.5+} - \Delta^{04-01}_{57.5-}$ is negative, convergence between treated and control over time occured

expected, older individuals more often flow into retirement, rather than to jobs and DI benefits. Moreover, it appears that individuals becoming unemployed in 2004 flow into jobs more often than individuals becoming unemployed in 2001. More importantly, for exit to DI benefits the difference between the age groups declines in the later years. This indicates that there is at least some effect of the 2004 policy change: stricter search requirements decrease the relative gap in outflow to DI benefits between the 55.5-57.5 and 57.5-59.5 year olds.[13] For the outflow to jobs and retirement, Table 3.5 also provides an indication of an effect of tighter search requirements. Moreover, Table 3.6 shows that the average duration until a job is found is decreasing stronger over the years for the older age group than for the younger age group. This suggests a higher speed of outflow to jobs for older unemployed in recent years.

[13]From Table 3.5 it seems that instead of observing an increase in inflow to DI for the older age group, there is a decline in inflow to DI for the younger age group. Indeed, inflow in DI declined following changes in the DI system in 2002 (De Jong, 2008). The fact that there is no decline in DI inflow for individuals aged 57.5-59.5 indicates that there was a counteracting (policy) change specifically affecting DI inflow for this age group - for example, the change in search requirements.

3.6 Estimation Results

3.6.1 Nonparametric Results

Figure 3.3 depicts the nonparametric estimation of the (kernel) smoothed hazards. Since individuals aged 57.5+ did not need to fulfill search requirements in 2001 and 2002, we expect the difference in the speed of outflow to a job between the young and the old age group to be large in those years. For the inflow in 2003 and 2004, both age groups needed to fulfill search requirements. We therefore expect the difference in outflow rates between the age groups to be smaller in 2003 and 2004 (as compared to 2001/2002). Figure 3.3 indeed shows that the speed of outflow to a job has converged between age groups. Note that individuals that are slightly younger than 57.5 and entered unemployment in 2003 and 2004 are also affected by the reform: they now need to continue searching when turning 57.5. Graphical or descriptive evidence cannot separate the discontinuity in age at inflow from the discontinuity in age during the UI spell, and therefore cannot show clear evidence on the impact of the reform. In order to separate these two discontinuities and at the same time take into account a general (continuous) age effect, we estimate the always search and continue search effects simultaneously using equation (3.1) specified in Section 3.5.1. Similarly, in order to separate a general 2004 business cycle effect from the effect of the policy change, we estimate equation (3.2) parametrically.

3.6.2 Parametric Results

Regression equation (3.1) is specified for the three exit states out of unemployment: exit to a job, (early) retirement, and DI benefits. An overview of treatment effects for the two regression specifications is given in Tables 3.7 and 3.8. Full results from the baseline model are given in Tables B.6 and B.7. Results are given in exponentiated coefficients and can therefore be interpreted as a change in the (overall) hazard ratio as a result of a 1-unit change in the corresponding covariate. If there is any positive effect of stricter search requirements for older unemployed on the inflow to jobs/early retirement/DI, we would therefore expect the reported coefficients to be significantly larger than 1.

Figure 3.3. Nonparametric hazards

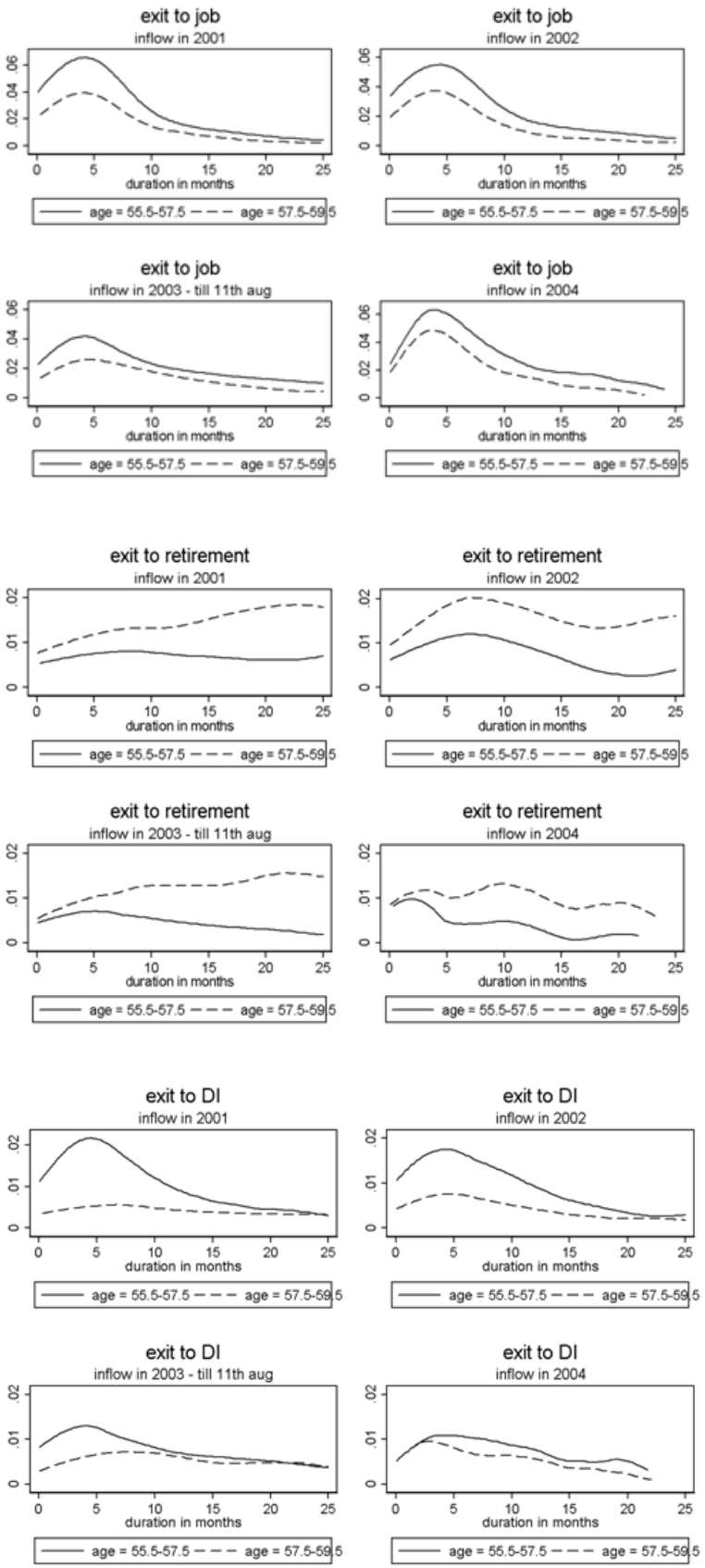


Table 3.7. Treatment effects, overview of regression 1 - comparison across specifications

MALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Always search vs. never (γ_3)	2.37***	1.38***	1.38***	1.56***	0.92	1.55*	1.46*	1.60**	4.14***	2.39***	2.48***	2.53***
(s.e.)	(0.20)	(0.12)	(0.13)	(0.19)	(0.16)	(0.35)	(0.34)	(0.37)	(0.68)	(0.42)	(0.47)	(0.50)
Continue search at age 57.5 (γ_5)	4.54***	1.84***	1.82***	2.36***	0.38***	0.63**	0.60**	0.84**	4.90***	3.08***	3.04***	3.24***
(s.e.)	(0.45)	(0.19)	(0.20)	(0.35)	(0.10)	(0.13)	(0.13)	(0.13)	(0.85)	(0.57)	(0.59)	(0.57)
Baseline controls[a]	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Incl sectors	no	no	yes	no	no	no	yes	no	no	no	yes	no
Frailty	no	no	no	gamma	no	no	no	gamma	no	no	no	gamma
# Obs	12945	12945	11665	12945	12945	12945	11665	12945	12945	12945	11665	12945
# Failures	5108	5108	4513	5108	2241	2241	2092	2241	1189	1189	1047	1189

FEMALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Always search vs. never (γ_3)	3.95***	1.77***	1.76***	2.04***	1.06	0.84	1.57	0.84	8.82***	5.19***	5.06***	5.99***
(s.e.)	(0.51)	(0.24)	(0.25)	(0.38)	(0.35)	(0.39)	(0.56)	(0.39)	(1.85)	(1.61)	(1.18)	(0.61)
Continue search at age 57.5 (γ_5)	4.61***	1.89***	1.75***	2.34***	0.26***	0.29**	0.42**	0.37**	6.24***	3.24***	3.66***	3.64***
(s.e.)	(0.72)	(0.30)	(0.30)	(0.55)	(0.09)	(0.14)	(0.21)	(0.18)	(1.61)	(0.87)	(1.03)	(1.11)
Baseline controls[a]	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Incl sectors	no	no	yes	no	no	no	yes	no	no	no	yes	no
Frailty	no	no	no	gamma	no	no	no	gamma	no	no	no	gamma
# Obs	5245	5245	4774	5245	5245	5245	4774	5245	5245	5245	4774	5245
# Failures	1680	1680	1520	1680	640	640	600	640	623	623	565	623

Standard errors in parentheses. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01. a) A full set of regressors can be found in Table B.6

Separate models are estimated for males and females, following the results of Wald tests which for each exits to job and early retirement clearly rejected a joint model ($p<0.01$). A joint model is estimated on regression equation (3.2) for exit to DI, since a Wald test indicated that joint estimation is acceptable ($p=0.11$).

In the baseline model, which includes background regressors (described in Section 3.5.1 and shown in Table 3.4), we find always search (γ_3) hazard ratios for the exit to jobs equal to 1.75 (males) and 1.96 (females). Loosely speaking, an unemployed man who is older than 57.5 at inflow and needs to search for jobs has a speed of outflow to jobs that is 1.75 times the speed of outflow of an 57.5+ year old that does not face any search requirements. The effect of a search requirement becoming effective at age 57.5 when an individual is between 55.5 and 57.5 at the time of inflow (i.e. the continue search effect) is of similar magnitude, increasing the hazard rate by a factor 1.95 (males) and 1.77 (females) over the remaining duration of the spell.

Do note that the magnitude of the coefficients is not informative on the magnitude of the absolute differences in outflow rates: since the effect of continued search is measured only over the latter part of the unemployment spell, where outflow rates are lower for all individuals, the *absolute* effect of the search requirement change could very well be larger for the 57.5+ year olds. We therefore graphically show in Figure 3.4 parametric hazards for the treatment and control groups based on the regression results. The hazard functions are calculated for all male treated individuals and subsequently averaged in order to show an average (intention to) treatment effect on the treated. It can be seen from Figure 3.4 that because of a smaller baseline hazard, the absolute treatment effect for the hazard rate to DI is smaller than for the hazard to a job.

In a competing risks setting, an increase in the hazard rate cannot directly be interpreted as an increase in the number of individuals leaving to a certain exit state. Figure 3.5 shows simulations of the average (intention to) treatment effect on percentage of individuals who flow out to jobs and disability benefits respectively. Since we can track labour market behaviour of individuals that start their unemployment spell in 2004 for a maximum of two years, we only show the change in outflow after a maximum of two years of unemployment. Another reason to choose this time limit is that there is only a very

Table 3.8. Treatment effects, overview of regression 2 - comparison across specifications

MALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Start search after 5-12 months (δ_3)	7.72***	2.87***	3.16***	5.38***	1.07	0.74**	0.76**	0.74**	3.39***	2.63***	2.16***	2.63***
(s.e.)	(2.09)	(0.91)	(1.06)	(2.25)	(0.12)	(0.10)	(0.11)	(0.10)	(0.76)	(0.67)	(0.58)	(0.67)
Baseline controls[a]	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Incl sectors	no	no	yes	no	no	no	yes	no	no	no	yes	no
Frailty	no	no	no	gamma	no	no	no	gamma	no	no	no	gamma
# Obs	5252	5252	4790	5252	5252	5252	4790	5252	7151	7151	6551	7151
# Failures	1637	1637	1438	1637	1537	1537	1455	1537	664	664	600	664

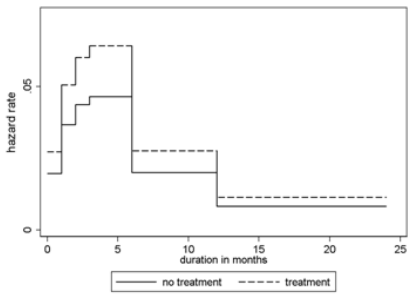
FEMALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Start search after 5-12 months (δ_3)	4.37***	1.94	2.17	1.94	2.07***	1.19	1.15	1.19	3.39***	2.63***	2.16***	2.63***
(s.e.)	(1.91)	(0.99)	(1.19)	(0.99)	(0.43)	(0.29)	(0.29)	(0.29)	(0.76)	(0.67)	(0.58)	(0.67)
Baseline controls[a]	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes
Incl sectors	no	no	yes	no	no	no	yes	no	no	no	yes	no
Frailty	no	no	no	gamma	no	no	no	gamma	no	no	no	gamma
# Obs	1899	1899	1761	1899	1899	1899	1761	1899	7151	7151	6551	7151
# Failures	462	462	426	462	276	276	243	276	664	664	600	664

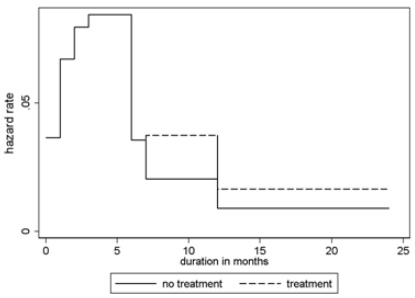
Standard errors in parentheses. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01. a) A full set of regressors can be found in Table B.6

Figure 3.4. Parametric hazards

Exit to Job for Males



always search



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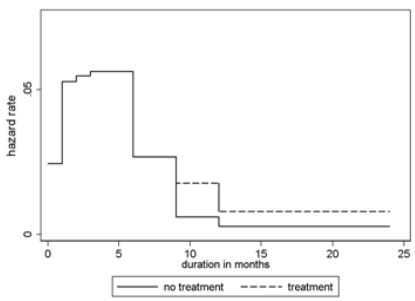
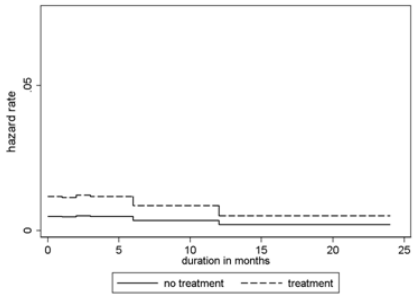


start search

Exit to Sickness/DI for Males



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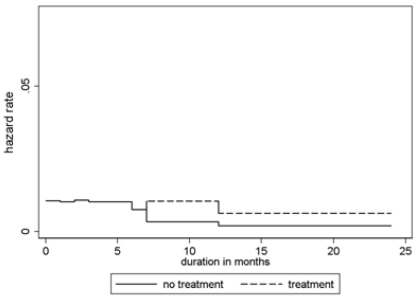
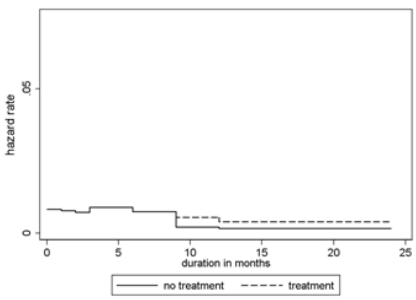


continue search



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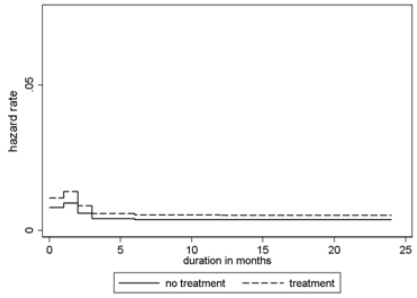
Exit to Retirement for Males



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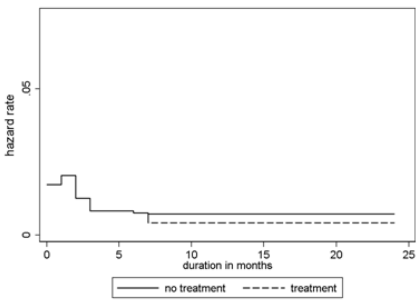

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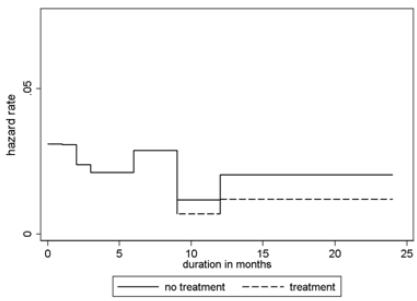

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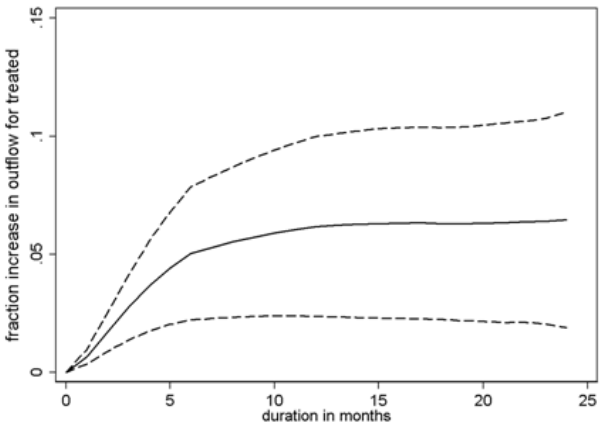
Figure 3.5. Cumulative incidence functions

Exit to job for Males



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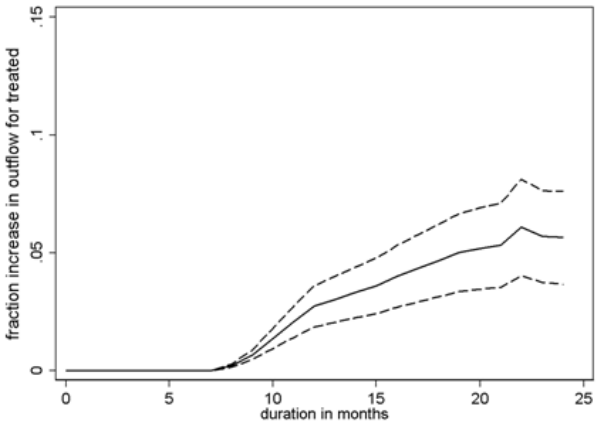

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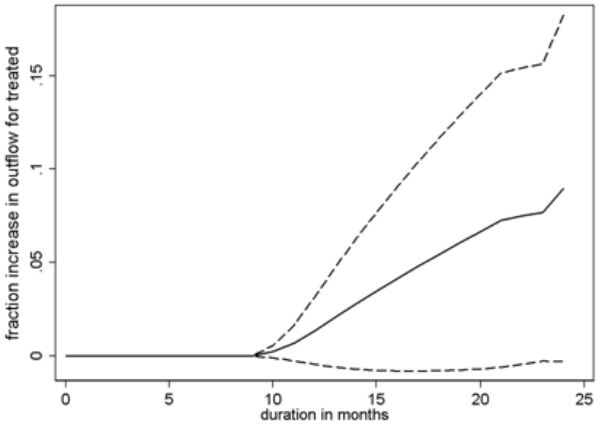

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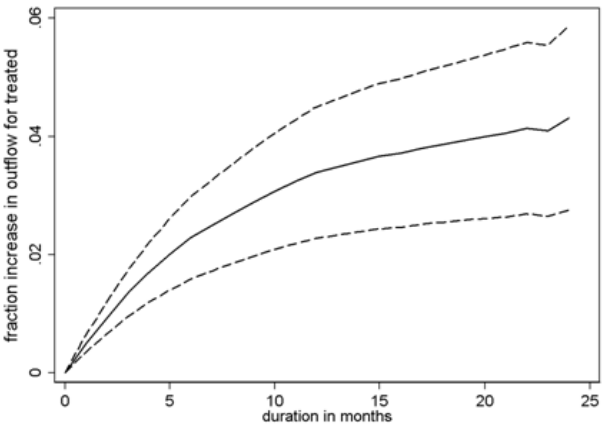
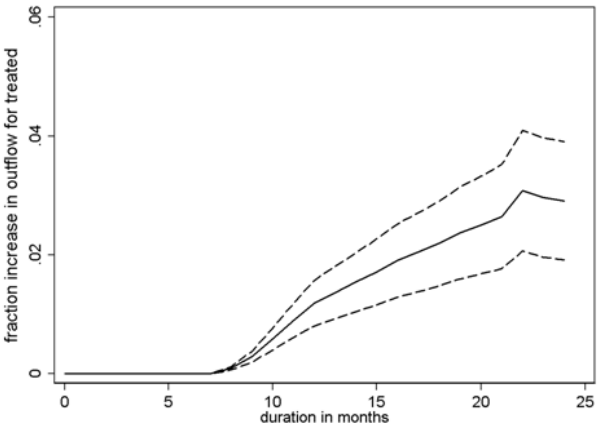
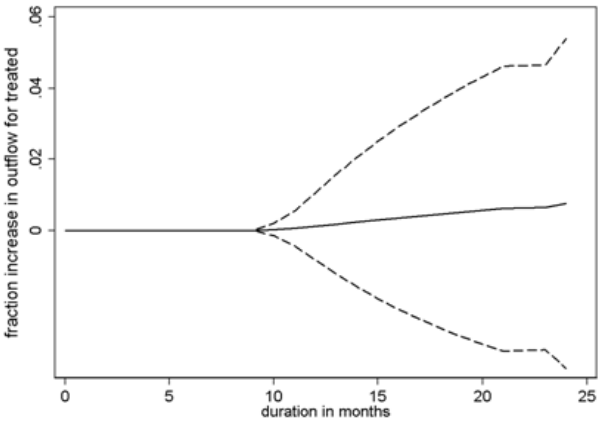
Exit to Sickness/DI for Males



always search



continue search



start search

small number of individuals that finds a job after being unemployed for more than two years. Standard errors used to compute the 95% confidence bounds are calculated using bootstrapping.[14] Table 3.9 provides for both males and females an overview of treatment effects for exit to a job, DI and retirement within two years.

Table 3.9. Percentage exit to job and DI within 2 years after entering UI

	Job		**DI**	
	males	females	males	females
57.5-59.5, always search	37.8	30.2	8.4	11.7
57.5-59.5, never search	31.3	19.1	4.1	2.5
Effect of always search (γ_3)	6.5**	11.1***	4.3***	9.1***
57, Continue search at age 57.5	49.9	41.3	10.3	12.5
57, Stop search at age 57.5	44.3	35.6	7.4	9.4
Effect of continue search (γ_5)	5.7***	5.8***	2.9***	3.1***
57.5-59.5, start search after 9 months	27.3	30.5	2.4	2.4
57.5-59.5, never search	18.3	23.2	1.7	1.7
Effect of start search (δ_3)	9.0*	7.2	0.8	0.8

Every first two lines reported are average exit rates within 2 years after entering UI for the treated individuals. Every third line reports the treatment effect. * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01

From Table 3.9, we conclude that the percentage of individuals finding a job within 2 years after becoming unemployed increased with about 6 (11) percentage points following the introduction of compulsory search requirements for male (female) individuals aged 57.5+ that needed to search from the start of their unemployment spell. The percentage point increase for a male (female) individual aged 57 who needed to continue search when turning 57.5 is about 6 (6) percentage points. However, there was also an increase of 4 (9) and 2 (3) percentage points in take up of disability benefits after a maximum of 2 years in unemployment, for male (female) individuals aged 57.5+ and aged 57 respectively. For the start search effect measured by the parameter δ_3 in equation (3.2), we can see from Table 3.9 that there is an increase in outflow to jobs of around 9 (7) percent and a small

[14] 100 bootstrap replications. Using the delta method to calculate standard errors gives similar results.

and insignificant increase in outflow to DI benefits for a male (female) individual that is already unemployed for 9 months and from that moment on requested to report job search efforts to the unemployment office. As for the exit to retirement, there is no general pattern in the estimated treatment effects in Tables 3.7 and 3.8. The gradual transition from a PAYG to an actuarially fair capital funded early retirement system greatly reduced the incentive for the unemployed to retire early. Since this effect cannot be completely separated from the effect of search requirements in UI, estimates are biased downwards. Cumulative incidence functions for this exit state are therefore omitted.[15]

Our results are in accordance with Been and Knoef (2012) who use a dynamic panel data model to show that the imposition of search requirements led to a reduction in take up of social insurance for men and women aged 55-64. Previous studies found that (financial) incentives matter for the number of individuals taking up various forms of social insurance as a means to exit the labour force at older ages (Kerkhofs et al. 1999, Heyma 2004, Inderbitzin et al. 2012). The findings in this paper show that substitution between social schemes is also important for unemployed individuals.

3.7 Sensitivity Analysis

After estimation of the baseline model including only the treatment effects (column 1 of Tables 3.7 and 3.8), a model including background regressors (column 2), adding the sector of the previous job as a regressor (column 3) and incorporating gamma distributed unobserved heterogeneity parameters (column 4), a few concerns may remain. We therefore supply additional sensitivity checks, results of which are reported in Tables 3.10 and 3.11. In all sensitivity checks, we compare results to that of the baseline model in column 2 of Tables 3.7 and 3.8. The baseline model results are reproduced in column 1 of Tables 3.10 and 3.11.

First, the age range from 55.5-59.5 might be too wide to be able to precisely estimate the always search and continue search parameters in regression (3.1). Making treatment

[15] In estimating the treatment effect in terms of outflow probabilities, we do need to take retirement into account as an alternative exit state. If outflow to retirement decreases, more individuals can exit to a job and the estimated treatment effect (in terms of outflow probabilities) for exit to jobs will be underestimated if exit to retirement is not taken into account.

and control groups even more similar, we estimate equation (3.1) using only 56.5-58.5 year olds. As can be seen from column 2 of Table 3.10, treatment parameters for exits to jobs, early retirement or disability hardly change.

Second, for regression equation (3.2), instead of only selecting individuals that became unemployed in 2003 until the 11th of August we can choose to form a treatment group containing *all* individuals becoming unemployed in 2003. The treatment parameters remain of similar magnitude, again strengthening the confidence that the cancellation of extended UI benefits does not interfere with our results.

Third, we show results using the individuals becoming unemployed in 2002 instead of 2001 as a control group in column 3 of Table 3.10 and Table 3.11. In this regression, we can only use individuals aged 56.5 and above since those unemployed are all at least 57.5 year old at the 1^{st} January 2004 and are therefore unaffected by the policy change. Interestingly, in regression (3.1) the estimated treatment effects for exit to disability seem slightly larger for males, and slightly smaller for females using this control group. Moreover, the start search effect for exit to a job as estimated in regression (3.2) becomes significantly positive for females.

We have carried out a large number of other sensitivity checks: we included average (monthly) wage earned in the previous occupation as an indicator of productivity. Unfortunately, including previous wage as a regressor results in a loss of about 70% of observations. Including this regressor does not lead to large changes in results, either qualitatively or quantitatively. The coefficient estimate on wage itself was often close to 1 and never significant.

Another concern with regression (3.1) might be that it is important to account for the possibility that business cycle effects influence older age groups differently (Jaimovich and Siu, 2009). Including an interaction effect of age with year of inflow does not lead to large changes in the estimates. Moreover, adding also an interaction of age with the indicator for being in the treatment group (γ_2) and an interaction of age with the always search treatment parameter γ_3 leads to slightly larger coefficient estimates on the treatment effects. In order to keep the specification parsimonious, we exclude these extra regressors from the baseline specification.

We present estimates on only single individuals in column 4 of Table 3.10. Single individuals were not affected by the abolition of extended benefits in August 2003: instead of extended benefits they receive IOAW payments which also equal 70% of minimum wage. The only difference between extended UI benefits and IOAW payments is that the latter is tested against the income of the spouse. Since spouse's income is zero for all singles, they are indifferent between receiving extended UI benefits or IOAW benefits. Although estimation only on single individuals leads to a loss of observations and hence a reduction in statistical significance, it does not lead to large changes in the estimated treatment effects.

In order to further strengthen confidence that the regression specifications do not erroneously return significant results on the treatment parameters, we can perform placebo tests. First, we run both regression specifications using 50.5-54.5 year olds, letting the 50.5-52.5 olds play a fake control group (fake in the sense that they are also treated) and indeed we do not find an extra effect of the policy reform for the (redefined) older age group.[16] Another check on the effectiveness of the reform is to run regression specification (3.1) using individuals becoming unemployed in 2001 and 1999 as a treatment and control group (both groups of individuals are not treated). Indeed, we do not find any effect of this fake reform on outflow to jobs, early retirement, or disability benefits.

As a check on heterogeneity of treatment effects (over and above the heterogeneity dictated by the proportional hazard structure) we run regressions on specific subgroups of the population. From a policy perspective, it is interesting to know whether search requirements are especially (and maybe only) effective for high employability individuals. These individuals face better prospects when actively searching for jobs and might therefore be affected the most by a compulsory search requirement. We test this hypothesis by running separate regressions by educational level. The results from these regressions do not show large differences in magnitude by education level for any of the search effects.[17]

[16] For exit to a job for males, we do find a significant and positive estimate of 1.43 on our always search γ_3 parameter.

[17] Because the expected payoff of searching is higher, highly educated individuals might use informal search channels even without a search requirement. This goes against finding a more positive effect for the highly educated.

Table 3.10. Sensitivity analysis regression 1

MALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Always search vs. never (γ_3)	1.38***	1.75***	1.61***	1.24	1.40*	1.12	0.93	1.52	2.21***	3.02***	3.70***	2.93***
(s.e.)	(0.12)	(0.22)	(0.20)	(0.17)	(0.27)	(0.39)	(0.19)	(0.27)	(0.30)	(0.74)	(0.86)	(0.78)
Continue search at age 57.5 (γ_5)	1.84***	1.95***	1.72***	2.07***	0.63**	0.42***	0.36***	0.50	3.08***	3.00***	4.08***	3.14***
(s.e.)	(0.19)	(0.24)	(0.19)	(0.45)	(0.13)	(0.13)	(0.08)	(0.26)	(0.57)	(0.70)	(0.89)	(1.05)
Control group	2001 inflow	2001 inflow	2002 inflow	2001 inflow singles only	2001 inflow	2001 inflow	2002 inflow	2001 inflow singles only	2001 inflow	2001 inflow	2002 inflow	2001 inflow singles only
Age range	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5
# Obs	12945	7195	7757	2751	12945	7195	9080	2751	12945	7195	7757	2751
# Failures	5108	2680	2783	1077	2241	1298	1850	345	1189	638	679	308

FEMALES

	Exit to a job				**Exit to retirement**				**Exit to DI benefits**			
Always search vs. never (γ_3)	1.77***	1.96***	1.41*	1.80***	0.91	0.47	1.09	1.36	3.73***	4.75***	2.92***	4.06***
(s.e.)	(0.24)	(0.38)	(0.26)	(0.34)	(0.42)	(0.35)	(0.52)	(0.94)	(0.76)	(1.46)	(0.82)	(1.35)
Continue search at age 57.5 (γ_5)	1.89***	1.77***	1.76***	1.90**	0.29**	0.32	0.31**	0.21**	3.24***	2.02**	2.00***	2.32
(s.e.)	(0.30)	(0.35)	(0.33)	(0.50)	(0.14)	(0.23)	(0.15)	(0.14)	(0.87)	(0.65)	(0.62)	(1.18)
Control group	2001 inflow	2001 inflow	2002 inflow	2001 inflow only singles	2001 inflow	2001 inflow	2002 inflow	2001 inflow only singles	2001 inflow	2001 inflow	2002 inflow	2001 inflow only singles
Age range	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5	55.5-59.5	56.5-58.5	56.5-58.5	55.5-59.5
# Obs	5245	1803	2823	3041	5245	1803	2823	3513	5245	1803	2823	3041
# Failures	1680	830	908	618	640	354	470	253	623	315	351	217

Standard errors in parentheses. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01

Table 3.11. Sensitivity analyses regression 2

MALES

	Exit to a job			**Exit to retirement**			**Exit to DI benefits**		
Start search after 5-12 months of unemployment (δ_3)	2.87***	2.92***	1.97***	0.74**	0.58***	0.91	2.63***	2.25***	2.85***
(s.e.)	(0.91)	(0.91)	(0.31)	(0.10)	(0.08)	(0.10)	(0.67)	(0.56)	(0.57)
Control group	2001 inflow	2001 inflow	2002 inflow	2001 inflow	2001 inflow	2002 inflow	2001 inflow	2001 inflow	2002 inflow
Treatment group	2003 11th aug	2003 total	2003 11th aug	2003 11th aug	2003 total	2003 11th aug	2003 11th aug	2003 total	2003 11th aug
# Obs	5252	6451	7025	5252	6451	7025	7151	8793	9630
# Failures	1637	2123	2185	1537	1745	1914	664	783	833

FEMALES

	Exit to a job			**Exit to retirement**			**Exit to DI benefits**		
Start search after 5-12 months of unemployment (δ_3)	1.94	1.93	2.52***	1.19	0.91	0.88	2.63***	2.25***	2.85***
(s.e.)	(0.99)	(0.95)	(0.81)	(0.29)	(0.21)	(0.18)	(0.67)	(0.56)	(0.57)
Control group	2001 inflow	2001 inflow	2002 inflow	2001 inflow	2001 inflow	2002 inflow	2001 inflow	2001 inflow	2002 inflow
Treatment group	2003 11th aug	2003 total	2003 11th aug	2003 11th aug	2003 total	2003 11th aug	2003 11th aug	2003 total	2003 11th aug
# Obs	1899	2343	2605	1899	2343	2605	7151	8793	9630
# Failures	462	635	735	276	536	548	664	783	833

Standard errors in parentheses. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01

A general concern with the estimation of competing risks in a one-by-one equation setting is that time to exit for the different states might be interrelated. Although neglecting possible correlation in hazard rates to the various exit states should not influence the estimation of interaction/treatment effects as much as level effects, it is nevertheless instructive to jointly estimate the 3-equation model. For this aim, we specify a Multivariate Mixed Proportional Hazards model with Heckman-Singer (1984) heterogeneity. We make use of 2 mass points of the heterogeneity distribution per equation and construct logit functions to estimate the mixing probabilities.[18] Sign and magnitude of the MMPH estimates are very similar to the single equation estimation results. Results are displayed in Table B.8 in Appendix B.

As a final sensitivity check, note that the continue search effect γ_5 should be close to the effect measured by Heyma and van Ours (2005). Selecting a sample of individuals aged 55.5-57.5 they study the effect of the absence of search requirements from age 57.5 on outflow to jobs *before* the policy change took place. They therefore study the same continue search parameter γ_5 in a slightly different model. The fact that our estimation returns similar results to Heyma and van Ours (2005) therefore strengthens confidence in the functional form specification of equation (3.1). Our estimated continue search effect is close to being the reciprocal of their discontinue search effect which is to be expected if both models are correctly specified. Moreover, from the full results of our baseline model depicted in Table B.6 we can see that before policy change, there is a discontinuity at age 57.5 both for males and for females. After the policy change, this discontinuity disappears.[19]

3.8 Post-unemployment Job Characteristics

Because an expansion of search requirements entails an increase in search costs, thereby decreasing the value of being unemployed, the January 2004 policy change theoretically

[18] Specifying more than 2 mass points reults in convergence of at least 2 of the heterogeneity parameters to the same point. We conclude that 2 mass points are sufficient to capture (neglected) unobserved heterogeneity.

[19] This can be seen from the parameter estimates presented in Table B.6: $\gamma_4 * \gamma_5 = 0.59 * 1.84 \approx 1$ for males and $\gamma_4 * \gamma_5 = 0.57 * 1.89 \approx 1$ for females.

leads to a decrease in the reservation wage. Although an increase in search effort is the effect that policy makers would like to establish with imposing the new search requirements, another possibility is that older workers are matched to lower-skilled and lower-paid jobs. It is therefore interesting to examine the effects on post-unemployment job characteristics more closely. Table B.9 gives an indication of the importance of these effects. For most of the groups, the wage distribution after unemployment is not first-order stochastically dominated by the wage distribution before unemployment. Instead, the wage distribution after unemployment is more dispersed than the distribution before unemployment, indicating that although some individuals need to give up some salary in order to get re-employed, there is also a considerable group of individuals that receives a higher wage after the unemployment spell. If anything, the difference between wages previously earned and wages accepted decreases over time between the age groups. Whereas the decrease in accepted wages and previous wages for unemployed aged 57.5-59.5 is large when they become unemployed in 2001, individuals aged 55.5-57.5 are earning wages comparable to their previous wage. For individuals becoming unemployed in 2003 and 2004 however, the loss (or gain) in wages accepted is very much equal between the two age groups. In conclusion: these descriptives do not provide direct evidence for a declining reservation wage theory.

Not only reservation wages may decline upon an increase in search costs, individuals may also start searching for jobs that are different in other respects. For example, older workers may only be able to find part-time employment after an unemployment spell. Table B.10 describes the fraction of individuals that were in part-time, full-time or flexible work arrangements both before and after the unemployment spell. As is intuitive, older individuals (aged 57.5+) are more likely to take up part-time employment after a spell of unemployment, trying to bridge the last couple of years to the pensionable age of 65. Although the fraction of full-time workers decreases in later years, there does not seem to be a clear pattern between the treatment and control groups: individuals becoming unemployed in any of the examined years are about half as likely to have a full-time job after their unemployment spell. In contrast, employment with flexible hours has become more popular as an option to take up a job for older unemployed. Taken together, Table

B.10 does not indicate that the 2004 policy change had large effects on post-unemployment job characteristics.

3.9 Conclusions

As the challenges associated with an ageing population become more prominent and many countries increase statutory retirement age, it becomes all the more important to document the effects of labour market policies on behaviour of older workers. This paper deals with one such policy change which has recently been implemented in various countries, namely the imposition of job search requirements for older unemployed. Using a large administrative database covering all wage and benefit payments to Dutch individuals in the years 1999-2005, we show the effects of a tightening of search requirements which is specifically aimed at older workers. A policy reform, coming into effect on the 1^{st} of January 2004, makes an end to the special treatment of older unemployed individuals. Before the law was initiated, an unemployed individual aged 57.5 did not need to report his/her job search effort to the unemployment office. The new policy required older unemployed to continue actively searching for a job even after turning 57.5. Using difference-in-difference and regression discontinuity techniques within a flexibly specified duration framework, we estimate the effect of this reform on outflow to jobs, early retirement and disability benefits for the various affected groups of individuals aged 55.5 to 59.5. The main finding is that within 24 months after the start of an unemployment spell, there is a 6 (11) percentage points increase in the number of male (female) individuals that find a job. However, this strong effect on labour market participation is accompanied by a 4 (9) percentage point increase in the number of male (female) individuals who use DI benefits as an alternative exit route. In light of the evidence that UI benefits and DI benefits are alternative pathways to early retirement, one would expect outflow to retirement to increase as well. However, changes in the UI and in the early retirement system cannot be completely separated, and therefore we cannot provide evidence for an increased outflow to early retirement. These conclusions are remarkably robust: using various sources of variation generated by the policy change we show strong effects of search requirements

for the older unemployed on their chances to find jobs, and their probability to receive DI payments. Moreover, the same results are found in many types of alternative regression specifications.

The finding that unemployed individuals substitute between receipt of UI benefits and DI benefits can be expected to hold in many countries. The exact magnitude of both the job finding effect and the substitution effect likely differs according to institutional settings such as the way in which stricter rules are enforced, the height of penalties, and the attractiveness of other social schemes. An interesting venue for further research is to estimate the contribution of these parameters to the gross effect presented in this paper. Another suggestion for further research is to estimate the impact of search conditions on after-unemployment job characteristics. Theory predicts that an increase in search costs will decrease reservation wages and might therefore lock the older workers into low-skilled and low-paid jobs, another unwanted side-effect of a policy that is meant to induce older workers to become more active and productive labour market participants.

Appendices

A Changes in the DI System 2001-2005

Most policy changes in the DI system in the period 2001-2005 were aimed at employers. The presumably largest changes in the DI system took place in 2002 and 2004. From April 1^{st} 2002, the Gatekeeper Improvement Act (Wet Verbetering Poortwachter) specifies that both employers and employees must prove that they have put enough effort in preventing inflow in the DA during the one year period of sickness. When the unemployment office decides that the reintegration programme does not suffice, the period in which the employer pays sickness benefits (the SA period) is extended for at most one year. Otherwise, DA payments to the employee are refused or reduced. Incentives to enter the DA therefore significantly decrease. However, in absence of an employer, the Act is not expected to have reduced SA inflow from unemployed workers.

Since January 1^{st} 2002, employers get a 2% reduction on the DA premium paid for a worker at least 57 years of age (on the 1^{st} of January of that year). An employer might therefore be more willing to hire 57+ year olds. Since employers' DA premiums comprised 4.76% of gross wage, less than 0.1% of gross wage can be saved by hiring a 57+-year old. Note again that this policy provides incentives for employers, and is not likely to influence behaviour of the unemployed. Although the number of job offers to older unemployed might increase slightly as a result of this reform, the savings on hiring a 57+-year old are so small that this is not likely to influence our results. Another possibly relevant adjustment came into effect on the 1^{st} of July 2003. As from this date, it is possible for employers to accept responsibility for payment of SA benefits to former employees (becoming unemployed less than 1 month before they get sick). In exchange, employers' SA premiums are reduced. As a result, inflow in SA of UI benefit recipients in the first month of unemployment can be reduced. However, only 26 (mainly small) employers take up this new right until January 1^{st} 2005. The policy change is therefore considered unsuccessful and is abolished in May 2006. It is unlikely that this temporary adjustment in the system will affect our results. Another reform, taking effect on the 1^{st} of January 2004, extends the maximum length of SA benefits from 1 to 2 years. For the

employer, this means that an ill employee costs him a maximum of two years of wage payments, instead of one. From this moment on, also unemployed individuals receive two years of SA benefits before transferring to DA. As with the Gatekeeper Improvement Act, such a policy measure aimed at increasing reintegration incentives of employers does not have a bite for individuals without an employer. Another law also introduced on the 1^{st} of January 2004 absolves employers from having to pay a basic (non-differentiated) DA premium when hiring a 50+ year old. Because this affects all individuals in our sample (aged 55.5-59.5) equally, this new policy cannot influence our results. Finally, on the 1^{st} of August 2004, the collective agreement on DA for self-employed is abolished. From that date on, self-employed are expected to self-insure via private insurers. Since we do not consider self-employed in the analysis, the change does not affect the estimates.

B Extra Tables

Table B.1. Average height and duration of sanctions

Average height of sanctions - percentage points cut in UI benefits

	2002	2003	2004	2005	2006
Total	17.81	17.54	16.98	16.27	15.62
Non-compliance with required # of job applications	20.96	20.99	20.88	20.92	20.85
Non-compliance with job applications on a suitable 'level'	23.06	22.24	23.98	24.69	22.37

Average duration of sanctions (in weeks)

	2002	2003	2004	2005	2006
Total	7.49	7.42	7.93	7.48	6.93
Non-compliance with required # of job applications	14.77	14.07	14.07	14.23	13.83
Non-compliance with job applications on a suitable 'level'	13.55	15.26	12.99	12.54	16.33

Data on sanctions are aggregate statistics from the unemployment office.

Table B.2. Number of sanctioned individuals per year

	2002	2003	2004	2005	2006
Total	28774	34829	49368	48440	38931
- as a % of number of individuals in UI	7.68	7.35	9.04	9.15	a)
Non-compliance with required # of job applications	12999	15120	23808	22327	15729
- as a % of number of individuals in UI	3.47	3.19	4.36	4.22	a)
- as a % of total number of sanctioned individuals	**45.18**	**43.41**	**48.23**	**46.09**	**40.40**
Non-compliance with job applications on a suitable 'level'	65	76	93	113	78
- as a % of number of individuals in UI	0.02	0.02	0.02	0.02	a)
- as a % of total number of sanctioned individuals	0.23	0.22	0.19	0.23	0.20

Data on sanctions are aggregate statistics from the unemployment office.

a) could not be calculated since the number of individuals is calculated making use of our 1999-2005 data. Publicly available aggregate statistics are on the number of benefits, not individuals. Since one individual can receive multiple UI benefits within a year (and even at the same time) this figure cannot be used here

Table B.3. Origin of UI spell (i.e. state of inflow)

Year of inflow in UI	2001		2003 (1st jan - 10th aug)		2004	
Age at inflow in UI	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5
Search required?	until 57.5	never	until 57.5 and from 01-01-04	from 01-01-04	always	always
Private sector job	3152	3476	4414	3675	6270	5292
	(0.83)	(0.86)	(0.85)	(0.88)	(0.86)	(0.87)
DI benefits	596	554	724	480	922	702
	(0.16)	(0.14)	(0.14)	(0.11)	(0.13)	(0.12)
Other	38	25	51	33	95	59
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
TOTAL	3786	4055	5189	4188	7287	6053

As a fraction of total inflow in parentheses

Table B.4. Identification regression 1

	being <57.5@inflow	being >57.5@inflow	turning 57.5, being <57.5@inflow
Inflow in 2001	a	b, γ_2	e, γ_4
Inflow in 2004	c, γ_1	d, $\gamma_1+\gamma_2+\gamma_3$	f,$\gamma_1+\gamma_4+\gamma_5$
	c-a=γ_1	d-b=$\gamma_3+\gamma_1$	f-e=$\gamma_1+\gamma_5$

γ_3=(d-b)-(c-a): effect of needing to search always as opposed to never (age at inflow >57.5)

γ_5=(f-e)-(c-a): effect of needing to continue search at 57.5 (age at inflow <57.5)

Table B.5. Identification regression 2

	till 1 jan 2004, being >57.5@inflow	from 1 jan 2004 , being >57.5@inflow
Inflow in 2001	a	b, δ_2
Inflow in 2003	c, δ_1	d, $\delta_1+\delta_2+\delta_3$
	c-a=δ_1	d-b=$\delta_1+\delta_3$

δ_3=(d-b)-(c-a): effect of starting to search (@ 1 jan 2004) after 5-12 months of unemployment as opposed to never (age at inflow >57.5)

Table B.6. Treatment effects, baseline - regression 1

	MALES			FEMALES		
	Job	**Ret.**	**DI**	**Job**	**Ret.**	**DI**
I^{04}	0.83***	0.80*	0.49***	0.72***	1.25	0.39***
$I[a^I \geq 57.5]$	0.56***	1.00	0.36***	0.45***	1.43	0.21***
$I[a^I \geq 57.5]*I^{04}$ - *always search*	1.38***	1.55*	2.39***	1.77***	0.84	5.19***
$I[a_t \geq 57.5]$	0.59***	1.20	0.44***	0.57***	1.43	0.25***
$I[a_t \geq 57.5]*I^{04}$ - *continue search*	1.84***	0.63**	3.08***	1.89***	0.29**	3.24***
$I[a_t \geq 57.5]*I^{04}$*married	0.97	0.91	0.92	0.97	1.09	0.72
married	1.03	1.38***	0.80***	0.85***	0.67***	0.93
age	0.80***		0.82	0.78**		0.96
age^2	1.04***		1.05*	1.04*		0.99
western	1.07	0.85**	0.95	0.96	1.03	1.19
non western	0.77***	0.89	1.41***	1.18	0.90	1.33
dependent child	1.26***	0.93	1.16**	1.24***	1.05	1.20*
education mid1	1.02	1.13	0.97	1.07	1.09	0.95
education mid2	1.03	1.36***	0.83**	1.22**	1.40**	0.92
education high	0.87***	1.62***	0.59***	1.34***	2.25***	0.73*
revived UI right	1.12***	0.53***	1.24***			
long PBD	0.59***	4.07***	1.27	0.53***	2.62***	1.03
unknown PBD	0.89	1.73*	0.94	0.95	1.38	1.15
april-june	0.82***	0.29***	0.54***	0.61***	0.53***	0.44***
july-sept	0.48***	0.28***	0.62***	0.57***	0.44***	0.51***
oct-dec	0.27***	0.25***	0.42***	0.37***	0.39***	0.42***
λ_{1-2}	1.73***	1.10	0.91	1.77***	0.95	0.99
λ_{2-3}	1.98***	0.66***	0.93	1.62***	0.61**	1.84***
λ_{3-6}	2.14***	0.47***	0.92	2.08***	0.43	1.66***
λ_{6-12}	0.97	0.49***	0.74***	1.13	0.50***	1.25
λ_{12-24}	0.43***	0.45***	0.45***	0.45***	0.41***	0.76
λ_{24+}	0.09***	0.35***	0.26***	0.10***	0.39***	0.22***
# Obs	12945	12945	12945	5245	5245	5245
# Failures	5108	2241	1189	1680	640	623

* indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01. A description of regressors can be found in the main text. The retirement equation also contains a set of regressors for age dependence, $I[56.5 \leq a_t \leq 57.5]$ till $I[63.5 \leq a_t \leq 64.5]$ and interactions of age dependence and the year 2004 $I[56.5 \leq a_t \leq 57.5]*I^{04}$ till $I[60.5 \leq a_t \leq 61.5]*I^{04}$

Table B.7. Treatment effects, baseline - regression 2

	MALES			FEMALES		
	Job	**Ret.**	**DI**	**Job**	**Ret.**	**DI**
I^{03}	0.97	1.62***	1.27**	1.46***	1.22	1.27**
I[$\tau \geq$1 Jan 2004]	0.22***	0.43***	0.33***	0.22***	0.44***	0.33***
I^{03}*I[$\tau \geq$1 Jan 2004] - *start search after 5-12 months unemployment*	2.87***	0.74**	2.63***	1.94	1.19	2.63***
married	1.00	1.22***	0.84*	0.87	0.67***	0.84*
age	2.20	1.40	3.57	1.62	1.95	3.57
age^2	0.91	0.99	0.84	0.94	0.94	0.84
western	1.03	0.92	0.83	0.77*	0.93	0.83
non western	0.93	0.93	1.29	1.18	0.90	1.33
dependent child	1.34***	1.04	1.05	0.98	0.94	1.05
education mid1	1.02	1.18*	0.91	0.93	1.19	0.91
education mid2	0.90	1.32***	0.93	1.07	1.48**	0.93
education high	0.82**	1.72***	0.67***	1.67***	2.25***	0.67***
revived UI right	1.18***	0.58***	1.37***	1.57***	0.90	1.37***
long PBD	0.50***	2.92***	1.06	0.37***	2.10***	1.06
unknown PBD	1.15	1.64	1.55	0.52***	0.80	1.55
april-june	0.59***	0.27***	0.43***	0.38***	0.53***	0.43***
july-sept	0.35***	0.24***	0.45***	0.34***	0.41***	0.45***
oct-dec	0.16***	0.21***	0.27***	0.18***	0.39***	0.27***
λ_{1-2}	1.80***	0.66***	0.72	1.56*	0.85	0.72
λ_{2-3}	2.24***	0.69**	1.03	2.73***	1.14	1.03
λ_{3-6}	2.34***	0.73**	1.33	2.73***	1.14	1.03
λ_{6-12}	1.21*	0.93	1.07	4.19***	0.85	1.33
λ_{12-24}	0.54***	1.48***	0.77	0.72	2.48***	0.77
λ_{24+}	0.22***	1.80***	0.67*	0.45***	2.70***	0.67*
# Obs	5252	5252	7151	1899	1899	7151
# Failures	1637	1537	664	462	476	664

* indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01. A description of regressors can be found in the main text

Table B.8. Multivariate mixed proportional hazard model

REGRESSION 1

MALES

	Job	**Retirement**	**DI benefits**
Always search vs. never (γ_3)	1.40***	1.43*	2.27***
(s.e.)	(0.10)	(0.28)	(0.30)
Continue search at age 57.5 (γ_5)	1.88***	0.58**	3.07***
(s.e.)	(0.22)	(0.12)	(0.57)
# Obs	12945	12945	12945

FEMALES

	Job	**Retirement**	**DI benefits**
Always search vs. never (γ_3)	1.98***	0.83	4.42***
(s.e.)	(0.27)	(0.38)	(0.86)
Continue search at age 57.5 (γ_5)	1.95***	0.25***	3.14***
(s.e.)	(0.38)	(0.12)	(0.87)
# Obs	5245	5245	5245

REGRESSION 2

MALES

	Job	**Retirement**	**DI benefits**
Start search after 5-12 months of unemployment (δ_3)	3.58***	0.73***	3.02***
(s.e.)	(1.19)	(0.09)	(0.92)
# Obs	5252	5252	5252

FEMALES

	Job	**Retirement**	**DI benefits**
Start search after 5-12 months of unemployment (δ_3)	2.38	1.06	1.94
(s.e.)	(1.47)	(0.24)	(1.01)
# Obs	1899	1899	1899

Standard errors in parentheses. * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01. Results on females for regression 2 are estimated under the assumption of no heterogeneity in retirement behaviour, since without restrictions the heterogeneity in the retirement equation would converge to the same point.

Table B.9. Gross hourly wage (in euros) of job before and after unemployment spell

Year of inflow in UI	2001				2003 (1st jan - 10th aug)				2004			
Age at inflow in UI	55.5-57.5		57.5-59.5		55.5-57.5		57.5-59.5		55.5-57.5		57.5-59.5	
Search required?	until 57.5		never		until 57.5 and from 01-01-04		from 01-01-04		always		always	
	Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
10%	9.0	8.6	10.2	8.6	9.8	9.0	10.0	8.9	9.4	9.3	9.9	9.3
25%	11.5	9.9	12.2	11.0	11.8	10.6	11.0	11.2	11.3	11.7	12.2	12.5
50%	14.1	13.8	14.8	14.3	14.7	13.5	14.6	15.6	14.3	15.3	15.0	15.8
75%	18.8	18.3	20.0	17.7	19.5	17.6	20.0	21.1	19.1	20.3	20.3	20.9
90%	24.7	26.8	27.5	23.7	27.0	27.5	26.9	30.9	26.4	27.3	26.6	25.1
Mean	16.1	16.7	17.3	15.7	17.0	16.0	17.2	18.2	16.5	17.3	17.2	17.7
Min	5.2	5.4	5.4	5.6	6.1	6.0	5.1	6.2	4.9	5.9	5.0	6.6
Max	68.2	93.6	72.3	48.5	77.0	78.7	100	65.2	68.8	123.6	92.2	57.3
# Hours	149	130	154	129	147	111	151	103	147	117	151	116
# Obs	822	206	1138	95	1257	237	1255	97	1763	394	1595	174

Inflation correction applied

Table B.10. Type of work before and after unemployment spell

Year of inflow in UI	2001		2003 (1st jan - 10th aug)		2004	
Age at inflow in UI	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5	55.5-57.5	57.5-59.5
Search required?	until 57.5	never	until 57.5 and from 01-01-04	from 01-01-04	always	always
Before						
Parttime	0.22	0.17	0.29	0.27	0.31	0.27
Fulltime	0.65	0.73	0.57	0.62	0.55	0.61
Flex	0.13	0.09	0.14	0.11	0.15	0.12
# Observations	1445	1615	2833	2195	4395	3461
After						
Parttime	0.34	0.38	0.36	0.45	0.33	0.35
Fulltime	0.45	0.45	0.37	0.32	0.37	0.40
Flex	0.21	0.17	0.28	0.23	0.31	0.25
# Observations	1642	1170	1901	1044	2791	1678

Numbers given as a fraction of the number of individuals for whom we observe whether they went to parttime, fulltime of flextime unemployment. That is, the total fraction of individuals in the three employment types should add up to 1 for each group (apart from effects of rounding).

Chapter 4

Pension Rules and Labour Market Mobility*

4.1 Introduction

Labour market flexibility offers a range of advantages. When companies need to readjust their workforce following a change in micro- or macro-economic conditions, labour market flexibility is needed to allocate the right employee to the right job. (Long-term) unemployment can be predicted to be lower in environments where workers can easily flow between firms (Tella and MacCulloch, 2005). A possible drawback of high mobility of labour is that firms underinvest in general training and education in case they face difficulties to retain highly mobile and productive employees. An important contribution in the ongoing discussion on the value of flexible labour markets is to identify rules and institutions that form obstacles to job transitions. Specifically, the accrual of pension benefits is a co-determinant of the financial benefits of any job, thereby affecting the attractiveness of a job offer. Backloaded pension arrangements with an increasing marginal effect on pension benefits in the few years prior to retirement comprise very different incentives to switch jobs than plans that are neutral with respect to past and future tenure in the firm. Especially when pension rights are not perfectly transferable, potential pension capital losses can prevent an individual from switching jobs. This makes pension provision a potential determinant of 'job lock', which is the phenomenon that workers stay in their

*This Chapter is joint work with H.G. Bloemen and S. Hochguertel

current job because leaving their job will lead to a decrease in employee benefits (Gruber and Madrian, 1994).

Studies testing the effects of (early) retirement pensions on labour market behaviour have usually been concerned with the retirement decision of the elderly.[1] Yet, financial incentives embedded in the pension system also affect job decisions in mid-career. Mitchell (1982) was the first to empirically show the negative correlation between job turnover and pension provision. Estimating probit models, she shows that the probability of male individuals changing jobs between 1974 and 1977 drops by 20 percent when the job offers a(ny) pension plan. Surprisingly, other fringe benefits seem to have no significant effect on labour market mobility. A summary of early theories on the impact of pension plans on employees' behaviour can be found in Allen and Clark (1987). These theories propose several hypotheses for the correlation between pensions and mobility. The first hypothesis posits that imperfect mobility of pension rights decreases mobility of individuals covered by a pension plan, because job transitions are associated with pension capital losses. Second, less switch-prone individuals might self-select into jobs with pensions: for example because the potential pension capital loss associated with a job change is not relevant when an individual does not intend to quit his job (Ippolito 1991). A final reason for lower turnover in jobs that offer pension plans comes from the fact that these jobs are generally more attractive, also in other respects.

In order to offer a cleaner estimate of the causal effect of pensions on labour market transitions, empirical studies have tried to correct for the selection of less mobile individuals into jobs that offer a pension plan. Examples are the inclusion of random effects (Mealli and Pudney, 1996) and the use of occupational pension offer rates by region of residence as an instrument for occupational pension coverage (Andrietti, 2004). Allen, Clark and McDermed (1993) use a simultaneous equation model to show that observable employee characteristics can explain both higher job turnover as well as coverage by a pension plan. They interpret this as evidence for a selection effect on observables.

We base our findings on a natural experiment offered by a variation in pension rules

[1] Examples of such studies include Burtless and Moffitt (1984) for the U.S., Börsch-Supan and Schnabel (1998) for Germany and Euwals, van Vuuren and Wolthoff (2010) for the Netherlands.

applying to some workers and not to others. Specifically, on January 1st 2004, the two largest pension funds in the Netherlands (one covering about 1.1 million civil servants, the other the same number of health care workers) changed their pension scheme from a final salary system to an average salary system. We have access to detailed administrative data sources comprising the entire Dutch population such that all relevant job transitions can be measured in order to detect a possibly subtle effect of pension rules on job transitions. We select two treatment groups and a control group representing about 45% of the total number of Dutch employees. Relying on this rich source of data, we estimate discrete choice models for transitions to jobs. The results show that the number of job transitions of civil servants and health care professionals significantly increased at the onset of the new pension rules. However, whereas one would expect that especially career-making individuals switch jobs from a DB-average salary scheme, this was not the case for civil servants and health care professionals. It therefore seems that although individuals are driven by a major change in their pension scheme, they are either not interested in, or do not understand the details of their pension accrual. Our results are specifically important for Spain where occupational pensions are still based on 25 years of final salary (OECD, 2015). Transition to an average salary system may (temporarily) increase labour market mobility in this country, thereby improving the matching process on the labour market and lowering unemployment. Most OECD countries now use lifetime earnings to calculate pension benefits (OECD, 2015). Examples of countries that have extended the period over which earnings are taken into account are France, Finland, Poland, Portugal, the Slovak Republic and Sweden (Martin and Whitehouse, 2008).

This paper contributes to the existing literature in two important ways. The first contribution is that we use a large change of industry standard to identify the causal effect of a change in pension rules. By studying the same individuals covered by two different pension schemes, we can convincingly exclude the possibility that the found correlation between mobility and pension schemes is driven by self-selection into jobs with an attractive pension arrangement[2]. The second contribution is that the specific

[2]Ippolito (2002) also uses a natural experiment: in 1984 the pension system for federal government employees in the U.S. was replaced by a new, less generous system which implied a lower capital loss when switching jobs. However, since only new entrants were covered by the less generous system, a selection

rules according to which pension accrual takes place may not create financial incentives that affect job choices and job mobility, where previous work showed that the provision of a(ny) pension scheme does matter for job mobility.

The remainder of this paper is set up as follows: Section 4.2 sketches the institutional context. Section 4.3 offers theoretical effects of a switch from a DB-final salary to a DB-average salary plan, focussing on the variation in potential pension capital losses incurred in both systems. Section 4.4 presents the data and some descriptives. The correlation between the type of pension plan (DB-final, DB-average and DC) and number of job transitions is shown. The results of the main regression analysis are given in Section 4.5 before turning to conclusions in Section 4.6.

4.2 Institutional Context

4.2.1 The Dutch Pension System

A full pension of a Dutch individual consists of a maximum of three components. First, everyone aged 65 or above receives a flat rate basic state old age pension, which is financed on a pay-as-you-go (PAYG) basis, meaning that current workers' contributions pay for current pensioners' benefits. From age 15 to age 65, every calendar year that an individual resides in the Netherlands, he or she accrues 2% of full rights to a state pension. A full state pension equals 100% of the legal minimum net wage for couples, and 70% of the minimum wage for singles. Second, over 90% of employees is covered by a capital-funded occupational pension scheme. General regulations, for example concerning the favorable tax treatment of pension premiums are laid down in the Law on Pensions (PensioenWet, PW). The exact specifications of the occupational schemes are part of labour market negotiations and specified in collective labour agreements. These agreements are made either at the industry or at the firm level. When agreements are made at the industry level, the Ministry of Social Affairs can require an entire sector to participate in the same pension fund if formally requested by the employers' organizations and trade unions leading the negotiations.

effect cannot be excluded.

In 1998, most pension arrangements were of the defined benefit (DB) type, whereas a small percentage was based on a(ny) defined contribution (DC) scheme. In the latter system, pension capital is treated as an investment, the proceedings of which are paid out as pensions. Payments are therefore directly dependent on (stock) market returns. The pension benefits from a DB scheme are pre-specified, with participants accruing a small percentage of their final or average wage every year. The typical employee in 1998 was covered by a final-pay DB scheme with a yearly accrual rate of 1.75%, assuring a 70% gross replacement rate after a labor market history of 40 years.[3] This can also be inferred from Figure 4.1 and Table 4.1. In most occupational pension schemes, participants start accruing pension rights immediately: the vesting period is legally maximized at two months for regular employees. The final component of a full pension system consists of individual pensions bought from insurance companies, and other personal savings that are used as an old-age-provision. Because of the importance and generosity of occupational pensions, this component on average provides only 7% of total income of the elderly (Bovenberg and Meijdam, 1999).

4.2.2 From Final to Average Salary Schemes

As mentioned in Section 4.2.1, the typical pension fund in 1998 offered their participants a final-pay DB scheme. From 1999 onwards, various reasons led many pension funds to abandon the final-salary scheme in favour of an average-salary DB system: (1) unfavourable stock market returns, (2) the aversion of the 'reverse solidarity' that existed between career- versus non-career-making employees, and especially, (3) the employer risk associated with backservice payments. Besides decreasing employer risk from backservice payments, another advantage of the average-salary system is that valorisation could be made conditional on the performance of the pension fund. In a final-salary system only pensioners are struck by temporary non-indexation of their rights, whereas in an average-salary system it is possible to adjust valorisation and indexation rates of all participants:

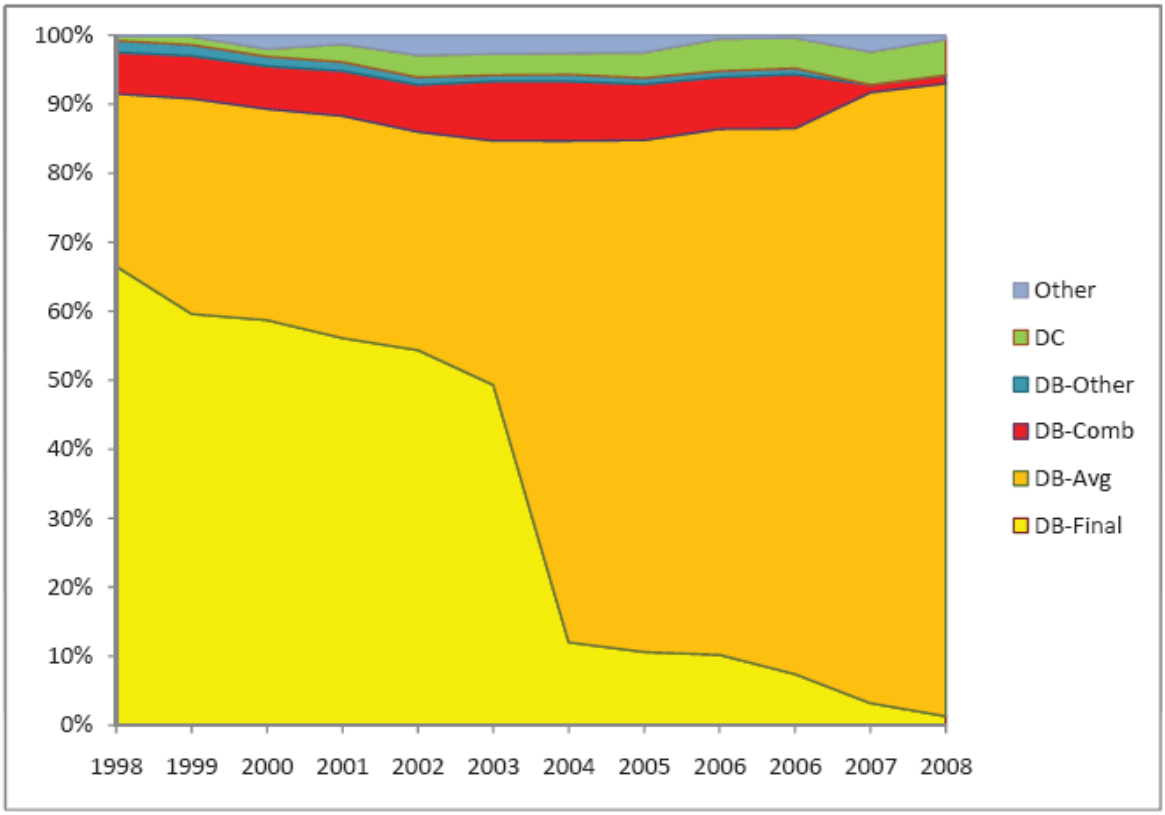
[3] This 70% gross replacement rate includes payments from both the occupational pension and the basic state pension, since usually occupational pensions are based on the wage over and above a 'franchise' (an amount usually based on the level of state pension payments). Net replacement rates tend to be significantly higher for many retirees.

Table 4.1. Yearly accrual rates old age pension

	< 1.5	1.5	1.5-1.75	1.75	1.75-2	2	> 2	Other/various accrual rates
	Percentage of pension funds							
1998	3.3	1.9	2.8	61.0	3.4	8.5	1.8	17.4
1999	3.3	1.7	2.9	59.7	3.9	8.9	2.2	17.5
2000	3.5	1.4	2.6	59.2	4.8	9.5	1.9	17.0
2001	3.8	1.3	3.1	58.0	5.4	10.6	2.5	15.3
2002	3.9	1.2	2.8	55.3	7.4	12.0	3.4	14.1
2003	3.6	1.1	3.1	51.0	9.1	14.0	4.9	13.2
2004	3.7	1.2	3.4	49.7	10.1	14.1	5.5	12.4
2005	3.8	1.0	3.5	46.5	10.2	15.5	7.1	12.5
2006	4.0	1.0	3.6	43.6	10.7	16.9	8.0	12.4
2006*	4.3	1.2	3.9	42.8	11.3	17.7	9.0	9.7
2007	3.7	0.0	3.9	26.8	9.6	18.6	37.4	0.0
2008	3.4	0.0	3.7	26.9	10.3	18.1	37.5	0.0
	Percentage of participants							
1998	12.0	0.1	1.9	74.2	0.3	3.1	0.4	7.9
1999	11.3	0.1	1.8	72.5	2.4	3.2	0.6	8.1
2000	11.2	0.1	1.7	72.4	3.2	3.5	0.7	7.3
2001	11.5	0.1	1.8	65.8	9.1	4.7	1.9	5.1
2002	11.8	0.1	1.6	63.8	10.1	5.3	2.2	5.1
2003	5.3	0.1	1.6	58.5	12.7	5.6	6.8	9.4
2004	4.5	0.1	1.6	37.9	32.6	6.7	7.4	9.1
2005	4.4	0.1	1.5	39.0	31.6	6.6	7.8	9.1
2006	4.1	0.1	1.6	35.7	30.7	6.0	9.5	12.4
2006*	4.2	0.1	1.7	37.4	32.4	7.0	10.0	7.1
2007	1.6	0.0	3.6	3.4	7.6	6.3	77.5	0.0
2008	1.8	0.0	4.9	2.8	8.1	5.8	76.7	0.0

*Note: from 2006 pension funds that are close to liquidation are no longer reflected in the statistics. The general increase in accrual rates from 2007 onwards is a result of the abolition of the favourable fiscal treatment of savings for early retirement pensions. Many pension funds compensated their employees by increasing the yearly accrual rate of pension wealth.

Figure 4.1. Percentage of Dutch pension fund participants by various types of pension schemes over time



from 2006 on: excl. pension funds close to liquidation

active members, sleepers, and pensioners (Ponds and van Riel, 2010).[4]

On the 1st of January 2004, the two largest Dutch pension funds, the pension fund for civil servants (ABP) and for the health care sector (PGGM, now PFZW), switched from a final-salary to an average-salary plan.[5] Around 30-35% of total Dutch active pension participants were affected by these changes (Figure 4.1).[6] Dutch civil servants and

[4]Indexation refers to the adjustment of payments to pensioners to reflect changes in costs or standards of living. Valorisation is the adjustment of past earnings to account for changes in living standards between the time when pension rights are earned and when they are claimed (OECD, 2005). An individual that has some pension rights with a pension fund but is currently not an active participant is called a sleeper.

[5]The professional military services kept a final-salary system in 2004 since an average-salary system was thought not to be able to account for the diverging salary structure and legal position of military personnel. The military is therefore not included in the data analysis.

[6]According to Statistics Netherlands, there were 841 pension funds in 2004 with a total number of 6,268,000 active participants (i.e. employees). Although the large majority of the pension funds were firm-specific funds, the 102 sector-specific funds covered in total 5,320,000 or 85% of the total number

health care professionals come from all layers of society: government officials and medical doctors are included, but so are the employees who perform administrative tasks, nurses, and those that keep the streets clean and safe. Since so many individuals were directly touched by these policy changes, this natural experiment offers an exceptional possibility to meaningfully estimate the effect of the type of pension plan on job transitions.

Previous work posits that there are three mechanisms that can explain a positive correlation between having a job which pays a pension and labour market mobility: (1) selection of less switch-prone indviduals in jobs without a pension (2) jobs with pensions are generally more attractive and (3) potential pension capital losses. (1) Self-selection cannot drive our results. First, since the new rules were immediately applied to existing participants of the system, we are able to compare behaviour of the same individuals before and after the policy change, effectively eliminating the selection effect. Second, even without a natural experiment the self-selection issue is mitigated by studying the effect of particular *characteristics* of a pension scheme on the propensity to move (Henley, Disney and Carruth,1994). Although it is in principle possible that individuals self-select into the type of pension scheme according to their implicit switching probabilities, this may require a more sophisticated calculus than a simple membership decision. (2) General attractiveness of the pension scheme can drive our results, since an average salary scheme is less attractive for individuals with high expected wage rises, thereby encouraging them to switch jobs when they are no longer covered by a final salary scheme. Section 4.3 elaborates on the characteristics of individuals who are more likely to switch jobs when the final salary system is replaced with an average salary system. However, switching to an employer which still offers a DB-final-salary plan is not an issue since only 12% of pension fund participants was still covered by a DB-final-salary scheme in 2004 (Figure 4.1). Since the pension funds that did offer a DB-final-salary scheme in 2004 mainly covered jobs in the technical and construction industry, substitution to these type of jobs seems practically irrelevant for civil servants and those working in the health care sector.

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of active participants (Statistics Netherlands, 2012). The treatment funds in our sample are the largest funds: both contained more than 1 million active participants or about 16% of total participants each in 2004. The third largest pension fund (PMT for the metal industry) 'only' covered 418,000 active participants in 2009.

4.3 A Theoretical Model of Transferable Pension Rights

This Section considers the individual-specific incentives involved in the job change decision in the situation where the current pension plan is a DB-final-salary scheme versus the situation where the current pension plan is a DB-average-salary scheme. From these theoretical incentives, a number of hypotheses are derived and tested in Section 4.5. We consider an individual facing a decision to either switch jobs to an employer covered by a different pension fund or to stay with the current employer. Our focus is on a specific part of the financial incentives involved in the decision to switch, namely the attainable per-year pension payments at age 65, P. We will use a star ($*$) to denote the value of variables with a different employer, non-starred symbols are used to denote the value of variables at the current employer.

In the following, we are mainly interested in the conditions under which $P^* > P$, i.e. the yearly pension rights at age 65 when taking up a job with an employer that has a different pension fund is higher than the yearly pension rights at age 65 when staying in the current job (with the current pension fund). Whenever $P^* > P$, there is an *incentive to switch* ($ITS^{\Delta fund}$) in terms of attainable pension rights. This incentive is composed of two parts:

1. Whether the future value (i.e. the value at age 65) of the pension rights that have already *been accrued* at the moment of the job transition will increase or decrease. In the equations for P below, this is reflected in the first part of the equation. For future reference, we will label the discrepancy between the value of *current* pension rights when a switch takes place and the value of *current* pension rights when not switching jobs $ITS^{\Delta fund}_{current}$.

2. Whether the future value (i.e. the value at age 65) of the pension rights that still *need to be accrued* after the job transition takes place will increase or decrease. In the equations for P below, this is reflected in the second part of the equation. For future reference, we will label the discrepancy between the value of *future* pension rights when a switch takes place and the value of *future* pension rights when not switching jobs $ITS^{\Delta fund}_{future}$.

An individual working in a job for a salary S_t in year t for a total of n years decides whether or not to make a transition to a new job. His salary is expected to rise at a constant rate w each year, such that $S_{t+1} = S_t(1+w)$. In case he stays in the same job (or switches to an employer covered by the same pension fund as his current employer), his pension rights are assumed to accrue for a total of N years. In case he changes jobs, his pension rights accrue for a total of n years with his old employer, and $N-n$ years with his new employer. Let the yearly accrual rate of pension rights be denoted by x and the valorisation of active and sleeper rights by r_A and r_S, respectively. In order to be able to single out the incentive to change jobs for individuals covered by an average versus a final salary plan, we assume that the new job and the old job have the same expected wage increase: $w = w^*$ and that all pension systems are exactly the same in terms of accrual rates x and valorisation $r_A = r_S = r$.[7]

4.3.1 Final Salary to Final Salary Switch (at time $n < N$)

First take an individual working in a job with a DB-final-salary (FS) system. When staying in the current job for the maximum number of N years, per-year pension payments at age 65 are:[8]

$$P^{FS} = xS_N N = xS_n(1+w)^{N-n}N \tag{4.1}$$

When changing jobs after n years, attainable yearly pension at age 65 when the new job also has a DB-final-salary plan will be (in case an individual will not transfer (NT) his accrued pension rights to his new employer):

[7] For some pension funds, indexation of sleeper rights is lower than indexation of active rights (an often encountered indexation is a correction for the average wage rise in the sector for active rights, and an inflation correction for sleeper rights). However, since both ABP and PGGM apply the same indexation for both types of rights, we abstract from this issue.

[8] When we denote indexations (r,w) to be net of inflation from time n, these equations can be thought of present values of the yearly pension at age 65. We assume an individual expects to live until age 65 with certainty. Also, we abstract from issues related to differing mortality tables and interest rates used by the current and new employer. Introducing parameters which are not directly relevant for our analysis (because no discontinuous shift in them takes place in the period studied) leads to a more complex notation which will distract the reader from the main argument presented in this section.

$$P_{NT}^{*FS} = xS_n(1+r)^{N-n}n + xS_n^*(1+w^*)^{N-n}(N-n) \tag{4.2}$$

Comparing equations (4.1) and (4.2), it is clear that switching between employers that are insured with different pension funds can bring about major changes in an employee's pension rights when those rights cannot be transferred to the new employer. A decrease in the future value of the accrued pension wealth can occur, since the rights that have been acquired from the previous employer will not rise with future increases in wages: there is no backservice over non-transferred rights. It depends on the rules concerning the valorisation of sleeper rights r to what extent the value of pension rights built up with the previous employer will rise in value. That is, accrued pension rights will decline in value upon changing employers whenever $w > r$. In other words, $ITS_{current}^{\Delta fund}$ is negative when $w > r$ and positive when $w < r$.

To repair this obstruction for employees to switch jobs whenever $w > r$, a new law was passed, becoming effective on July 8th 1994. The law established standard calculation rules on the basis of which pension rights can be transferred from one pension fund to the other (if wished by the employee). However, until January 1st 2007 pension rights could not be transferred to (or from) *profession-specific* pension funds. For jobs to which rights could be legally transferred, the present value of the rights is calculated and is treated as if it were accrued in the pension fund of the new employer. In case of a transfer between DB-final salary plans, this includes the provision of backservice over the transferred pension value.[9] The yearly attainable pension at age 65 when switching between DB-final salary plans and transferring (T) accrued pension rights will be:

$$P_T^{*FS} = xS_N^*N^* = xS_n(1+w^*)^{N-n}n + xS_n^*(1+w^*)^{N-n}(N-n) \tag{4.3}$$

[9] A switch between employers does not have to be immediate: a period of unemployment between jobs is no obstruction to the right to transfer. Transferring pension value is not possible when the coverage rate of one or both pension funds is below 100%. In this case a transfer can still be requested, such that the actual transfer can take place at the moment the coverage rate of both pension funds is above 100%.

with

$$\begin{aligned} N^* &= N + (n^* - n) \\ n^* &= n \left\{ \frac{x}{x} \frac{S_n}{S_n^*} \right\} \end{aligned} \tag{4.4}$$

Where n^* is calculated from equalizing the value of the pension with the old employer when the individual would retire now, with the value of the pension with the new employer when the worker would retire now:

$$S_n x n = S_n^* x n^* \tag{4.5}$$

As we can see from comparing equations (4.1) and (4.3), as long as the final attainable salary in both jobs is the same ($S_N = S_N^*$), some pension rights are lost when a promotion is made at the moment of transfer ($S_n^* > S_n \rightarrow N^* < N \rightarrow P_T^{*FS} < P^{FS}$). In this case the employee does not accrue pension rights over the increment in salary for the time spent with the old employer, since in the past there was no pension accrual over this extra salary. The number of years n^* transferred to the new employer is therefore lower than the actual number of years worked n. Since a salary increase with the current employer *does* lead to a full backservice, it can be financially more attractive to accept a small salary increase with the current employer, as compared to a larger increase in salary with the new employer. It decreases the mobility of a career-making employee covered by a DB-final salary plan, even when he has an option to transfer his accrued rights to the new pension fund. In other words, $ITS_{current}^{\Delta fund}$ is negative when $S_n^* > S_n$. Moreover, an individual covered by a DB-final-salary plan will be reluctant to accept a demotion with an employer that is covered by the *same* pension fund, whenever he cannot make up for the decrease in salary at some later point in time. In this case, the future value of his pension rights will decrease in value: every accrued working year is now valuated against a lower salary. That is, $ITS_{current}^{same\ fund}$ is negative when $S_n^* < S_n$.[10]

[10] Since the number of accrued pension years is especially high for the elderly, the Dutch law allows for the continuation of pension rights on the old (higher) level for individuals facing a demotion from age 55.

4.3.2 Final Salary to Average Salary Switch (at time $n < N$)

In case a switch takes place from a DB-final salary to a DB-average-salary (AS) plan, pension rights at age 65 when not transferring these rights will be:

$$P_{NT}^{*AS} = xS_n(1+r)^{N-n}n + x\sum_{t=n+1}^{N} S_n^*(1+w^*)^{t-n}(1+r^*)^{N-t} \tag{4.6}$$

Whereas using a transfer of the current pension value translates in an accumulation of pension rights at age 65 of:

$$P_{T}^{*AS} = xS_n(1+r^*)^{N-n}n + x\sum_{t=n+1}^{N} S_n^*(1+w^*)^{t-n}(1+r^*)^{N-t} \tag{4.7}$$

Therefore, an individual is indifferent to the decision to transfer accrued pension rights or not under our assumptions. Moreover, pension rights are lost whenever $w > r$. Since this affects both the pension rights already accrued and the pension rights to be accrued in the future, there is a negative incentive to switch ($ITS^{\Delta fund}$) in a final-salary plan for individuals with high expected future wage increases. Conversely, the incentive to switch is positive when $w < r$.

4.3.3 Average Salary to Average Salary Switch (at time $n < N$)

Now take an individual working in a job with a DB-average-salary system. When *staying* in the current job for the maximum number of N years, per-year pension payments at age 65 are:

$$P^{AS} = x\sum_{t=1}^{N} S_t(1+r)^{N-t} \tag{4.8}$$

When an individual transits to another job with a DB-average-salary plan, the total accrued yearly pension value at age 65 when not transferring current pension rights will be:

$$P_{NT}^{*AS} = x\sum_{t=1}^{n}\left\{S_t(1+r)^{n-t}\right\}(1+r)^{N-n} + x\sum_{t=n+1}^{N} S_n^*(1+w^*)^{t-n}(1+r^*)^{N-t} \tag{4.9}$$

Whereas with a transfer of accrued pension rights the yearly pension at age 65 reads:

$$P_T^{*AS} = x \sum_{i=1}^{n} \left\{ S_t (1+r)^{n-t} \right\} (1+r^*)^{N-n} + x \sum_{t=n+1}^{N} S_n^* (1+w^*)^{t-n} (1+r^*)^{N-t} \qquad (4.10)$$

As is clear from equations (4.9) and (4.10), under our assumptions an individual is indifferent between transferring and not transferring accrued pension rights. Moreover, no pension rights are lost in case of a switch between two average salary systems with equal parameters.

4.3.4 Average Salary to Final Salary Switch (at time $n < N$)

The resulting yearly attainable pension at age 65 when switching from a job with a DB-average-salary-plan to a job with a DB-final-salary-plan is

$$P_{NT}^{*FS} = x \sum_{t=1}^{n} \left\{ S_t (1+r)^{n-t} \right\} (1+r)^{N-n} + x S_n^* (1+w^*)^{N-n} (N-n) \qquad (4.11)$$

when not transferring accrued pension rights and

$$P_T^{*FS} = x \sum_{t=1}^{n} \left\{ S_t (1+r)^{n-t} \right\} (1+w^*)^{N-n} + x S_n^* (1+w^*)^{N-n} (N-n) \qquad (4.12)$$

when transferring accrued pension rights. That is, an individual for whom $w > r$ will transfer his rights and has an incentive to switch ($ITS^{\Delta fund}$) to a job with a final salary plan. Note that, since both current and future pension rights become more valuable, both $ITS_{current}^{\Delta fund}$ and $ITS_{future}^{\Delta fund}$ are positive. In contrast, when $w < r$ rights will not be transferred and there will be a negative incentive to switch. Since only future pension rights are negatively affected, only $ITS_{future}^{\Delta fund}$ is negative in this case.

4.3.5 Hypotheses Derived from Theoretical Incentives

Table 4.3 summarizes the theoretical effects of coverage by a DB-final-salary versus a DB-average-salary scheme on the incentive to switch. For example, an individual who is covered by a DB-average salary plan and for whom $w > r$ has a positive incentive to switch to an employer with a DB-final-salary plan ($ITS^{\Delta fund}$). On the other hand, an

individual who is covered by a DB-final-salary plan and for whom $w > r$ has a negative incentive to switch to an employer with a DB-final-salary plan. Every fifth line indicates the expected increase or decrease in the number of job transitions from January 1st 2004 on, when the pension funds ABP and PGGM changed their pension system from final to average salary. For the group of individuals for whom $w > r$, the number of job transitions is expected to increase since they now face a positive instead of a negative incentive to switch.

It is likely that the majority of individuals has $w > r$ instead of $w < r$ since valorisation r is never higher and often lower than the median salary rise in a sector. This is a direct consequence of the fact that in the first few years of the 21st century, the valorisation rate r was usually pegged to the basic wage increase (agreed upon in collective labour agreements) which is added to the wage of all workers.[11] In fact, the pension fund for the civil servants ABP increased yearly accrual rates from 1.75% per year to 1.75% - 1.9% per year in order to make the switch from final- to average-salary benefit-neutral for the average ABP participant - see Table 4.2. However, ABP also increased the joint premium for both old age occupational pension and widow(er)s pension from 15.2% in 2003 to 19% in 2004 (the employee pays $\frac{1}{4}$ of the total premium). Moreover, most participants agreed to pay the full premium (1.7%) for the widow(er)s pension themselves, in order to avoid that the payments of widow(er)s pension after the individual turns 65 would get cut in half. Civil servants therefore on average did not experience a cut in future pension benefits but did experience an increase in today's costs in 2004. The pension fund for the health care sector PGGM did not raise valorisation rates or premiums in 2004. Health care workers therefore were likely to experience a cut in future pension benefits but did not experience an increase in today's costs.

From Table 4.3, a number of testable hypotheses can be derived:

Hypothesis 1: Individuals with high expected wage increases ($w > r$) are more likely to switch jobs (to an employer with a different pension fund) when their current pension plan is of the DB-average-salary form.

[11] Nowadays, valorisation is usually pegged to price increases instead of wage increases, in order to keep the valorisation rate low.

Table 4.2. Changes in accrual rates - civil servants

	Age on 12-31-2003	Accrual rate	Franchise
2003 scheme	all	1.75%	15,450
2004 scheme	<40	1.9%	13,000
	40-49	1.8%	14,250
	>49	1.75%	15,250

Note: since the state offers a basic pension to every Dutch citizen, it is unnecessary to accrue pension wealth over the entire salary. The franchise is the part of salary over which no pension wealth is accrued. For employees of at least 50 year of age the adjustments are minimal, since for them salary is not expected to rise much.

When a career-making individual covered by a DB-final-salary-plan switches to an employer with an average salary plan he loses part of his current and future pension rights when making the switch. In contrast, a career-making individual covered by a DB-average-salary-plan will gain in terms of both current and future pension rights.

Hypothesis 2: Individuals with low expected wage increases ($w < r$) are less likely to switch jobs (to an employer with a different pension fund) when their current pension plan is of the DB-average-salary form.

When a non-career-making individual covered by a DB-final-salary-plan switches to an employer with an average salary plan he gains both current and future pension rights when making the switch. The same individual also has an incentive to switch to an employer with another final salary plan since in that case he can choose for his current pension rights to be indexed by r instead of w. In contrast, a non-career-making individual covered by a DB-average-salary-plan will lose in terms of future pension rights.

Hypothesis 3: Job switches (to an employer with a different pension fund) with individuals experiencing a promotion ($S_n^* > S_n$) are more likely to occur when their current pension plan is of the DB-average-salary form.

An individual covered by a DB-final-salary-plan who experiences a promotion when switching to an employer with another final salary plan loses part of his accrued pension rights when making the switch. For all other transitions (final-average or average-final or average-average) such problems do not arise.

Table 4.3. Theoretical effects of pension system on number of job switches

		$ITS_{current}^{\Delta fund}$	$ITS_{future}^{\Delta fund}$	$ITS^{\Delta fund}$	$ITS_{current}^{samefund}$	ITS^{total}
$w > r$	AS→FS	+	+	++	0	++
	AS→AS	0	0	0	0	0
	FS→FS	0	0	0	0	0
	FS→AS	-	-	- -	0	- -
#switches 2004				++++	0	++++
$w < r$	AS→FS	0	-	-	0	-
	AS→AS	0	0	0	0	0
	FS→FS	+	0	+	0	+
	FS→AS	+	+	++	0	++
#switches 2004				- - - -	0	- - - -
$Sn* > Sn$	AS→FS	0	0	0	0	0
	AS→AS	0	0	0	0	0
	FS→FS	-	0	-	0	-
	FS→AS	0	0	0	0	0
#switches 2004				+	0	+
$Sn* < Sn$	AS→FS	0	0	0	0	0
	AS→AS	0	0	0	0	0
	FS→FS	0	0	0	-	-
	FS→AS	0	0	0	0	0
#switches 2004				0	+	+
Total						
#switches 2004						++

$ITS_{current}^{\Delta fund}$: difference between the value of current pension rights when a switch takes place to a job with a different pension fund and the value of current pension rights when not switching jobs. $ITS_{future}^{\Delta fund}$: difference between the value of future pension rights when a switch takes place to a job with a different pension fund and the value of future pension rights when not switching jobs. $ITS^{\Delta fund}$: summation of $ITS_{current}^{\Delta fund}$ and $ITS_{future}^{\Delta fund}$. $ITS_{current}^{samefund}$: difference between the value of current pension rights when a switch takes place to a job with the same pension fund and the value of current pension rights when not switching jobs. ITS^{total}: summation of $ITS^{\Delta fund}$ and $ITS_{current}^{samefund}$. AS: average salary pension scheme. FS: final salary pension scheme. w: yearly wage increase. r: valorisation rate of accrued pension wealth. Sn: salary in the current job. $Sn*$: salary when accepting a new job.

Note: Predicted effects from the pension system reforms in 2004 are given in gray. The magnitude of the incentive to switch ranges from - - - - (a strong negative incentive to switch jobs) to ++++ (a strong positive incentive to switch jobs).

Hypothesis 4: Job switches (to an employer with the same pension fund) with individuals experiencing a demotion ($S_n^* < S_n$) are more likely to occur when their current pension plan is of the DB-average-salary form.

An individual covered by a DB-final-salary-plan who experiences a demotion when switching to an employer who is covered by the same pension plan loses part of his accrued pension rights when making the switch. Individuals are therefore less likely to accept a demotion when they are covered by a final-salary pension fund.

Hypothesis 5: On aggregate, individuals are more likely to switch jobs when their current pension plan is of the DB-average-salary-form.

As the majority of the theoretical effects points in the direction of an increase in job switches we expect aggregate job-to-job flows to increase. One can think of circumstances in which the expected number of job-to-job flows will decrease, for example, when there are many individuals for whom $w < r$. However, since the valorisation r is never higher and often lower than the average salary rise in a sector, this situation is irrelevant empirically.

4.4 Data

We make use of administrative data obtained from Statistics Netherlands. The so-called Social Statistical Files 1999-2008 data is obtained from municipalities, tax authorities and social insurance administrations. It contains high quality, detailed information on beginning- and enddate of wage payments for all individuals living in the Netherlands. It also provides information on characteristics of the job an individual is working in, such as the wage paid, whether the individual is in fulltime or parttime employment, and the number of days worked in a job every year. Data on the exact occupation is unknown, but the data does contain the sectoral code of the employer with up to 5-digit precision. Since many pension funds in the Netherlands are sector-specific, a number of pension funds can be linked to the sectoral codes using the information in collective labour agreements.[12]

[12] A similar procedure is used by Euwals et. al. (2010). The collective labour agreements can be found on www.caoweb.nl and contain direct information on the sector code to which the agreement applies. Apart from using the sectoral codes to identify the employees covered by ABP or PGGM, a cross-validation was carried out for ABP using an indicator for being employed by the government available from the data. A cross-validation for PGGM was carried out by merging our dataset with a

Linking pension funds to sectoral codes was not possible for all pension funds, including those that are company-specific instead of sector-specific. In addition, some sectors are served by multiple pension funds, and some industries do not have a compulsory pension fund, making it impossible to link a job to a specific pension fund. Apart from the pension funds for civil servants and the health care sectors, we select all identifiable pension funds that offered a DB-average-salary plan throughout the years 1999-2008. These 14 pension funds will form the control group in the empirical difference-in-difference estimation. The pension fund for civil servants and the pension fund for the health sector offered a final-salary scheme in 1999, but in 2004 changed to an average-salary scheme. They therefore form the treatment groups. The selected pension funds are listed in Table 4.4. For these funds, we track individuals from the age of 25. This was the legal maximum age at which pension accrual is supposed to start (as from 2007, this maximum age was reduced to 21). We follow an individual until he/she reaches the age of 55, such that our analysis is not affected by retirement decisions. In 2004, 27 percent of Dutch employees retired before the age of 60 (CBS, 2016).

We follow Royalty (1998) and label as job-to-job transitions only those transitions in which the next job starts within 1 month (31 days) after the current job ends.[13] The choice of this relatively short time interval has several advantages. First, we can be sure that there is no long-lasting spell of unemployment, sickness or disability in between the two jobs. Although the possibility to transfer any accrued pension rights to the new employer is not compromised by an intervening spell of unemployment or disability, it seems unlikely that individuals that have been unemployed for some time are paying much attention to pension arrangements in their search for a new job. Second, confining the maximum interval between jobs to 1 month makes it more likely that the transitions we observe are voluntary, such that the analysis is not contaminated by the inclusion of

datafile acquired from PGGM that lists participants in the pension fund on the 1st of January each year. For both ABP and PGGM, the use of the sectoral SBI indicator had a near-complete matching (>98% for ABP and >90% for PGGM) with the other indicators – strengthening confidence in the identification of the members of various pension funds using sectoral indicators.

[13] We also consider as job-job transitions all spells in which the next job starts at most 1 month before the current job ends. In this case, the next job should also continue for at least 1 month after the current job ends. This way we allow for a possible small overlap between subsequent jobs.

Table 4.4. Overview of pension funds included in the sample

Pension fund	SBI '93	Description
ABP	75 (not 753, 7513, 7522)	civil servants/public sector
	80 (not 8042)	education
PGGM	85*	health care
BPD	159 (not 1596, 1597)	beverages industry
BPSG	7470	(window-)cleaning industry
GBF	222	graphic industry
GF	153	vegetable and fruit industry
PK	93021	haircutters
BPL	011-016, 1571	agriculture
PMT	285, 342, 362, 453	metal industry
BPSAG	4544	construction industry
PS	52221	butchers
PT	33101	dental care
PBVD	2430	paint industry
VLEP	15132, 5132	meat industry
SFW	4524	waterworks industry
PW	52441, 52442, 52444, 52465, 52466	furniture industry

*Note: excluded from PGGM are: 851111, 85121, 85122, 8513, 85141, 85142, 85145,85146, 85151, 85152, 85153, 8516, 8517, 8520, 85329, 85331, 85342, 85344. This mainly exludes those who are covered by a profession-specific funds, such as GP's, specialists, midwives, dentists, and veterinarians. For ABP, code 7522 denotes the military, for whom the switch from final to average-salary did not take place.

layoffs.[14] Results of Section 4.2 are not affected by considering all jobs that start within 2 months after the current job ends as job-to-job transitions.

For the analysis, we only select the years 1999-2004: years 1999-2003 pre-reform and year 2004 post-reform. From 2005-2008, there are various data issues concerning the number of jobs according to sector in the Social Statistical Files. In 2005, part of the jobs in agriculture and the construction industry are missing from the data. Between 2005/2006 and 2006/2007 Statistics Netherlands advises not to publish the number of

[14]Reorganisations within the government or health care sector are also picked up as transitions whenever the reorganisation means that one job contract is closed and another one is signed. This might affect the number of within-government or health care transitions observed. The data-analysis therefore uses a multinomial logit model to separate between within-sector and between-sector movements. We are not aware of any large government or health care reorganisations taking place in the period studied.

jobs per sector on a detailed level because of a number of deviations from the trend in those years.

4.4.1 Descriptive Statistics

Table 4.5 shows background characteristics of individuals included in the control group, ABP (civil servants) and PGGM (health care sector) samples. As can be seen from the Table, the selected ABP-employed individuals are on average slightly older and earn more than those working in one of the control sectors. The health care sector covered by PGGM has a much larger percentage of female workers and (because of that) parttime workers than the sectors representing the control group. Both employees working as civil servants and health care workers are higher educated than those working in the control group sector.

The common trend assumption is the key identifying assumption of the difference-in-difference estimation in Section 4.5. In other words: in case the final salary to average salary change would not have taken place, the trend in the fraction of yearly job switches in the government (health care) sector would have been the same as the trend in the control group. The top left panel of Figure 4.2 shows that in the years 1999-2003, the percentage of job transitions for the control group and the two treatment groups follow a very similar pattern. In fact, the fluctuations in the propensity to change jobs from 1999-2003 for each group is very similar to that of the aggregate economy (excluding ABP and PGGM), providing confidence that sectoral-specific issues do not differentially influence job transition behaviour in this period. The Figure also shows that the percentage of job-to-job transitions is increasing for civil servants, but not for the control group (hypothesis 5 - an overall increase in the propensity to switch jobs). However, there also seems to be a small anticipation effect for civil servants: the percentage of job transitions in 2003 decreases relatively more for civil servants than for the control group. In the regression analysis in Section 4.5 we therefore do not take the year 2003 as a baseline, but all years 1999-2003. Taking 2003 as a baseline results in slightly larger estimates than the ones presented in Section 4.5 for civil servants, excluding 2003 as a baseline results in slightly smaller estimates. Figure 4.2 does not show an increase in the percentage of job-to-job

Table 4.5. Background characteristics

	Full sample			**Selected sample: only 50-54 year olds**		
	Control group	Civil servants	Health care	Control group	Civil servants	Health care
Age	35.63	38.49	36.94	50.58	50.30	50.18
Female	0.46	0.51	0.83	0.46	0.39	0.81
Single	0.43	0.37	0.37	0.06	0.10	0.10
Married	0.50	0.56	0.55	0.81	0.78	0.75
Divorced/widowed	0.07	0.07	0.08	0.13	0.12	0.16
Dependent Child	0.78	0.77	0.78	0.75	0.76	0.75
Dependent Child < 12	0.32	0.34	0.36	0.11	0.12	0.14
Gross wage pday	82.80	118.74	94.49	91.81	139.11	100.93
Low education*	18.1%	1.9%	5.4%	46.3%	7.8%	25.7%
Mid education*	39.1%	14.1%	30.9%	32.4%	20.3%	35.0%
High education*	42.8%	84.0%	63.7%	21.4%	72.0%	39.3%
Fulltime work*	46.9%	43.3%	16.2%	48.6%	51.9%	18.4%
Parttime work*	44.7%	53.4%	74.0%	44.0%	46.1%	74.6%
Flexible work*	8.4%	3.4%	9.8%	7.4%	1.9%	7.0%
# Individuals	1,245,726	1,228,964	1,237,973	185,940	431,031	245,281

*Number of observation is lower for variables education (about 60% of total) and type of work (fulltime, parttime, flex, about 85% of total). Age is age at January 1st 1999

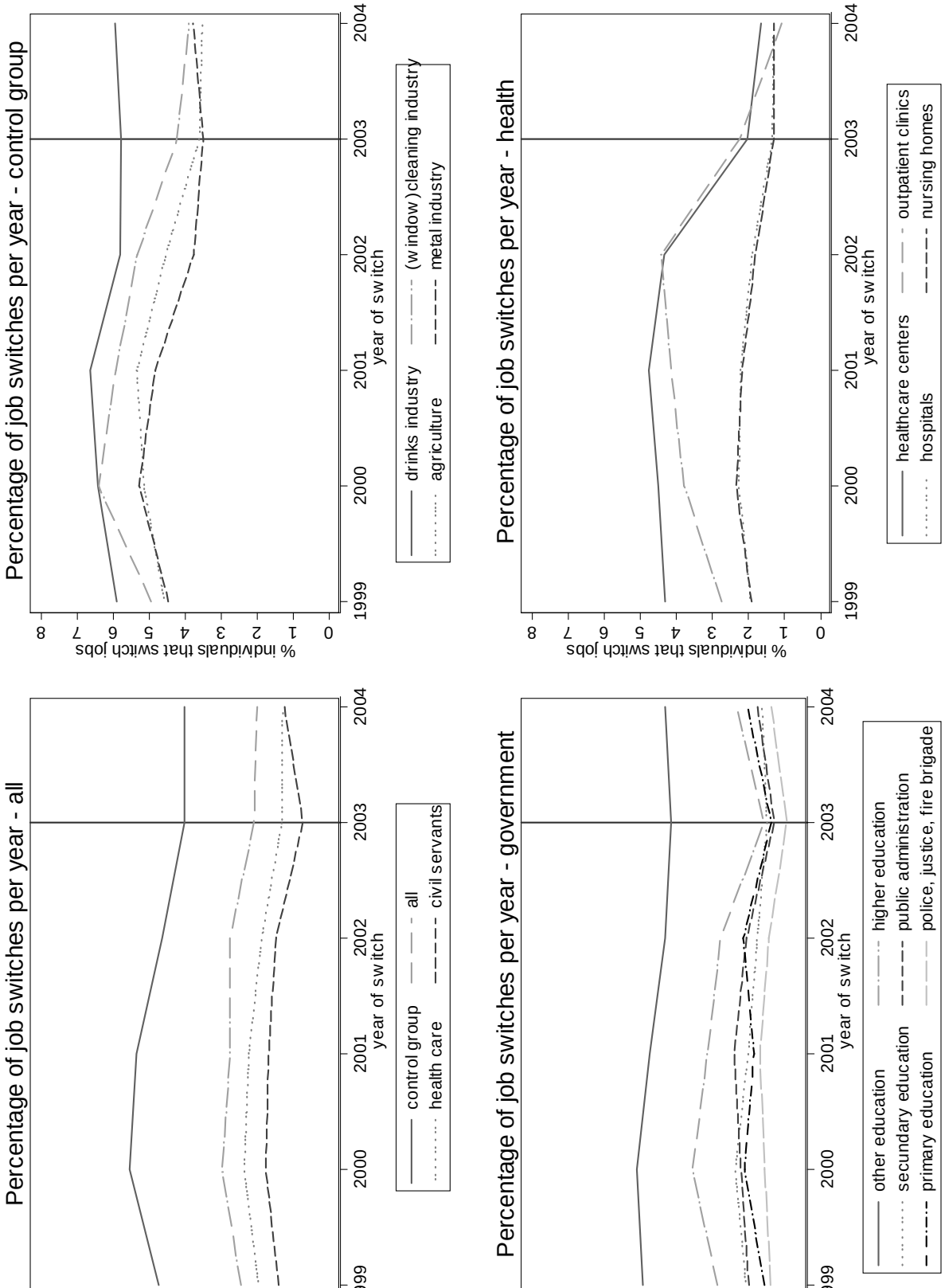
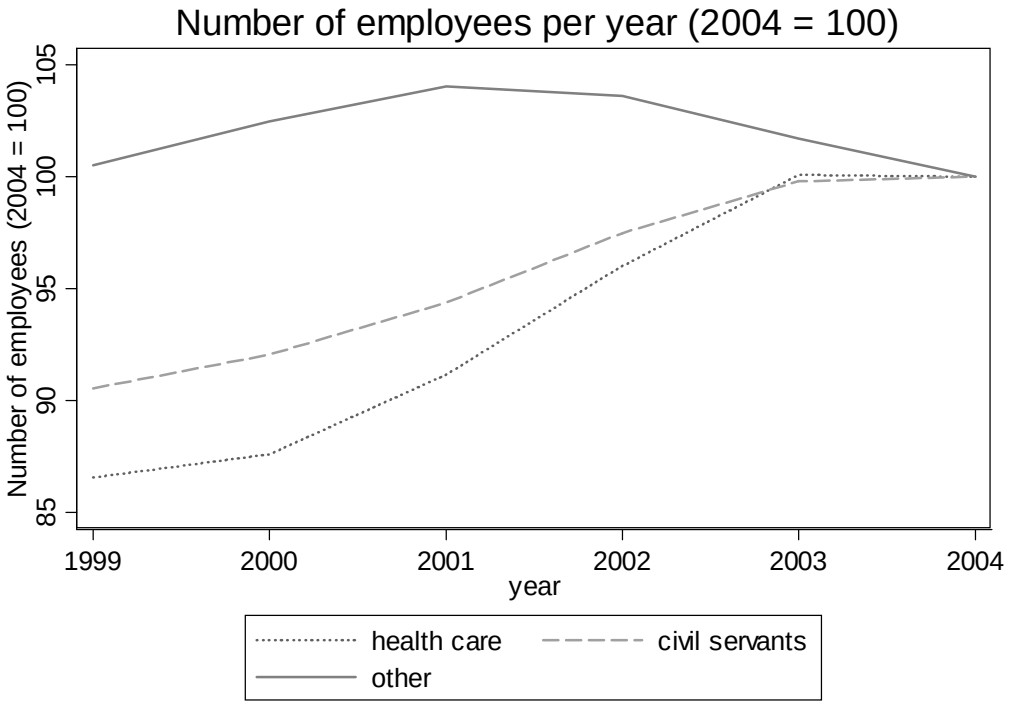


Figure 4.2. The common trend assumption

Figure 4.3. NUMBER OF CIVIL SERVANTS INCREASING FROM 1999-2004



transitions for those working in the health care sector.

The increase in the fraction of job switches from jobs in the public sector in 2004 is not mimicked by a general decline in the number of employees in the public sector (as would be the case if - for example - a budget cut in the public sector would have taken place). Figure 4.3 shows that in fact, the number of employees in both the health care and the public sector stays constant whereas the number of employees in other sectors is decreasing in 2004 (and 2003).

The top right panel of Figure 4.2 shows that between the four largest sectors of the control group, there are no large differences in the patterns of job switches over the years. The (window)cleaning industry has a slightly higher increase in the percentage of job switchers in 2000 as compared to the other sectors. The change in the percentage of switches from 2003 to 2004 is slightly positive or slightly negative for all sectors in the control group. For the various types of civil servants (down left panel) we see an increase in the percentage of job switches from 2003 to 2004 for everyone except those working in 'other educational jobs' (not primary, secondary or higher education). For the health

care sector (down right panel) we see either a slight increase or a slight decrease in the percentage of job transitions from 2003 to 2004, comparable to those in the control group. However, in outpatient clinics the percentage of job transitions is clearly decreasing in 2004. In a sensitivity analysis of our estimations in Section 4.5 we will estimate the effects of the change in pension scheme in 2004 separately for the various types of civil servants and health care professionals depicted in Figure 4.2.

Table 4.6 provides some detailed information on the percentage and type of job-to-job transitions made by members of treatment and control group in the years 1999-2004. The first summary statistic - the percentage of individuals switching jobs - shows the exact figures underlying Figure 4.2. The percentage of individuals switching jobs is indeed increasing for civil servants (hypothesis 5).

We also expect those with a high expected wage increase in their new job ($w > r$) to change jobs more often in 2004 (hypothesis 1 and 2). However, the percentage of job switches which involves individuals with a high actual wage increase in their new job actually decreases for civil servants. An individual is considered to have $w > r$ when their wage growth in the new job is larger than r (0.3%).[15]

We also expect those who make a promotion to switch more often to a job with a different pension fund, and those who make a demotion to switch more often to jobs with the same pension fund (hypothesis 3 and 4). However, while the percentage of job switches with the same pension fund which involves a demotion is indeed increasing for both civil servants and health care professionals, this is not true for the percentage of job switches with a different pension fund which involve a promotion. In 2004, a higher percentage of accepted wages is below the wage in the old job: moving from a final salary system to an average salary system decreases transaction costs of individuals, thereby decreasing the reservation wage (van den Berg, 1992) which puts a downward pressure on the distribution of accepted wages. An individual is considered to make a promotion when the real daily wage in the new job in period t is higher than the real daily wage in the old job in period t-1.

[15] In the period 1999-2003, the average real wage increase which was laid down in collective labour agreements was 0.3% per year.

Table 4.6. Switches and wage growth/promotion in new job

	1999	2000	2001	2002	2003	2004
% switching						
Control group	4.7	5.5	5.4	4.7	4.0	4.0
Civil servants	1.4	1.8	1.7	1.5	0.7	1.3
Health care	2.0	2.4	2.2	1.9	1.3	1.3
% of switches with $w>r$ in new job						
Control group	59.9	66.3	64.9	60.5	54.5	56.7
Civil servants	58.7	63.0	71.5	59.0	70.3	62.7
Health care	49.8	57.5	55.8	54.1	43.2	43.9
median wage increase in new job (percentage points)						
Control group	7.0	12.0	11.4	7.2	3.8	5.0
Civil servants	6.8	10.5	15.9	5.8	16.8	9.9
Health care	0.2	6.7	5.0	4.1	-5.7	-5.0
% of switches to same pension fund						
Control group	12.3	13.8	12.0	13.8	15.6	17.0
Civil servants	15.8	20.3	15.0	24.4	33.4	28.1
Health care	16.2	17.9	17.3	17.6	20.7	21.6
of switches to same pension fund: % promotion						
Control group	37.4	42.8	44.7	45.1	39.6	38.5
Civil servants	26.5	34.4	46.1	36.9	39.0	30.8
Health care	35.3	38.5	40.7	38.9	39.0	34.6
% of switches to different pension fund						
Control group	87.7	86.2	88.0	86.2	84.4	83.0
Civil servants	84.2	79.7	85.0	75.6	66.6	71.9
Health care	83.8	82.1	82.7	82.4	79.3	78.4
of switches to different pension fund: % promotion						
Control group	40.0	43.1	44.4	40.2	39.0	40.4
Civil servants	38.5	43.0	46.9	38.9	56.0	46.3
Health care	32.5	36.8	35.7	36.9	32.8	32.2

An individual is considered to make a promotion whenever the real daily wage in the new job in the year of switching is higher than the real daily wage in the old job. An individual is considered to have $w>r$ whenever the real daily wage increase in the new job from the year of switch t to t+1 is higher than 0.3% (the average real yearly wage increase pinned down in collective labour agreements in the period 1999-2003).

The descriptives do not control for a possible general trend in decreasing relative wages for those (formerly) in the government and health care sector. The descriptives also do not control for a possible correlation between a promotion at the time of switching jobs (higher wage in new job as compared to old job) and a high wage increase in the new job. In the estimation in Section 4.5 we will control for these various possible confounding factors.

An advantage of using individuals that are employed in a different sector of industry as a control group, is that only a tiny fraction of individuals move between these sectors. If substitution between the treatment and control sectors were large, a decrease in the attractiveness of pension system for the treatment group could induce a lower number of job transitions in the control group, thereby overestimating the treatment effect. Table 4.7 shows that only 2 percent of the job switchers in our control group switch jobs to the health care or government sector. Further, the fraction of individuals that switch to a job which is covered by the same pension fund increases in 2004 for all groups.

Table 4.7. Fraction of individuals switching between pension funds

Before 2004 (1999-2003)

	New pension fund				
	Control group	Civil servants	Health care	Other	Total
Old pension fund					
Control group	0.13	0.01	0.01	0.85	1.00
Civil servants	0.01	0.20	0.02	0.76	1.00
Health care	0.03	0.02	0.18	0.77	1.00

In 2004

	New pension fund				
	Control group	Civil servants	Health care	Other	Total
Old pension fund					
Control group	0.17	0.01	0.01	0.81	1.00
Civil servants	0.01	0.28	0.02	0.69	1.00
Health care	0.03	0.02	0.22	0.73	1.00

4.4.2 Correlations Between Pension Type and Job Transition Probabilities

The Social Statistical Files do not contain direct information on the type of pension scheme offered to the workers. However, we can show some interesting correlations between the type of pension scheme and the percentage of individuals that change employer using a different dataset, listing for each individual the pension scheme offered on December 31st 2005. This dataset is also available from Statistics Netherlands. Since the dataset only measures pension participation on December 31st 2005, it will not be used for analysis of the natural experiment, which took place in 2004. Merging this dataset to the Social Statistical Files makes it possible to identify the pension scheme for every individual with exactly one job on December 31st 2005, and record any job changes up to December 31st 2008. Table 4.8 shows the percentage of individuals experiencing a transition from a DB or a DC pension plan job, respectively. There is a striking positive correlation between being covered by a DC plan and the propensity to switch jobs. Table 4.8 also shows that also for DB-plans the propensity to switch jobs has a clear ranking. From highest to lowest: individuals with a non-indexed average-salary scheme, an indexed average-salary scheme or a moderated final-salary scheme, and a pure final-salary scheme. When transferability of pension rights matters, this is exactly what we would expect to see. A DC plan creates no incentive to stay with the current employer as a means to retain pension rights, whereas the loss of pension rights inherent in a DB-final-salary plan keeps employees from switching jobs. However, the found correlation can not be interpreted as a causal effect of intransferable pension rights, as it might be that sectors with a high job turnover are more likely to offer a DC pension plan.

4.5 Estimation Results

In this Section we will test the hypotheses laid down in the theory in Section 4.3. All hypothesis are tested using (multinomial) logit regressions. In these models, the yearly probability to switch to another job is given as:

Table 4.8. Percentage that switch jobs by type of pension scheme

	2006	2007	2008
% switching from Defined Benefit, Defined Contribution			
Defined Contribution	12.6	13.4	9.0
Defined Benefit	7.5	10.0	6.1
% switching from Final Salary, Average Salary			
Non-indexed Average Salary	13.8	15.0	9.4
Indexed Average Salary	7.8	11.2	6.7
Moderated Final Salary	8.5	10.5	5.9
Pure Final Salary	5.3	8.3	6.4

$$\text{Prob}(Y_i = j) = \frac{e^{\beta_j' x_i}}{\sum_{k=0}^{K} e^{\beta_k' x_j}} \tag{4.13}$$

Here, β_0 is normalized to 0 and $K = 1$ in the logit models. In the multinomial logits, $K = 2$ or $K = 3$. First, when a change in pension rules is truly driving the job decision of individuals, we would expect that especially the number of transitions to a sector outside the domain of the old pension fund is increased at the time of the policy change. In the first multinomial logit model below, we therefore identify two exit states ($K = 2$): (1) a switch to a job covered by the same pension fund and (2) a switch to a job covered by a different pension fund. Second, we would expect that especially the number of transitions for career-making individuals increased at the time of the policy change. In the second multinomial logit model below, we therefore identify four different states ($K = 3$): (1) no switch and promotion, (2) no switch and demotion (3) switch and promotion ($S_n^* > S_n$) and (4) switch and demotion ($S_n^* < S_n$). As regressors we include a dummy for being female, married or widowed (as opposed to being single), having a child in the household and having a young child in the household (<12 years old). We also include the unemployment rate per year, a dummy for the treated pension fund, a dummy for the year 2004, and an interaction of the unemployment rate with a dummy for the treated pension fund and an interaction of the year 2004 with a dummy for the treated pension fund. We use the years 1999-2003 as our baseline. The treatment effect is the percentage point change in the yearly fraction of job transitions for the treated and is

calculated as the coefficient on the interaction term of the dummy for the treated pension fund and the dummy for the year 2004. Standard errors are calculated using the delta method.

4.5.1 A General Increase in the Percentage of Job Switches

Using logit and multinomial models, we can test whether pension coverage by a system that induces less capital losses upon a change of jobs will lead to a higher number of job transitions: *Hypothesis 5: On aggregate, individuals are more likely to switch jobs when their current pension plan is of the DB-average-salary-form.*

Table 4.9. Baseline results - logit estimates

	PGGM-Health care			**ABP-Civil servants**		
Age	Treatment	From	To	Treatment	From	To
25-54	0.08***	1.23	1.30	0.61***	0.64	1.25
25-29	0.09	2.27	2.36	1.34***	1.21	2.55
30-34	0.04	1.37	1.41	0.78***	0.63	1.42
35-39	0.08	0.98	1.06	0.44***	0.52	0.96
40-44	0.06	0.83	0.89	0.42***	0.43	0.86
45-49	0.06	0.67	0.73	0.28***	0.43	0.71
50-54	0.07	0.48	0.55	0.26***	0.33	0.59

Average treatment effects are percentage point changes in the yearly fraction of job transitions for the treated
***, **, * indicate significance at 1%,5% and 10% level respectively

Results from the logit estimates are given in Table 4.9. The models are estimated for the full sample (first line), and separately for each five-year age group in order to account for the differences in job transition behaviour of younger and older employees. Here it is shown that for health care professionals, covered by pension fund PGGM, the percentage of job switches did change slightly in following the transition from a DB-final salary to a DB-average salary system. The effect is only significant for the full sample. Pension fund ABP for civil servants experienced a large increase in the percentage of job transitions, for all age categories. Table 4.10 shows that virtually all of these increased

Table 4.10. Baseline results - multinomial logit estimates

PGGM-Health care

	To a different pension fund			**To PGGM**		
Age	Treatment	From	To	Treatment	From	To
25-54	0.06**	0.97	1.02	0.02	0.26	0.28
25-29	0.10	1.84	1.93	0.00	0.42	0.42
30-34	0.02	1.12	1.14	0.04	0.23	0.27
35-39	0.05	0.78	0.83	0.03	0.20	0.23
40-44	0.04	0.62	0.66	0.01	0.22	0.22
45-49	0.05	0.50	0.55	-0.00	0.18	0.18
50-54	0.06*	0.33	0.39	-0.01	0.16	0.15

ABP-Civil servants

	To a different pension fund			**To ABP**		
Age	Treatment	From	To	Treatment	From	To
25-54	0.50***	0.40	0.90	0.08***	0.27	0.35
25-29	1.06***	0.96	2.02	0.27***	0.25	0.53
30-34	0.65***	0.47	1.12	0.12***	0.17	0.29
35-39	0.34***	0.33	0.68	0.05	0.23	0.28
40-44	0.32***	0.24	0.56	0.06*	0.24	0.29
45-49	0.24***	0.20	0.45	-0.02	0.29	0.26
50-54	0.23***	0.14	0.36	-0.04	0.27	0.22

Treatment effects are percentage point changes in the yearly fraction of job transitions for the treated
***, **, * indicate significance at 1%,5% and 10% level respectively

transitions are transitions to jobs not covered by the old pension fund.[16] The increase in terms of percentage points is quite small. However, the increase relative to the baseline is large: for most age groups job mobility almost doubles when going from a DB-final salary to a DB-average salary pension plan. We perform several sensitivity analyses. First we include a dummy for the year 2003, using only the years 1999-2002 as a baseline. Second, we include a dummy for the years 1999, 2000, 2001 and 2002 using only the year 2003 as a baseline. Third we included education dummies as regressors in the equations. Fourth,

[16]For individuals aged 25-29 and 30-34 we also see that transitions between employers that both offer an ABP pension almost doubled.

we included random effects in the logit estimation. In all alternative specifications, the significance of the estimates remains. Moreover, there is no sign of differential treatment effects for males versus females, high versus low educated, or those working fulltime or parttime. When estimating differential treatment effects for various subsectors of civil servants (primary education, secondary education, public administration etc.), all subsectors show significantly positive results. For subsectors health care centers and outpatient clinics, treatment effects are (significantly) negative. Those working in health care centers are typically GP's and other medical specialists in primary care. GP's and many other specialists in primary care are not covered by PGGM and therefore not affected by the policy change.

4.5.2 Differential Effects for Those Experiencing Promotion, Demotion, $w > r$ or $w < r$

Because the effects of a policy change that constitutes a switch from a final-salary to an average-salary system are predicted to be heterogeneous, we continue by estimating a multinomial logit model with as states: (1) no switch and promotion, (2) no switch and demotion (3) switch and promotion ($S_n^* > S_n$) and (4) switch and demotion ($S_n^* < S_n$).

Hypotheses 3 and 4: Job switches (to an employer with a different pension fund) with individuals experiencing a promotion are more likely to occur when their current pension plan is of the DB-average-salary form. Job switches (to an employer with the same pension fund) with individuals experiencing a demotion are more likely to occur when their current pension plan is of the DB-average-salary form.

In the data, an individual is considered to make a promotion when the real daily wage in the new job in period t is higher than the real daily wage in the old job in period t-1. For those years in which the individual does not switch jobs, an individual is considered to make a promotion when the real daily wage in the old job in period t is higher than the real daily wage in the old job in period t-1. Because we use information from period t-1 in the estimation and our data run from 1999-2005, job switches in the year 1999 are not included in these estimations.

Another source of heterogeneity in effects may be important. Those with high expected

wage rises are expected to switch jobs more easily, whereas for those with low expected wage rises the percentage of job switches should decrease:

Hypotheses 1 and 2: Individuals with high expected wage increases ($w > r$) are more likely to switch jobs, whereas those with low expected wage increases ($w < r$) are less likely to switch jobs when their current pension plan is of the DB-average-salary form.

Since we use administrative data, expected wage increases are not observed. We use the actual wage increase in the new job as a proxy for the expected wage increase. For those years in which the individual switches jobs, wage growth w is determined by taking the real daily wage in year t and t+1 in the new job and calculating wage growth. Whenever this number is higher than r (0.3%) the individual is considered to have a high expected wage increase ($w > r$). For those years in which the individual does not switch jobs, wage growth w is determined by taking the real daily wage in year t and year t+1 in the old job and calculating wage growth.

There is potentially a correlation between future wage rises in the new job ($w > r$) with the experience of promotion or demotion at the moment the transition is made. We therefore include extra interactions in the model and test hypothesis 1, 2, 3 and 4 simultaneously. The extra regressors we include are: (1) an indicator when $w > r$ (2) an interaction of the indicator $w > r$ with a dummy for the treated pension fund (3) an interaction of the indicator $w > r$ with a dummy for the year 2004 and (4) an interaction of the indicator $w > r$ with a dummy for the treated pension fund and the year 2004.

It is likely that those with high (expected) wage increases are more prone to switch jobs, even in the absence of any pension rule changes. However, there is no reason to believe that this selection effect is especially strong for individuals working at ABP/PGGM in the year 2004, and not in other years or for those working in other sectors. In other words, our dif-in-dif framework controls for a possible positive correlation between (expected) wage increases and switching probability (assuming a common trend on a possible selection effect as well).

Wage growth is not observed for all individuals. In fact, almost all individuals for whom wage growth is observed either do not change jobs or change to a job with a different pension fund. The estimation results in Table 4.11 and Table 4.12 should therefore be

interpreted as the effect of a switch from a DB-final-salary to DB-average-salary pension scheme on the propensity to switch to a job which is covered by a different pension fund. Hypothesis 4 (higher propensity to switch to a job covered by same pension fund for those experiencing a demotion) is therefore not tested in these estimations. We expect the propensity to switch to a job covered by another pension fund either not to change for those who experience a demotion, or to decrease since more individuals will opt for a new job covered by the same pension fund. However, both for civil servants (Table 4.12) and health care professionals (Table 4.11) the number of switches to a different pension fund for those experiencing demotion actually increases. Moreover, the number of health care professionals experiencing a promotion decreases, whereas for civil servants there seems to be a rise in the number of switches with promotion matching the number of switches with demotion. These results are not in line with hypothesis 3. For both civil servants and health care professionals, hypotheses 1 and 2 are also not confirmed by the estimation results. For health care professionals, the difference in propensity to switch jobs seems much more driven by making either a promotion or demotion, than with actual wage increase in the new job. For civil servants, the relative change from the baseline percentage of switches is about the same for those who have $w > r$ and for those who have $w < r$. The increase in the number of job switches by civil servants and health care professionals in 2004 can therefore not be explained by the financial incentives caused by the change in pension rules. In principle, the fact that we observe an increase not only in the number of promotions but also in the number of demotions could be driven by general equilibrium effects of the lower costs of turnover embedded in the DB-salary system. First, lower transaction costs puts downward pressure on the reservation wage (van den Berg, 1992) thereby decreasing accepted wages of civil servants and health care professionals. Second, lower transaction costs may induce employers of civil servants and health care professionals to pay a higher wage in order to retain their most valuable workers, who therefore are not observed to switch jobs. Indeed, the multinomial logit estimates show an increase in the number of promotions without a switch for civil servants, but not for health care professionals in 2004.[17] However, possible second order general equilibrium

[17] The percentage of civil servants who do not switch jobs and receive a promotion increases from 15%

effects of the policy change are not likely to be quantitatively more important than the first order effect of decreasing transaction costs for individual workers.

4.5.3 The Extent of Heterogeneity in Treatment Effects

In order to show the extent of the heterogeneity in treatment, and to provide a range to the estimated treatment effect, we incorporate unobserved heterogeneity using random coefficient logit models. These models include a (standard) random effect on the constant, and a random effect on the treatment. These models did not converge on most of the specified samples. Since most models did not converge, we cannot quantify the exact range of treatment effects. Table 4.11 and Table 4.12 show that there is substantial heterogeneity in observed treatment effects, however.

4.6 Conclusions

This paper studies the effect of financial incentives embedded in the pension system on job mobility. A career-making individual with a high expected future wage increase who is employed on a job offering a (backloaded) DB-final salary pension scheme will suffer a loss in pension wealth when switching jobs, even when the new job offers an equally favourable DB-final salary pension. This loss occurs especially when pension rights cannot be transferred to the new job. On the other hand, an individual with a low expected wage increase will gain pension wealth when transferring to a job offering a DB-average salary pension. When the current job offers a DB-average salary pension scheme, pension wealth will not be affected from a transfer to a job which offers an equally favourable DB-average salary scheme. On average, one would expect that (backloaded) DB-final salary pensions can lock an individual in his job, thereby decreasing job mobility. Indeed, this study shows that Dutch employees who are covered by a DB-average salary plan are much more likely to switch jobs than individuals covered by a DB-final salary plan. Other studies already showed that employees with jobs that do have pension coverage are less likely to switch jobs than employees with jobs without pension coverage. However, these studies

to 20% according to the multinomial logit estimates. This increase is solely driven by the individuals for whom $w > r$. Results available from the author on request.

Table 4.11. Heterogeneous treatment effects - multinomial logit estimates for PGGM - health care

Promotion

	Average effect for all			**Average effect for those with w<r**			**Average effect for those with w>r**		
Age	Treatment	From	To	Treatment	From	To	Treatment	From	To
25-54	-0.02	0.20	0.18	-0.00	0.05	0.05	-0.03	0.27	0.23
25-29	-0.07	0.44	0.37	0.05	0.08	0.13	-0.11	0.57	0.46
30-34	-0.03	0.23	0.20	0.01	0.05	0.06	-0.04	0.30	0.26
35-39	-0.00	0.15	0.15	-0.01	0.04	0.03	0.00	0.20	0.20
40-44	-0.00	0.11	0.11	0.01	0.03	0.04	-0.01	0.15	0.14
45-49	-0.03	0.12	0.09	-0.03	0.06	0.02	-0.03	0.15	0.13
50-54	0.00	0.06	0.06	-0.02	0.03	0.01	0.02	0.07	0.09

Demotion

	Average effect for all			**Average effect for those with w<r**			**Average effect for those with w>r**		
Age	Treatment	From	To	Treatment	From	To	Treatment	From	To
25-54	0.13***	0.40	0.52	0.42***	0.60	1.02	0.06***	0.09	0.14
25-29	0.29*	0.82	1.11	1.12***	1.63	2.75	0.05	0.23	0.28
30-34	0.12	0.51	0.63	0.43***	0.87	1.30	0.04	0.12	0.16
35-39	0.09	0.32	0.41	0.32***	0.21	0.73	0.06***	0.06	0.12
40-44	0.08	0.22	0.30	0.25***	0.31	0.56	0.04***	0.04	0.08
45-49	0.07	0.20	0.27	0.24	0.25	0.49	0.04	0.04	0.08
50-54	0.05	0.12	0.17	0.11**	0.16	0.27	0.03***	0.02	0.06

Treatment effects are percentage point changes in the yearly fraction of job transitions for the treated.

***, **, * indicate significance at 1%,5% and 10% level respectively.

Table 4.12. Heterogeneous treatment effects - multinomial logit estimates for ABP - civil servants

Promotion

	Average effect for all			**Average effect for those with w<r**			**Average effect for those with w>r**		
Age	Treatment	From	To	Treatment	From	To	Treatment	From	To
25-54	0.12***	0.10	0.22	0.03***	0.02	0.05	0.14***	0.12	0.27
25-29	0.32***	0.27	0.51	0.10**	0.03	0.14	0.38***	0.33	0.71
30-34	0.17***	0.14	0.31	0.02	0.02	0.03	0.22***	0.17	0.39
35-39	0.08***	0.09	0.17	0.04*	0.03	0.06	0.09***	0.11	0.20
40-44	0.08	0.05	0.13	0.01	0.01	0.02	0.10	0.07	0.17
45-49	0.04**	0.05	0.09	0.01	0.02	0.03	0.05***	0.05	0.10
50-54	0.04*	0.03	0.07	0.03	0.01	0.04	0.05*	0.03	0.08

Demotion

	Average effect for all			**Average effect for those with w<r**			**Average effect for those with w>r**		
Age	Treatment	From	To	Treatment	From	To	Treatment	From	To
25-54	0.14***	0.11	0.25	0.38***	0.34	0.72	0.07***	0.04	0.11
25-29	0.29***	0.22	0.51	0.79***	0.64	1.43	0.16***	0.10	0.26
30-34	0.19	0.15	0.34	0.44	0.42	0.86	0.11	0.06	0.17
35-39	0.07	0.12	0.19	0.17*	0.35	0.52	0.04	0.05	0.09
40-44	0.09***	0.07	0.16	0.26***	0.22	0.48	0.04***	0.02	0.06
45-49	0.09***	0.05	0.14	0.30***	0.18	0.48	0.03***	0.02	0.05
50-54	0.07**	0.03	0.10	0.23**	0.11	0.35	0.02**	0.01	0.03

Treatment effects are percentage point changes in the yearly fraction of job transitions for the treated.

***, **, * indicate significance at 1%,5% and 10% level respectively.

were not able to identify a causal effect from having a backloaded pension plan on a lower propensity to switch jobs. An alternative explanation is that less switch-prone individuals self-select into jobs with a pension plan, or that jobs offering a pension plan are simply more attractive than other jobs.

This paper makes use of a natural experiment to examine effects of potential capital losses and general attractiveness of pension schemes on employees' propensity to change jobs. On January 1st 2004, the two largest pension funds in the Netherlands, for civil servants and for the health care sector, changed their pension scheme from DB-final salary to DB-average salary. The two pension schemes were effectively offered to the same indiviuals, such that our results cannot be driven by any self-selection of individuals into jobs with an attractive pension scheme. The empirical results show that the onset of the DB-average salary pension scheme in 2004 coincided with an increase in the propensity to change jobs. Specifically, the percentage of yearly job switches increases with 0.08 percentage points for employees working in the health care sector (i.e. from 1.23% to 1.30%). The percentage of yearly job switches increases with 0.61 percentage points for employees working as civil servants (i.e. from 0.64% to 1.25%). However, the estimates for both civil servants and health care professionals are not in line with the hypotheses that job mobility should especially increase for career-making employees who made a promotion at the time of the switch, and for those with a high subsequent wage growth in the new job. Observed behaviour is therefore not in agreement with the theoretical incentives in the pension system. Our results can be interpreted in two ways. First, it can be that individual workers do react on a major change in their pension system, but do not pay much attention to the details of their pension scheme. Second, it can be that individual workers are interested in their pension scheme, but have a hard time understanding the impact of rules and regulations embedded in the pension system on their (future) income.

Chapter 5

Summary

This thesis examines various ways in which labour market institutions can influence the willingness of an individual to accept a(nother) job offer. The first and second essay consider unemployed individuals and their search for jobs, whereas the third essays considers the job transition decision of employees. All essays are mainly empirical in nature, although the first essay also contributes to the theoretical literature on search models.

The first essay studies the effect of wealth on reservation wages and search effort of unemployed individuals. Intuitively, when an individual with high wealth holdings becomes unemployed, he can use his assets as an addition to his income until a good job offer arrives. For a wealthy individual it is therefore less urgent to put a lot of costly effort into the search for a new job. Moreover, when a job offer is made an individual with high wealth holdings can decide to decline the offer until a more attractive job offer arrives. Indeed, the theoretical model in this essay predicts wealth to influence reservation wages positively and search effort negatively. The theoretical results are empirically tested by estimating reduced form equations for reservation wages and search intensity using Dutch survey data. The main results show that wealth has a significantly positive effect on reservation wages. In particular, a 100% increase in wealth at the mean of the wealth distribution raises the reservation wage by 2.9% for household heads, and 3.7% for spouses. Moreover, wealth has a significantly negative impact on the search effort of household heads. At the 10th percentile of the wealth distribution household heads (spouses) on average apply for 4.95 (2.09) jobs in two months, whereas at the 90th percentile heads (spouses) on average apply for 4.33 (1.71) jobs in two months.

The second essay focuses on the effect of UI regulations on unemployment duration. Specifically, it shows how imposition of job search requirements for older unemployed increases their probability to find a job within 24 months of unemployment. The Netherlands used to exempt their older unemployed (defined as being at least 57.5 years old) from the requirement to actively search for a job in order to receive full UI benefits. This situation changed on January 1^{st} 2004. From that date, the 57.5+ year olds needed to apply for 4 jobs every 4 weeks just like all other UI benefit recipients. Three groups of individuals were affected by this policy change: (1) individuals aged 57.5+ and entering unemployment in 2004. After the policy change they needed to (formally) search for jobs or risk a cut in UI benefit payment (2) individuals aged 57.5- and entering unemployment in 2004. After the policy change they needed to continue searching even when they turned 57.5 (3) individuals aged 57.5 and over at the time they entered unemployment in 2003 needed to start searching on the 1^{st} of January 2004. The essay shows that the outflow to employment and sickness benefits increased for all three groups of individuals. The main finding is that due to the imposition of search requirements, the number of 57.5-59.5 year old males (females) that find a job in the first 24 months of unemployment increases by 6 (11) percentage points. However, this strong effect on labour market participation is accompanied by a 4 (9) percentage point increase in the number of 57.5-59.5 year old males (females) who take up sickness benefits after a maximum of 24 months in unemployment.

The last essay in this thesis makes use of a natural experiment to examine the effects of potential capital losses and general attractiveness of pension schemes on employees' willingness to accept another job. On January 1^{st} 2004, the two largest pension funds in the Netherlands, for civil servants and for the health care sector, changed their pension scheme from DB-final salary to DB-average salary. Theory predicts that a (backloaded) DB-final salary pension scheme can keep individuals locked in their job, since they will suffer a loss in pension wealth when switching to another job. The potential loss in pension wealth is increasing in the (expected) future salary increases of the individual. The main empirical results indeed show that the onset of the DB-average salary pension scheme in 2004 coincided with an increase in the percentage of yearly job switches of 0.08 (0.61) percentage points for employees working as health professionals (civil servants).

However, the estimates could not confirm that job mobility especially increased for career-making employees who made a promotion at the time of the switch, and for those with a high subsequent wage growth in the new job. Observed behaviour can therefore not be explained by the theoretical incentives embedded in the pension system. Our results can be interpreted in two ways. First, it can be that individual workers do react on a major change in their pension system, but do not pay much attention to the details of their pension scheme. Second, it can be that individual workers are interested in their pension scheme, but have a hard time understanding the impact of rules and regulations embedded in the pension system on their (future) income.

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Samenvatting (Summary in Dutch)

Dit proefschrift onderzoekt de verschillende manieren waarop arbeidsmarktbeleid de bereidheid van een individu om een baan te accepteren kan beïnvloeden. Het eerste en tweede artikel kijkt naar het baanzoekgedrag van werkloze individuen, terwijl het derde artikel de baan naar baan mobiliteit van werknemers bestudeert. Alle drie de artikelen zijn voornamelijk empirisch van aard, hoewel het eerste artikel ook een bijdrage levert aan de theoretische literatuur omtrent zogenaamde zoekmodellen.

Het eerste artikel bestudeert het effect van vermogen op reserveringslonen (het laagst mogelijke loon waarvoor een individu bereid is een baan te accepteren) en de intensiteit waarmee werklozen op zoek gaan naar een baan. Wanneer een persoon met een hoog vermogen werkloos wordt, kan hij een deel van dat vermogen gebruiken om zijn inkomen tijdens werkloosheid aan te vullen. Voor een vermogend persoon is het daarom niet direct nodig om heel actief op zoek te gaan naar een baan zodra hij werkloos wordt. En hij kan meer kieskeurig zijn bij het accepteren van een baan en net zo lang wachten totdat hem een goede baan met dito salaris wordt aangeboden. Het theoretische model in dit artikel voorspelt daarom dat vermogen een positief effect heeft op het reserveringsloon, en een negatief effect op de intensiteit waarmee werklozen op zoek gaan naar een baan. Deze theoretische resultaten worden empirisch getest met herleide vorm vergelijkingen op gegevens uit een Nederlandse enquête. De belangrijkste resultaten laten zien dat vermogen een significant positief effect heeft op het reserveringsloon. Wanneer het vermogen toeneemt van een gemiddeld vermogen naar twee maal het gemiddelde vermogen neemt het reserveringsloon van zelfbenoemden hoofden van een huishouden toe met 2.9%. Het reserveringsloon van werklozen die geen hoofd van het huishouden zijn neemt dan zelfs toe met 3.7%. Voor hoofden van huishouden heeft vermogen ook een significant negatief

effect op hun zoekintensiteit. Op de 10e percentiel van de vermogensverdeling solliciteren hoofden van huishoudens (echtgenoten) gemiddeld 4.95 (2.09) keer per maand, terwijl op het 90e percentiel van de vermogenverdeling de hoofden van huishoudens (echtgenoten) gemiddeld 4.33 (1.71) keer per maand solliciteren.

Het tweede artikel zoomt in op het effect van regels die gelden tijdens een periode in de WW op werkloosheidsduur. Het artikel laat zien dat wanneer oudere werklozen sollicitatieplicht hebben, hun kans om binnen 24 maanden na verliezen van hun baan een nieuwe baan te vinden toeneemt. Tot 1 januari 2004 hadden Nederlandse WW'ers geen sollicitatieplicht meer vanaf het moment dat zij 57.5 jaar oud werden. Vanaf 1 januari 2004 moeten echter ook oudere werklozen iedere 4 weken 4 maal solliciteren. Er waren 3 groepen werklozen die door deze beleidsverandering geraakt werden: (1) individuen die in 2004 werkloos werden en op dat moment 57.5 of ouder waren. Zij moesten hun sollicitaties rapporteren aan het UWV of ze liepen het risico om op hun uitkering gekort te worden (2) individuen die in 2004 werkloos werden en op dat moment nog geen 57.5 waren. Zij moesten blijven solliciteren, ook wanneer zij 57.5 werden en (3) individuen die in 2003 werkloos waren geworden en op het moment dat zij werkloos werden 57.5 jaar of ouder worden. Voor hen gold ook de sollicitatieplicht vanaf 1 januari 2004. Het artikel laat zien dat voor ieder van deze 3 groepen, meer mensen een baan vonden maar ook meer mensen de Ziektewet instroomden. Het belangrijkste resultaat is dat als gevolg van de sollicitatieplicht het aantal mannen (vrouwen) tussen 57.5 en 59.5 jaar oud dat binnen 24 maanden nadat zij hun baan verloren weer een nieuwe baan vindt toeneemt met 6 (11) procentpunten. Dit sterke effect op de arbeidsdeelname van ouderen gaat echter samen met een 4 (9) procentpunt toename in het aantal 57.5 tot 59.5 oude mannen (vrouwen) die doorstromen naar de Ziektewet na maximaal 24 maanden WW.

Het laatste artikel in dit proefschrift maakt gebruik van een 'natuurlijk experiment' om te onderzoeken wat het effect is van het type pensioenregeling op de bereidheid van werknemers om een andere baan te accepteren. Op 1 januari 2004 vervingen de twee grootste pensioenfondsen van Nederland (ABP en PGGM) hun middelloonregeling door een eindloonregeling. Een theoretisch model voorspelt dat een eindloonregeling ervoor kan zorgen dat werknemers niet van baan willen wisselen, omdat ze op het moment dat ze

van baan wisselen een deel van hun (opgebouwde en/of toekomstige) pensioenvermogen inleveren. Het mogelijke verlies van pensioenvermogen is hoger wanneer een werknemer (verwacht dat hij) in de toekomst veel meer gaat verdienen. De belangrijkste empirische resultaten bevestigen dat de overgang van een middelloonregeling naar een eindloonregeling samenviel met een toename in het percentage jaarlijkse baanwisselingen met 0.08 (0.61) procentpunt voor werknemers in de gezondheidzorg (ambtenaren). De resultaten bevestigen echter niet dat het aantal baanwisselingen vooral toenam onder werknemers die op het moment van de baanwissel promotie maakten en voor werknemers die hun loon in de nieuwe baan snel zagen stijgen. Het gedrag van de werknemers kan daarom niet verklaard worden door de financiële prikkels in het pensioensysteem. Deze resultaten kunnen op twee manieren geïnterpreteerd worden. Ten eerste duiden de resultaten er mogelijk op dat werknemers wel reageren op een grootscheepse verandering van pensioenregelgeving, maar weinig aandacht hebben voor de details van hun pensioenvoorziening. Ten tweede kan het zijn dat werknemers wel aandacht hebben voor hun pensioenvoorziening, maar dat ze het lastig vinden om de impact van pensioenregelgeving op hun (toekomstige) inkomen te begrijpen.

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

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