The increase of the statutory retirement age to 67: how will it affect the labour participation in the Netherlands?

Erasmus University Rotterdam
Erasmus School of Economics
Department of Economics

Supervisor: Yvonne Adema

Author: Sanne Rosendaal
Student number: 303805
E-mail address: sanne.rosendaal@gmail.com

Abstract

This paper examines the effects of the increase of the statutory retirement age from 65 to 67 on the old-age labour participation in the Netherlands with the use of a comparative and empirical analysis. The comparative analysis is based on case studies of 15 OECD countries. The case studies investigate the pensions systems and demography in the countries and find that the statutory retirement age and life expectancy weakly affect the old-age labour participation in the age group 55-64, whereas the early and late accrual rate have a larger effect. The empirical analysis extrapolates the labour participation to find the labour participation in the age group 65-69. Two models are designed to examine the effect. The first is based on the statutory retirement age only, whereas the second controls for the effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy. It is found that the statutory retirement age only affect the labour participation in the age groups 55-64 and 65-69 when not controlled for other variables. The addition of the control variables finds that the effective retirement age and late accrual rate significantly affect the old-age labour participation rate. It is concluded that the increase of the statutory retirement age from 65 to 67 is only effective in the Netherlands when it is simultaneously increased with the late accrual rate.

Keywords: old-age labour participation, pension reforms, the Netherlands, increase statutory retirement age

Table of Contents

1. Introduction

The global economic crisis causes countries to lose the possibility to fulfil their obligations. Debts reach record breaking heights and the population's trust diminishes. In order to regain trust and repay obligations, government spending needs to be reduced. Consequently, high expenses are most likely to be cut first.

Due to the social welfare state of the Netherlands, the government's social security expenses are high. When one reaches the statutory retirement age, one is entitled to receive a social security pension and at the early retirement age, old-age workers are entitled to disability programs or unemployment insurance and have the possibility to receive an early retirement payment. The economic crisis demands measures to be taken to reduce public expenditures. Increasing the statutory retirement age is one of the measures to decrease public spending and be sustainable to the economic crisis.

Furthermore, the change in demography puts a larger pressure on the labour force to bear the cost of the retirees. The fall in the fertility rate diminishes the amount of entrants to the labour force, whereas the increased longevity causes retirees to spend more time in retirement. Further, the baby boom enters retirement in the next decade, and therefore increases the amount of retirees even further. The dependency ratio of the amount of people in retirement to the amount of people in the labour force was 25.1% in 2000 and is expected to increase to 54.7% in 2040 (CBS, 2009). The declining rate of workers in the labour force and the increasing amount of retirees causes an increase in the demand of pension social security programs, and consequently increasing the social security expenditures. An increase in the statutory retirement age is expected to decrease the amount of people in retirement and therefore decreases the public expenditures on pension social security.

In this paper the effects of the increase of the statutory retirement age on the labour participation are examined. The paper gives an answer to the research question:

What will be the effect of the increase of the statutory retirement age to 67 on the labour participation in the Netherlands?

The first chapter gives an introduction on the research question. A description of the incentives to retire provided by the literature is given in the second chapter. The third chapter provides the variables that need to be taken into account to measure the effects of the increase of the retirement age on the labour participation. Case studies of 15 OECD countries are given in the fourth chapter, whereas in the fifth chapter, the comparison of the case studies is used to examine the effects of the retirement age on the labour participation in the Netherlands. The sixth chapter provides an

empirical analysis based on the case studies. In the seventh chapter the results of the comparative and empirical analysis are discussed.

With the use of a comparative and empirical analysis of 15 OECD countries this paper finds that the increase of the statutory retirement age alone leaves the labour participation unaffected. A simultaneous increase of the late accrual rate causes the increase of the labour participation.

2. Retirement incentives

In the Netherlands the statutory retirement age is established at 65 years. At the age of 65, Dutch citizens are entitled to the Social Security pension offered by the government. The pension received by Dutch citizens is partly financed by the government in a pay-as-you-go system, where the current labour force pays for the current retirees in the form of a tax imposed on their income, and partly financed by a defined benefit system, where employers and employees save money collectively. Even though the statutory retirement age is set at 65 years, the effective retirement age in 2007 was 61.6 for male in the Netherlands (OECD, 2007). The effective retirement age is substantial below the statutory retirement age, implying that the value of work drops below the value of retirement at a point significantly below the official retirement age. When the value of work declines to a point below the value of retirement, employees choose to retire.

The incentives to retire and the value of labour move together in opposite ways. Börsch-Supan (2000) investigate the incentives to retire in Germany, and find evidence that the option value to retire has an negative influence on the retirement choice, indicating that with a high willingness and affordability to retire, employees retire earlier. In other words, a decrease in the value of labour consequently causes an increase in the value of retirement. Therefore, an incentive for an employee to retire is a disincentive to remain in the labour market. The choice between retirement and labour is comparable to the choice between leisure and income, the neoclassical microeconomic model for supply of labour, where leisure represents retirement, and income represents labour. In neoclassical economics, individuals are assumed to behave rational and maximize their utility, implying that an individual chooses that certain amount of hours in leisure and that specific amount of income that maximizes his utility. Figure 1 gives a graphical representation of the choice between leisure and labour.

Figure 1 – Choice between leisure and labour
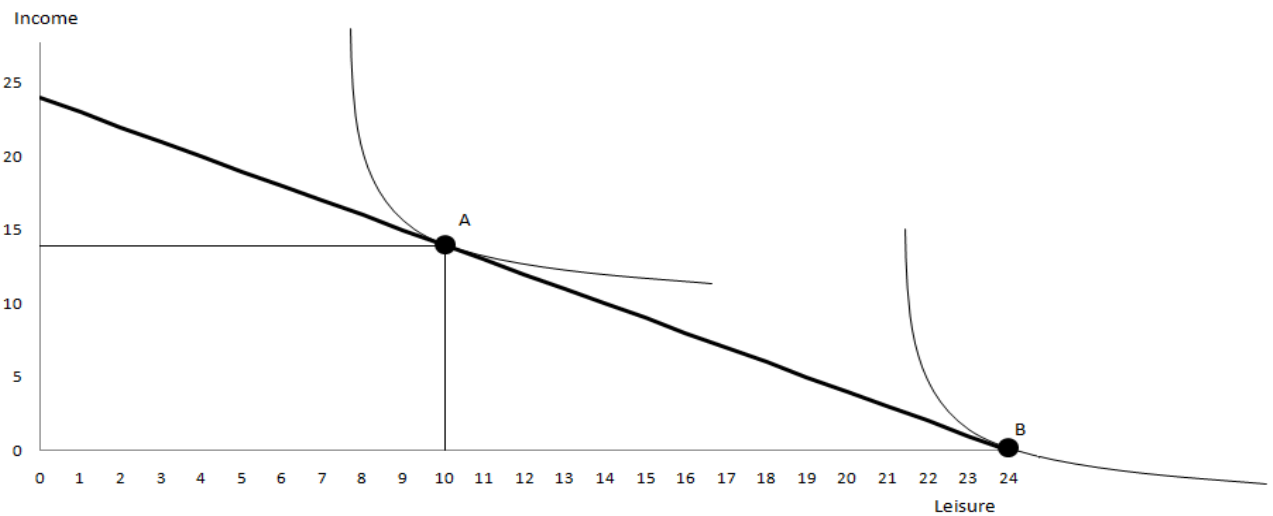
At point A, an individual chooses to enjoy 10 hours in leisure and work 14 hours. Point B is the point where an individual retires and enjoys 24 hours in leisure. Here, it is assumed that the choice between retirement and labour maximizes an individual's utility. An individual's utility depends on financial and social incentives, but is also influenced by exogenous variables, like cyclical incentives and employability. This chapter gives an answer to the question why employees remain employed, or on the contrary, retire instead.

2.1. Financial incentives

First of all, financial incentives cause retirees to enjoy retirement without causing complications to their financial situation. A financial incentive causes an employee to retire when he/she has sufficient financial resources to support him/her during retirement. Social security programs, such as disability insurance, unemployment insurance and private early retirement allowances in the Netherlands, stimulate employees to retire early. During the 1980s and 1990s these programs increasingly encouraged employees to retire before the statutory age. Restricted eligibility for the public programs for disability and unemployment, decreased the amount of people counting on these securities, but the effective retirement age remains underneath the statutory age. Therefore, it is assumed that the old-age pension system influence the retirement decision.

2.1.1. Old-age pension system

Blöndal and Scarpetta (1999) argue that the incentives to retire are embedded in the old-age pension system. They find that the standard age of retirement, pension replacement rate, pension accrual rate and implicit tax on continuous work are factors that are taken into account when assessing the effect of the old-age pension system on the labour participation.

First of all, when looking at the age at which male retire, an immediate decline is shown after the standard retirement age. Thus, by setting an entitlement age, people work upon the age of eligibility and retire immediately after the retirement age. Blöndal and Scarpetta (1999) find a peak at the ages at which employees are eligible to retire in different OECD countries. Figure 2 gives the probability of retirement at different ages. It shows a peak at the age of 65, which is the statutory retirement age in most of the countries in the figure.

Figure 2 – Probability of retirement at different ages
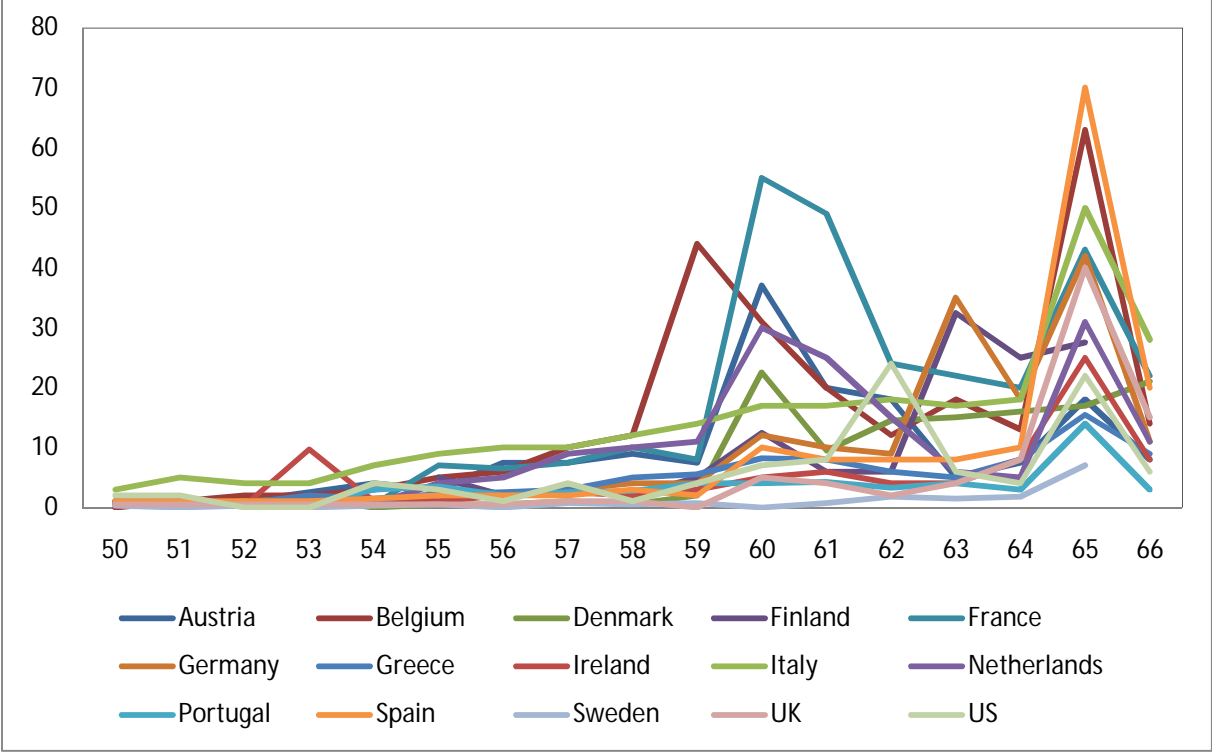
Source: Blöndal and Scarpetta (1999)

Furthermore, based on the Health and Retirement Study (US), Brown (2006) states that workers retire at the age they assume as the usual age to retire. The usual retirement age is often equal to the statutory retirement age. The survey finds that 30% of the respondents retire at the age of 65 and 20% retires at the age of 62, whereas 35% of the respondents reject that they retire at the age they assume to be the retirement age. In contradition to Blöndal and Scarpetta (1999), who find that a peak in retirement exist at the statutory retirement age, Brown (2006) only finds that 50% of the workers retire at the early retirement age or at the standard retirement age. Further empirical research done by Duval (2003) gives evidence that the statutory retirement age has an increasing effect on the retirement decision in the age group 60-64 and 65+.

Additionally, employees wishing to retire at the age of 62 in the USA have the possibility to retire against reduced social security benefits upon early retirement by means of a retirement earnings test. However, Gustman and Steinmeier (2004) show that the abolishment of the retirement earnings test increases the labour participation, but increases the social security retirement benefits to a larger extent. To offset the costs of higher social security benefits, the early retirement age should increase, they claim.

Sap et al. (2009), on the other hand, claim that the social security pension benefit should be independent of an official retirement age, but instead it should depend on years of contribution. They claim that a labour-dependent social security improves the labour participation. In research done by the Centraal Plan Bureau, Streefkerk (2009) finds that labour-dependent social security is twice as effective as the increase in the eligible retirement age by two years.

Secondly, the pension replacement rate influences the labour participation. The pension replacement rate is the rate of income during retirement to income throughout employment. When the pension replacement rate is high, retirement is more attractive. A replacement rate above 100% indicates that the income received in retirement is higher than the income received throughout working life. Nevertheless, replacement rates barely exceed 100%. Increasing replacement rates shows that the living standards of retirement improve and hence, a higher opportunity cost for work develops.

Over the last decades the replacement rate fluctuated among the OECD countries. In the Netherlands the replacement rate, based on the public pensions for an average person, increased from 32.2% in 1961 to 45.8% in 1995, whereas the replacement rate in Austria remained 79.5% since 1961. Table 1 gives an overview of the pension replacement rates in OECD countries over the period 1961-1995.

Table 1 - Gross replacement rates over 1961-1995 (per cent)

|	*1961*	*1975*	*1995*
Australia	19.1	32.8	40.9
Austria	79.5	79.5	79.5
Belgium	72.6	70.5	67.5
Canada	31.3	45.1	51.6
Czech Republic			53.2
Denmark	35.9	42.3	56.2
Finland	34.9	58.6	60.0
France	50.0	62.5	64.8
Germany	60.2	59.6	55.0
Greece			120.0
Hungary			54.6
Iceland			93.0
Ireland	38.6	28.9	39.7
Italy	60.0	62.0	80.0
Japan	24.6	54.1	52.1
Luxembourg			93.2
Netherlands	32.2	48.0	45.8
New Zealand	32.0	43.0	61.3
Norway	25.3	61.2	60.0
Poland			53.7
Portugal	85.0	77.0	82.6
Spain		50.0	100.0
Sweden	53.8	77.1	74.4
Switzerland	28.4	51.7	49.3
United Kingdom	33.4	33.8	49.8
United States	39.1	49.1	56.0
Average	44.0	54.6	59.3

Source: Blondal, Scarpetta (1999)

Empirical research on the participation rate of males in the age 55-64 done by Blöndal and Scarpetta (1999), finds evidence that there is a positive relationship between the pension replacement rate and retirement. An increase of 10 percentage points of the pension replacement rate increases the participation rate by 0.5 percentage points.

Thirdly, Blöndal and Scarpetta (1999) also find evidence for the claim that the pension accrual rate influences the labour market participation rate. The pension accrual rate is the rate at which pensions are adjusted upon early and/or late retirement. A low or zero pension accrual rate indicates that by working an additional year, additional contributions are paid, but there is no adjustment for the pension benefits received upon retirement; an implicit tax is paid on working. An additional year of work with a low or zero accrual rate gives employees a disincentive to continue working, as

pension benefits are not adjusted. Blöndal and Scarpetta (1999) find evidence that an increase of the pension accrual rate by 10 percentage points, gives an increase in the participation of male of 1.3 to 2.5 percentage points.

In the United States continuous work after the statutory retirement age provides workers with a Delayed Retirement Credit. The Delayed Retirement Credit is a means to increase the amount of old-age labour supply. Pingle (2006) finds evidence that the Delayed Retirement Credit increases the employability of old-age workers. Figure 3 shows that the employment rate among male aged 65-69 simultaneously increases with the Delayed Retirement Credit.

Figure 3- Employment rate among males 64-69 and Delayed Retirement Credit
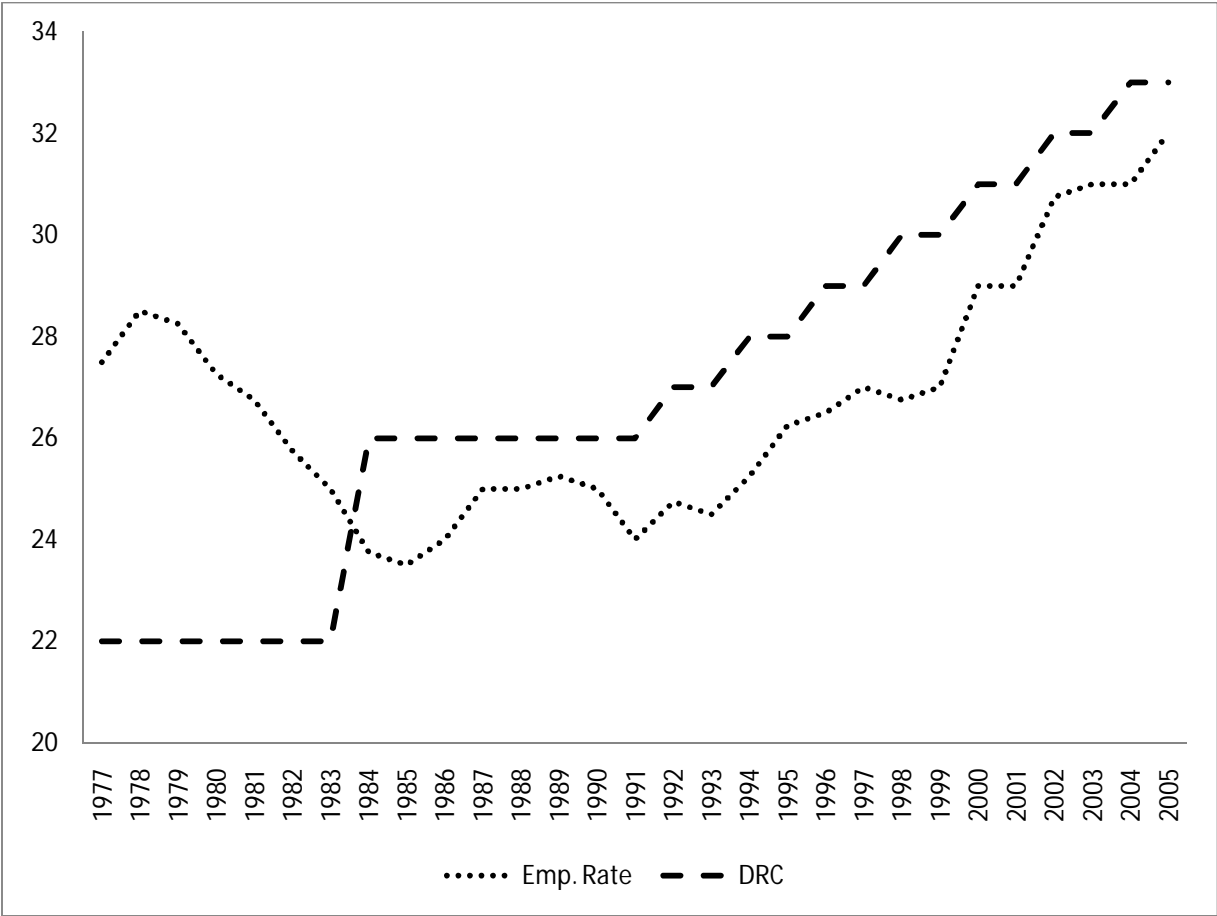
Gustman and Steinmeier (1985) measure the effects of the Social Security Reforms of the USA in 1983 on the long-run labour supply. Two explanatory variables have significant effects. The increase of the retirement age and the increase of the Delayed Retirement Credit both have a significant effect on the postponement of retirement.

Blöndal and Scarpetta (1997) argue that prior to the statutory retirement age employees have work incentives; by retiring before the early retirement age they are not eligible to an early retirement allowance. By deferring retirement, employees remain contributing to their pension allowance, but if the pension benefit is not adjusted with an accrual rate, retirees do not receive additional pension benefits upon later retirement. The part that is foregone due to later retirement is explained as the implicit tax on continuous work. Figure 4 (Blöndal and Scarpetta, 1997) shows the relation between the implicit tax rates on continued work and average effective retirement age for males in the age 55-64. A negative correlation exist between the implicit tax rate on continued work and average age of retirement, implying that with more foregone pension benefits (high implicit tax), employees retire earlier.

Figure 4 - Implicit tax rate on working and effective retirement age of male in 1995
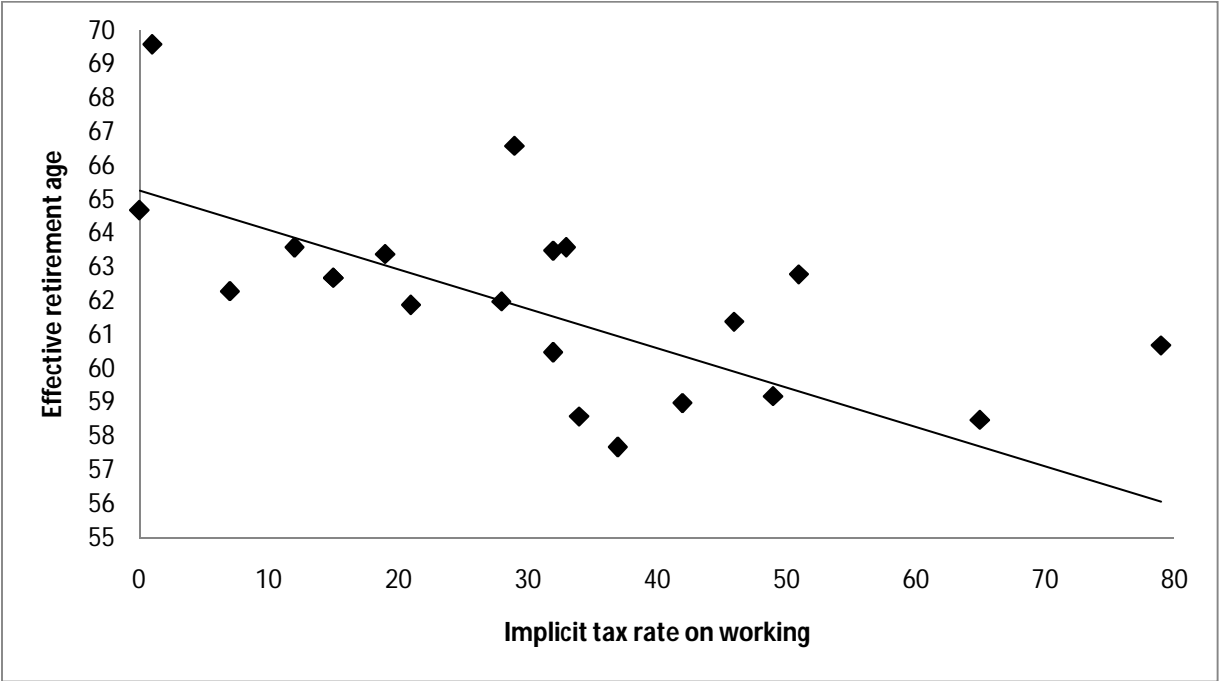
Source: Blöndal and Scarpetta (1997)

In a research done in 14 OECD countries, Duval (2003) finds additional empirical evidence to Blöndal and Scarpetta (1997) that the implicit tax on continuous work encourages retirement. Duval finds a significant effect in the age groups 55-59, 60-64 and 65+, where Blöndal and Scarpetta (1997) only find evidence for the age group 55-64. Gruber and Wise (1998) use the sum of the implicit tax rates on continued work from the age 55 to 69 to verify that a relationship between the implicit tax rate and the retirement age exists.

2.1.2. Option value of leisure

Although a high implicit tax on work creates incentives to retire, a higher value of leisure also increases the demand for retirement. A simulation by Euwals et al. (2005) shows the reform of the pay-as-you-go unfunded early pension system to an actuarial neutral pension system by studying the reform established in the pension fund for civil servants (ABP) in 1997 in the Netherlands. In the reform Euwals et al. (2005) find that a price effect on leisure exists. Upon early retirement the pension benefits is actuarially adjusted, implying that a price is paid for the early access to leisure, whereas in the old system without the actuarially adjustment, the price for leisure was zero. Therefore, early retirement is less attractive when a price is paid for leisure and later retirement becomes more attractive as a higher reward is received upon retirement.

Lumsdaine and Mitchell (1999) find that older people have strong preferences for leisure, and therefore pension reforms need to emphasize the increase in employability in such a way that people value work higher than leisure and consequently remain working. The increase in benefit when continuing work increases the participation rate of old-age workers when the benefit is higher than the value of leisure.

2.1.3. Wealth incentive

Besides the price effect of leisure, the reform examined by Euwals et al. (2005) embeds a wealth effect, implying that in an actuarially fair system early retirement is more expensive, and consequently retirement is deferred. The simulation finds evidence that the reform increases the average retirement age by at least 4 months. When the retirement wealth is decreased by the amount of a year's salary, retirement is postponed by 1.5 to 2 months. Berkel and Börsch-Supan (2003) find significant evidence for the effect of wealth on the retirement decision in Germany. An increase in wealth subsequently causes employees to retire earlier. Additionally, Field and Mitchell (1984) find that employees with a higher base wealth decide to retire earlier, whereas employees, who expect to gain more by retiring later, extend retirement.

2.2. Cyclical incentives

Furthermore, fluctuations in the economic situation tend to influence the retirement decisions of employees. During economic growth, employees are expected to be wealthier, and hence retire earlier, whereas in an economic downturn more unemployment occurs, making it unaffordable to retire early. On the other hand, economic turmoil causes employers to fire old employees to replace them by young, and therefore forces old-age workers to retire early. As it is hard to measure in which extent the effects counterbalance, it is concluded that redundancy in labour supply causes unemployment.

Blöndal and Scarpetta (1999), and Auer and Fortuny (2000) use the European Labour Force Survey of 1995 to determine the incentives to retire in the European Union in 1995. They found that in Denmark, Finland, Sweden and the United Kingdom, one out of four people decides to retire due to redundancy in the labour supply. The effects of redundancy in labour supply on the participation rate are less substantial in other European Union countries.

On the other hand, in Spain the termination of a contract is the reason to retire in 11.1% of the retirement decisions. Nevertheless, in other countries this effect is even smaller.

According to the literature, cyclical incentives do not show to have a significant effect on the participation rate

2.3. Social incentives

Whereas financial incentives control the affordability to retire and cyclical incentives force people into retirement, social incentives are a combination of influences from the environment and individual restrictions. First of all, health affects the retirement decision of older workers. The deterioration of health makes it impossible for disabled employees to maintain the same workload and forces them to retire. In his empirical research, Börsch-Supan (2000) finds evidence that a negative relation exists between the health status and retirement in Germany, implying that health deterioration increases retirement. Auer and Fortuny (2000) examined The European Labour Force Survey of 1995 and find that health deterioration gives an incentive to retire in Finland, Germany, Spain and the United Kingdom in one out of five retirement decisions. Additionally, Berkel and Börsch-Supan (2003) finds evidence in Germany that healthier workers retire later.

Besides health deterioration, discouragement of re-entering the labour market also causes early retirement. Even if the employee is still physically able to work, it could be mentally impossible to take on a job. Once replaced, an employee could face difficulties by returning to the labour market and gets discouraged and enters retirement at an early stage. Furthermore, the competition of younger workers in the labour force discourages older workers to re-enter the labour force, as younger workers have a higher possibility to be offered a job than older workers. The expectation of unemployment diminishes labour participation according to empirical research done by Duval (2003).

Furthermore, employees with a high pleasure of working are found to retire later. The Household Survey executed in the Netherlands by De Nederlandse Bank (2008) finds that 50% of the people have the intention to retire before the age of 65, whereas 40% intend to remain working after the age of 65. Next to financial incentives, the reason for employees to extend retirement was the pleasure of working.

Moreover, people tend to follow peer behaviour, hence it is expected that the trend of early retirement forces employees to retire, due to peer pressure. However, the literature does not find evidence to prove a relation between peer behaviour and retirement decisions.

Finally, when a relative needs care, older employees have a higher tendency to take care of the relative and therefore leave the labour market at an earlier stage. Auer and Fortuny (2000) find in the European Labour Force Survey of 1995 that in some cases caring for a relative is a reason for retirement, but this only happens occasionally and therefore it is no significant reason for retirement.

2.4. Employability incentives

Next to the financial, cyclical and social incentives, the possibility of employment is embedded in the employability incentives. One of the reasons why employers choose young workers above older workers is the up-to-date knowledge that young workers possess. In order to increase the employability among old-age workers, investment in human capital is essential. Martins et al. (2005) finds that the investment in human capital is important due to three reasons. First of all, the ratio of average education of workers aged 55-64 to the average education of the population aged 55-64 is above one in all cases, except for Korea and Turkey. Figure 5 gives the relative level of education in the age group 55-64. A ratio above one implies that higher educated workers remain working and lower educated workers increasingly leave the labour force.
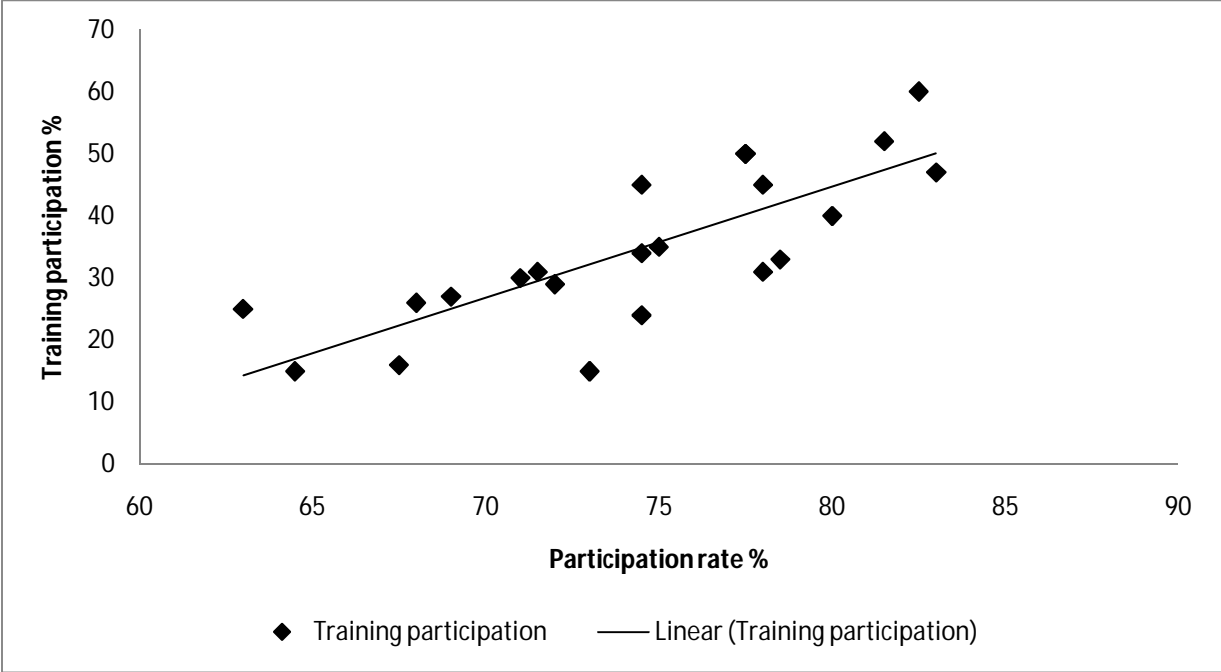
Figure 5- Relative level of education workers 55-64
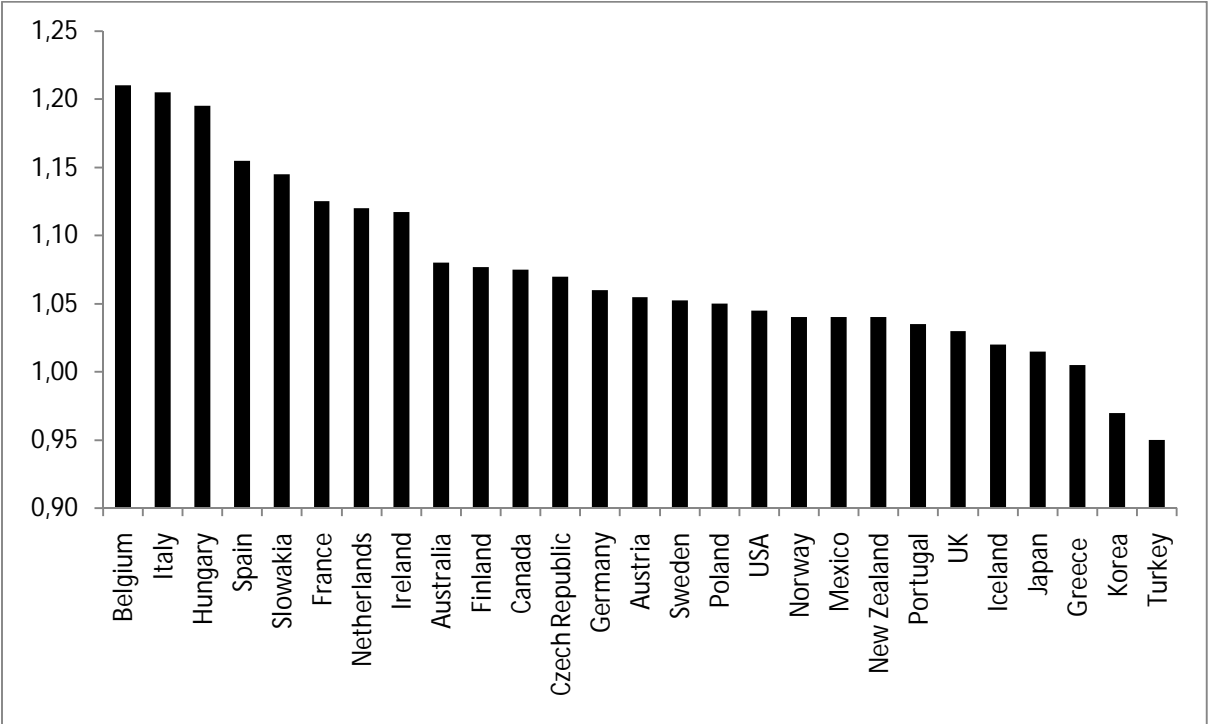
Source: Martins et al. (2005)

Secondly, Martins et al. (2005) finds that trained workers have a higher participation rate in the labour market. Figure 6 shows a positive correlation between the participation rate and training participation.

Figure 6 - Participation rate to training participation (per cent)

Source: Martins et al. (2005)

Thirdly, Martins et al. (2005) assume that higher skills and education have a positive effect on the chance to maintain your job. Empirical research done by Farber et al. (1997) in the United States over 1981-1995 finds that higher education indicates less risk in losing your job.

2.5. Conclusion

The incentives described above show that many incentives are taken into account when examining which factors influence the retirement decision. Financial incentives represent the affordability to retire, whereas cyclical incentives forces employees into retirement. Social incentives are a combination of individual restrictions and the social environment, whereas employability incentives provide us with evidence that investment in human capital is important to remain employed. The literature tells us that the financial incentives are the most significant factors in estimating the effects on labour participation.

3. Data

The retirement incentives given in the previous chapter indicate that the financial incentives significantly affect the labour participation. As most financial incentives are embedded in the pension

system, pension systems are an important indicator when assessing labour participation. Pension systems differ across counties. However, demography also differs across countries. Therefore, when examining the effect of the increase of the statutory retirement age on the labour participation rate, both demography and pension systems should be taken into account.

3.1. Pension systems
3.1.1. Tiers

Different OECD countries have different approaches to pension systems. Nevertheless, the purpose of a pension system is universal. Pension systems provide the retiree with a benefit upon retirement. According to the OECD (2007) pensions systems in OECD can be divided in three tiers. The first tier is the redistributive tier, and provides retirees with a minimum amount of retirement benefit. The second tier is the insurance tier and insures you with a certain standard of living. The third tier is a supplementary voluntary provision.

In every OECD country retirees are entitled to the first tier in a pension system. The first tier provides retirees with a sufficient standard of living and is publicly collected. OECD (2007) mentions three types of systems. The basic type provides every retiree with the same amount or it provides you with an amount based on the years of employment. The second type is resource-tested, meaning that increased benefits are provided to poorer retires, while lower benefits are provided to wealthier retirees, where wealth is measured in accumulated pension benefits and income from other resources or by accumulated income and assets. The third type provides poorer retirees with a minimum income, based on benefits received from pension income. Unlike the resource-tested type, where wealth is based on all sorts of incomes, the minimum type is only based on pension income.

In contradiction to the first tier, the second tier is collected both publicly and privately. It is collected by employers and employees and can be collected in three ways. First of all, a defined benefit system provides employees with a defined benefit upon retirement by means of an employee's contribution throughout its working life. The allowance is either funded or unfunded. In a defined contribution system, on the other hand, a predefined contribution entitles the employee with an undefined benefit upon retirement. The employee or the employer invests the defined contributions throughout the employee's working life and upon retirement these contributions plus the earned interest are provided to the retiree. The third system is called a notional defined contribution system and is based on a defined contribution system, but the additional returns obtained are determined by a formula set by the government, based on the life expectancy, instead of returns from investments in the market. Upon retirement the retiree receives the contributions made in the notional account, plus the amount determined by the life expectancy rate.

Whereas the first tier is publicly provided and the second tier is both publicly and privately provided, the third tier is only provided privately. The third tier is on voluntary basis and is provided individually. Additional to the minimum and a certain standard of living, the voluntary provision provides retirees with the additional benefits permitted and requested by an individual. The third tier is not regulated by the government and is therefore not represented in the case study. Table 2 provides an overview of the different pension systems in the 15 OECD countries in the comparison.

Table 2 - Pension systems

	Pension system - first tier	Pension system - second tier
Austria	RT	Public DB
Denmark	RT + Basic	Private DC
Finland	Minimum	Public DB
France	RT + minimum	DB + points
Germany	RT	Points
Iceland	RT + Basic	Private DB
Italy	RT	Public NDC
Japan	Basic	Public DB
Netherlands	Basic	Private DB
Poland	Minimum	Public NDC + Private DC
Spain	Minimum	Public DB
Sweden	Minimum	Public NDC + Private DB + Private DC
Turkey	Minimum	Public DB
UK	Basic + Minimum	Public DB
US	RT	Public DB

Notes:

RT	Resource Tested
DB	Defined Benefit
DC	Defined Contribution
NDC	Notional Defined Contribution

Source: OECD (2007)

3.1.2. Retirement ages

Blöndal and Scarpetta (1999), Brown (2006) and Duval (2003) find that the retirement age at which employees are eligible to retire affects the retirement decision. Therefore the comparison takes the early retirement age and the statutory retirement age into account. The early retirement age is the earliest age at which people are entitled to (early) retirement provisions. For simplicity, the comparison takes only male into account. Some countries set different ages for male and female, but as it only concerns Austria and Turkey, the difference is not substantial. The case studies use the early retirement age of 2007 given by OECD (2007).

Besides the early retirement age, the case studies provide the statutory retirement age, which is the official retirement age. At this age employees are officially entitled to retirement provisions. Some

countries set different statutory retirement ages for male and female. However, this only concerns Austria, Poland, Turkey and the UK and these countries, except for Poland, have plans to equalize the statutory retirement age for male and female. As the statutory retirement age for male and female is equal in nearly all countries, we use the retirement age for males only. The case studies use the statutory retirement age of 2007 given by OECD (2007).

The early and statutory retirement age are determined by the pension system, but the effective retirement age is a result of the retirement decision of the population. The effective retirement age is the retirement age at which people actually retire. As we use the early and statutory retirement age for males, the effective retirement age for males is used too. The case studies use the effective retirement age over a five year period from 2002-2007 given by OECD (2007). Table 3 gives an overview of the early, statutory and effective retirement age in the 15 OECD countries in the comparison. Figure 7 in the Appendix gives a graphical overview of the early, statutory and effective retirement age, and the life expectancy.

Table 3 - Early, statutory and effective retirement age

	Early retirement age	Statutory retirement age	Effective retirement age
Austria	62	65	58.9
Denmark	65	65	63.5
Finland	62	65	60.2
France	60	60	58.7
Germany	63	65	62.1
Iceland	62	67	68.9
Italy	60	65	60.8
Japan	60	65	69.5
Netherlands	60	65	61.6
Poland	65	65	61.4
Spain	61	65	61.4
Sweden	61	65	65.7
Turkey	60	60	63.5
UK	65	65	63.2
US	62	65	64.6
Average	61.9	64.5	62.9

Source: OECD (2007)

3.1.3. Pension replacement rate

The pension replacement rate provides us with information over the wealth status of an average person during retirement. The pension replacement rate is the ratio of total pension earnings to pre-pension earnings. Pre-pension earnings are the earnings over lifetime. A high replacement rate

implies a wealthier retirement. The ratio used in the case studies is the gross replacement rate, which is not corrected for taxes and social security contributions. The replacement rate is adjusted to earnings; therefore the mean replacement rate is used to represent the average person. For consistency in the comparison, the rates of the year 2007 are used given by OECD (2007). Table 4 provides an overview of the pension replacement rate in the 15 OECD countries, whereas Figure 8 in the Appendix provides a graphical overview of the pension replacement rate in ascending order.

Table 4 - Pension replacement rate (per cent)

	Pension replacement rate
Austria	80.1
Denmark	75.8
Finland	63.4
France	51.2
Germany	39.9
Iceland	77.5
Italy	67.9
Japan	34.4
Netherlands	81.9
Poland	61.2
Spain	81.2
Sweden	62.1
Turkey	72.5
UK	30.8
US	41.2
Average	61.4

Source: OECD (2007)

3.1.4. Pension accrual rate – early and late retirement

The pension accrual rate is the rate at which pensions are adjusted upon early or late retirement. When the accrual rate is zero, this implies that an implicit tax is paid when retirement exceeds the statutory retirement age. The pension accrual rate provided by OECD (2007) is used in the case studies. For the countries where pension benefits are notional adjusted, the average of the countries adopting an accrual rate is used for the comparison, e.g. Italy adopts an accrual rate of 5.7% for early retirement, while it uses a notional defined contribution system. In France the early retirement benefit is dependent on the years of foregone contributions or age at retirement, and hence it also adopts the average of the accrual rates, 5.7%, in the comparison. Denmark and Sweden apply an adjustment for late retirement. In Denmark the adjustment is dependent on the life expectancy and years of contribution, and Sweden adopts a notional defined contribution system; late retirement is automatically, actuarially adjusted. For simplicity, the average of the countries adopting an accrual

rate for late retirement, 6.1%, is used. Table 5 gives an overview of the pension accrual rate for early and late retirement in the different OECD countries in the case studies.

Table 5 - Pension accrual rate for early and late retirement (per cent)

	Pension accrual rate – early retirement	Pension accrual rate – late retirement
Austria	4.20	4.20
Denmark	-	Yes[1]
Finland	4.8 and 7.2	7.2 and 4.8
France	Yes[2]	3%
Germany	3.60	6%
Iceland	7	9%
Italy	Yes[3]	-
Japan	6	8.40
Netherlands	-	-
Poland	-	-
Spain	8 (30); 7.5 (31-34); 7 (35-37); 6.5 (38-39); 6 (>40)	2
Sweden	6 (62-65)	Yes[4]
Turkey	-	-
UK	-	10.40
US	3 years: 6⅔; >3 years: 5	2004: 7; 2006-7: 7.5; 2008: 8

Source: OECD (2007)

3.2. Demography

3.2.1. Age composition and dependency ratio

The age composition gives a representation of the division between the dependent population and the independent population. The dependent population exist out of people aged younger than 15 years and people aged 65 and older. The independent population are the people ageing 15 to 65. The dependency ratio is the ratio of dependent people to the total population. The age composition and dependency ratio are taken from the year 2007 and are provided by OECD (2010). Table 6 gives an overview of the age composition and dependency ratios in the countries in the comparison. Figure 9 and 10 in the Appendix provide a graphical overview of the age composition and dependency ratio in ascending order, respectively.

---

[1] Denmark adopts an actuarial adjustment for late retirement; in the comparison the average of 6,1% is used.
[2] France adjust the early retirement benefit on the basis of missing years in contribution or age at retirement.
[3] Italy adopts a notional defined contribution system, therefore early retirement is actuarially adjusted; in the comparison the average of 5,7% is used.
[4] Sweden has a notional defined contribution system, therefore late retirement is actuarially adjusted; in the comparison the average of 6,1% is used.

Table 6 - Dependent and independent population, and dependency ratio (per cent)

	People aged younger than 15 over total population	People aged 15-64 over total population	People aged 65 and older over total population	Dependency ratio
Austria	15.5	67.5	17.0	32.5
Denmark	18.5	66.0	15.5	34.0
Finland	17.0	66.5	16.5	33.5
France	18.3	65.2	16.5	34.8
Germany	13.8	66.3	19.9	33.7
Iceland	21.0	67.5	11.5	32.5
Italy	14.0	66.0	20.0	34.0
Japan	13.5	65.0	21.5	35.0
Netherlands	18.0	67.4	14.6	32.6
Poland	15.6	71.0	13.4	29.0
Spain	14.6	68.8	16.6	31.2
Sweden	16.9	65.7	17.4	34.3
Turkey	27.7	66.3	6.0	33.7
UK	17.6	66.4	16.0	33.6
US	20.4	67	12.6	33.0
Average	17.5	66.8	15.7	33.2

Source: OECD (2010)

3.2.2. Life expectancy

Life expectancy is the number of years people are expected to life at birth. Since the early, statutory and effective retirement age are taken from the male population, it is necessary for the comparison to take the life expectancy of the male population. Furthermore, for consistency, the life expectancy in the year 2007 is used. The life expectancy is given by OECD (2010). Table 7 gives the life expectancy in the 15 OECD countries. Moreover, it also provides the effective retirement age to measure the years spend in retirement.

Table 7 - Effective retirement age, life expectancy and years spend in retirement on average

	Effective retirement age	Life expectancy	Years spend in retirement
Austria	58.9	77.3	18.4
Denmark	63.5	76.2	12.7
Finland	60.2	76.0	15.8
France	58.7	77.5	18.8
Germany	62.1	77.4	15.3
Iceland	68.9	79.4	10.5
Italy	60.8	78.5	17.7
Japan	69.5	79.2	9.7
Netherlands	61.6	78.0	16.4
Poland	61.4	71.0	9.6
Spain	61.4	77.8	16.4
Sweden	65.7	78.9	13.2
Turkey	63.5	71.1	7.6
UK	63.2	77.3	14.1
US	64.6	75.4	10.8
Average	62.9	76.7	13.8

Source: OECD (2007, 2010)

3.3. Participation rate

The participation rate measures the participation in the labour market. The comparison gives the participation rate of the age group 15-24, 25-54 and 55-64. Table 9 gives an overview of the participation rates in the different age groups.

To measure the participation rate of old-age workers, the participation rate of the age group 55-64 is used. The participation rate is the dependent variable, indicating that the indicators given above influence the participation rate. In order to measure the effects of the different variables on the participation rate of older workers, we classify the participation rate of older workers in three categories: low, average and high. Low implies that a country has a participation rate of 40% or lower; average implies that a country has a participation rate between 40% and 60%; and high implies that a country has a participation rate of 60% or higher. Table 8 classifies the countries by the participation rates. Figure 11 in the Appendix gives a graphically classification of the countries by the participation rates.

Table 8 - Participation rates in age group 55-64 in ascending order and per category, low, average and high (per cent)

	55-64
Low (<40)	
Turkey	29.4
Poland	29.7
Italy	33.8
France	38.3
Austria	38.8
Average (40-60)	
Spain	44.6
Netherlands	50.1
Germany	51.3
Finland	55
UK	57.4
Denmark	58.7
High (>60)	
US	61.8
Japan	66.1
Sweden	70.1
Iceland	84.9

Source: OECD 2010

In order to measure the participation rate of people aged older than 65, a combination of the effective retirement age and labour participation of people 55-64 is used. When both variables are affected by a specific indicator it is expected that the labour participation of people aged older than 65 is affected simultaneously.

For consistency in the comparison, all indicators in the case studies are taken from the year 2007 and are provided by the OECD.

3.4. Conclusion

The incentives given in the previous chapter show that pension systems affect the labour participation rate. Therefore, the differences in pension systems are compared in the case studies. Furthermore, as demography differs across countries and could affect the labour participation rate, it is also taken in to account when comparing pension systems across countries.

4. Comparative analysis

In order to measure the effects of the increase of the retirement age in the Netherlands, the different variables that affect the participation rate are compared in 15 OECD countries. Pension

systems and demography differ substantially across countries. Consequently, the countries used in the comparison adopt a wide variety of pension systems and are exposed to large differences in demography.

In absence of the participation rate of workers aged older than 65, the participation rate of workers aged 55-64 is used to measure the effects of the different variables on the labour participation. The participation rate is divided in three groups; the lowest participation rate (<40%), average participation rate (40-60%) and the highest participation rate (>60%). Turkey (29.4%), Poland (29.7%), Italy (33.8%), France (38.3%) and Austria (38.8%) are classified as countries with a low participation rate. Spain (44.6%), the Netherlands (50.1%), Germany (51.3%), Finland (55%), the United Kingdom (57.4%) and Denmark (58.7%) are classified as countries with an average participation rate. The United States (61.8%), Japan (66.1%), Sweden (70.1%) and Iceland (84.9%) have a high participation rate. Figure 11 in the Appendix provides a graphical overview of the three categories.

In the case studies is shown that the countries with a low participation rate subsequently have a low effective retirement age, except for Turkey. On the other hand, countries with a high participation rate are also found to have the highest effective retirement age. However, this only shows that a relationship exists between the effective retirement age and the old-age labour participation, but it does not explain why there is a relationship. The effective retirement age shows the average age at which people retire and therefore together with the labour participation of workers aged 55-64 gives an indication of the labour participation of old-age workers after the age of 65.

The case studies try to explain the effect of the characteristics of the different pension systems and demography on the effective retirement age and labour participation with the use of the three categories for labour participation. Together the effective retirement age and labour participation rate for workers aged 55-64 give an indication of the effects of the labour participation of workers aged 65 and older.

4.1. Austria
4.1.1. Pension system
In the first tier, Austria adopts a resource-tested scheme. Dependent on your income, a minimum pension is provided. In the second tier, retirees are provided with a public defined benefit system. Throughout their working life, employees pay contributions, which are received upon retirement. The early retirement age is 62 for male and 60 for female (subject to increase in 2017). Early retirement is solely accessible after 37.5 years of contribution. The statutory retirement age is 65 for male and 60 for female (subject to increase in 2033). The effective retirement is 58.9, which is below

the early retirement age and statutory retirement age. Austria adopts an accrual rate for both early and late retirement of 4.2% per year. Furthermore, the pension replacement rate is 80.1%, implying that retirees receive a high pension income.

4.1.2. Demography

The percentage of people aged under 15 over the total population is 15.5%, and the percentage of people aged 65 and older over the total population is 17%. This results in a dependency ratio of 32.5%, which is below the average of the 15 OECD countries of 33.2%. The life expectancy of male is 77.3. With an effective retirement age of 58.9, this indicates that 18.4 years are spend in retirement by males.

4.1.3. Participation rate

In the age group 55-64, 38.8% participates in the labour force, which is below the average of 51.3%. Moreover, it can be classified in the group of countries with the lowest participation rate.

4.2. Denmark
4.2.1. Pension system

Denmark adopts a basic pension and resource-tested pension in the first tier, which is supplemented by a private defined contribution upon retirement. Under the social security system early retirement is not possible; retirement is only possible at the statutory retirement age of 65. There is no accrual rate for early retirement, but actuarially adjusted pensions are possible for late retirement, dependent on the years of contribution and life expectancy. The effective retirement age is 63.5, which is under the statutory retirement age of 65, implying that, on average, people retire before they are officially entitled to retirement earnings. Furthermore, the pension replacement rate is 75.8%, which is above the average of 61.4%.

4.2.2. Demography

The dependent population in Denmark is above the average of 33.2%. The percentage of people aged younger than 15 is 18.5%, whereas the percentage of people aged 65 and older over the total population is 15.5%, resulting in a dependency ratio of 34%. The life expectancy is 76.2 for male, which is close to the average of 76.7. With an effective retirement age of 63.5, this indicates that on average Danish male retirees spend 12.7 years in retirement.

4.2.3. Participation rate

More than half of the old-age population participate in the labour market in Denmark. The participation rate for workers aged 55-64 is with 58.7%, above the average of 51.3%; it is classified in the average category.

4.3. Finland
4.3.1. Pension system

In the first tier, pensions are based on a pension income received in the minimum pension system. In the second tier Finland adopts a public defined benefit system, where the benefits are publicly collected. The early retirement age is equal to 62 for both males and females, whereas the statutory retirement age is equal to 65. The effective retirement age of 60.2 is below the early retirement age. The first tier and the second tier adopt an accrual rate for early retirement of 4.8% and 7.2%, respectively. The accrual rate for the first tier is only accessible between the ages 62 and 65. In the second tier the benefits are only adjusted until the age of 63. For late retirement, the first tier provides an actuarial adjustment of 7.2%, but the second tier only provides an adjustment of 4.8% after the age of 68. The pension replacement rate is 63.4%, indicating that retirees receive a normal retirement provision in comparison to their lifetime earnings.

4.3.2. Demography

The dependent population in Finland differs only slightly from the average dependent population in the countries in the comparison. Finland has a dependency ratio of 33.5, where the young dependent population is 17% of the population, whereas the old dependent population is 16.5%. The life expectancy in Finland is equal to 76. Together with the effective retirement age of 60.2, this indicates that 15.8 years are spend in retirement on average by a male.

4.3.3. Participation rate

In Finland 55% of the people aged 55-64 still participate in the labour market. In comparison to the other countries, this is above the average of 51.3%. With a rate of 55% Finland is in the average category of participation rates.

4.4. France
4.4.1. Pension system

In the first tier, France applies two pensions; the first is based on the value of the pension income only and the second is based on income from all resources. In the second tier, a public defined benefit system is applied on the basis of contributed points throughout a working year. Early retirement is possible from 56-57, but only under certain work related circumstances. The statutory retirement age is 60, and requires 40 years of contributions. Early retirement is adjusted on the basis of foregone years of contribution or age of retirement. As there is no fixed accrual rate, 5.7% is used in the comparison. An accrual rate of 3% per year for late retirement is provided, under the condition that the employee contributed for 40 years. The pension replacement rate is 51.2%, implying that the total earnings received throughout retirement are half the earnings received throughout working life.

4.4.2. Demography

The dependent population represents 34.8% of the population in France, where the young population accounts for 18.3% and the older dependent population accounts for 16.5%. The life expectancy for male is 77.5, which 0.8 year higher than the average life expectancy. French male spend 18.8 years in retirement on average, which is five years more than the average years spend in retirement.

4.4.3. Participation rate

The participation rate of older workers in France belongs to the lowest category with a rate of 38.3%.

4.5. Germany

4.5.1. Pension system

In Germany the first tier provides the lowest income with a basic pension. The second tier is a defined benefit system, where earnings are received on the basis of contributed points. The early retirement age is 63, and the statutory retirement age is 65. The effective retirement age of 62.1 is below the early and statutory retirement age. Upon early retirement the pension earnings are adjusted by 3.6% per year and for late retirement the adjustment is 6% per year. The pension replacement rate is 39.9% and this rate is among the lowest replacement rates in the comparison. Retirees receive a substantial lower amount during retirement than in working life.

4.5.2. Demography

The older population in Germany represents 19.9% of the population, so one would expect a high dependency ratio, but the high percentage for old population is offset by the low population of people aged younger than 15 of 13.8%. In total this results in a dependency ratio of 33.7%, which is only slightly above average. The life expectancy is 77.4, implying that with an effective retirement age of 62.1, German males spend 15.3 years in retirement.

4.5.3. Participation rate

The participation rate in Germany equals the average of the OECD countries in the case studies. With a participation rate of 51.3% Germans belong to the average category in the comparison.

4.6. Iceland

4.6.1. Pension system

The first tier encloses two elements; the basic element is based on income received from other sources than pension income, while the resource-tested element is based on the pension income. Both elements are dependent on received income. The second tier is a private defined benefit system, where the employees are obliged to contribute to their supplementary retirement income.

Retirement is possible from the age of 67 in the first tier, but in the second tier early retirement is accessible from the age of 62, dependent on the pension system. For the comparison 62 is taken, as many pension system gives access to early retirement at the age of 62. The statutory retirement age is among the highest in Europe; people are entitled to normal pension at the age of 67 in Iceland. Early retirement is discouraged by an accrual rate of 7% before retirement, whereas late retirement is encouraged by an accrual rate of 9% for each extended year until the age of 70, with exception of the first tier, which is not subject to deferral. The high accrual rates could give an explanation to the high effective retirement age; with an effective retirement age of 68.9, Iceland has the highest effective retirement age. The pension income received throughout retirement is 77.5% of the earnings received before retirement.

4.6.2. Demography

Iceland has a large young population; 21% is aged younger than 15 years, whereas only 11.5% is aged 65 years or older. Nevertheless, the high percentage for the young population and the low percentage for the old population balance each other out, resulting in a dependency ratio of 32.5%. This is only slightly below the average of 33.2%. The life expectancy is 79.4; only 10.5 years are spend in retirement by Icelandic males.

4.6.3. Participation rate

With a percentage of 84.9%, Iceland has the highest participation rate of people aged 55-64. Besides, Iceland also has the highest participation rate among people aged 25-54. The high accrual rate upon early retirement and high retirement age in Iceland could discourage employees to retire and encourages them to stay in the labour force and hence could give an explanation for the high participation rate.

4.7. Italy

4.7.1. Pension system

In the first tier, retirees with a social security below the minimum payment are entitled to a basic pension. In the second tier, earnings are based on the notional defined contribution system. The early retirement age is 60 in 2007, but is increasing to 61 in 2010, and 62 in 2014. As the early retirement is 60 in 2007, we use this age in the case study. The effective retirement age of 60.8 is only slightly above the early retirement, but to a larger extent under the statutory retirement age of 65. Early retirement is not adjusted with a fixed percentage, but on the basis of the notional defined contribution, which is accessible from the age of 57. Late retirement is not actuarially adjusted, only the amount of accumulated contributions increases. The replacement rate of 67.9% is above the average of 61.4%.

4.7.2. Demography

Italy has a low percentage of people aged 15 and younger in the population (14%), whereas the percentage of people aged 65 years and older is high on average (20%). Nevertheless, the dependency ratio is 34%, which is close to the average of 33.2%. The life expectancy in 2006 is 78.5, implying that together with an effective retirement age of 60.8, Italian male belong to the group who spend most years in retirement.

4.7.3. Participation rate

A low participation rate in the age group 55-64 could result in a low effective retirement age. The participation rate of 33.8% in the age group 55-64 partly explains why the effective retirement age is as low as 60.8. With a participation rate of 33.8% Italy belongs to the lowest category.

4.8. Japan

4.8.1. Pension system

The basic pension in the first tier is dependent on years of contributions. After 40 years of contribution every retiree is entitled to the basic pension. The second tier is a public defined benefit system, where earnings are publicly regulated, but individually contributed. The early retirement age is 60 and employees are officially entitled to the normal pension at the age of 65. Nevertheless, the effective retirement age is above the statutory age. The effective retirement age of 69.5 is the highest in the case studies. On the other hand, the pension replacement rate is among the lowest in the comparison; in Japan you are entitled to 34.4% of the income received throughout working life upon retirement. The high effective retirement age could also be explained by the high accrual rate for both early and late retirement. Early retirement implies that the pension income is adjusted by 6%, whereas late retirement results in a additional 8.4% per year.

4.8.2. Demography

Like Germany and Italy, Japan also has a low population of people aged below 15 years and a high population of people aged 65 years or older. Nevertheless, the young population is still the smallest and the old population the largest, resulting in a dependency ratio of 35%. The dependency ratio of 35% causes Japan to have the largest dependent population in the comparison. The life expectancy is 79.2. In combination with the effective retirement age of 69.5 this implies that only 10.2 years are spend in retirement by Japanese male.

4.8.3. Participation rate

Considering the high effective retirement age, the participation rate is also expected to be high. With a participation rate of 66.1% Japan belongs to the category with the highest participation rates.

4.9. Netherlands

4.9.1. Pension system

In the Netherlands every retiree is entitled to a basic pension upon retirement in the first tier. In the second tier benefits are collected by means of a private defined benefit system. Early retirement is possible at the age of 60, whereas normal retirement is possible at the age of 65. The effective retirement age is 61.6 and there is no adjustment for early or late retirement. The Netherlands has the highest replacement rate in the comparison (81.9%), implying that retirees in the Netherlands are most wealthy in comparison to their income in working life.

4.9.2. Demography

The dependent population in the Netherlands is largest among the young population. The young population exist of 18% of the population, while the old population make up 14.6% of the population. In total, they account for a dependency ratio of 32.6%. The life expectancy is 78, implying that with an effective retirement age of 61.6, Dutch male spend 16.4 years in retirement.

4.9.3. Participation rate

The participation rate of older workers in the Netherlands belongs to the countries of average participation rates in the cases studies. The participation rate of 50.1% in the Netherlands is just below the average of 51.3% of the 15 OECD countries.

4.10. Poland

4.10.1. Pension system

Poland provides a minimum pension to retirees with a low pension income. In the second tier, employees contribute a fixed amount throughout employment and upon retirement pension benefits are received based on the life expectancy in a public notional defined contribution system. Additionally, one can choose to transfer part of the contribution throughout employment to another account, which is converted into a fixed amount to be received during retirement. The early retirement equals the statutory retirement of 65, as there is no possibility for early retirement. The effective retirement of 61.6 is under the early and statutory retirement age. Since early retirement is not possible, there is no accrual rate for early retirement. Besides that, late retirement is not adjusted either, but additional contributions are received as supplementary pension benefits upon retirement. The pension replacement rate of 61.2% is nearly equal to the average of the 15 OECD countries, 61.4%.

4.10.2. Demography

The population in Poland exists for 15.6% out of people aged younger than 15 and for 13.4% out of people aged 65 or older, resulting in a dependency ratio of 29%. Poland has the lowest dependency

ratio in the comparison, indicating that less independent people (15-64) need to carry the burden of the dependent people. The life expectancy of 71 for males in Poland is the lowest among the countries in the comparison. With an effective retirement age of 61.6, male spend 9.6 years in retirement on average.

4.10.3. Participation rate

The low effective retirement age could imply a low participation rate of older workers. The effective retirement age is 61.6 and the participation rate of people aged 55-64 in Poland is 29.7%. This rate belongs to the lowest participation rates in the comparison.

4.11. Spain

4.11.1. Pension system

In the first tier a minimum pension is accessible for retirees with a low income, without a dependent spouse. In the second tier, a public defined benefit system is adopted, and pension earnings are based on the years of contribution. Early retirement is possible at the age of 61 and official retirement is possible at the age of 65. The effective retirement age of 61.4 is in between the early and statutory retirement age. Early retirement is adjusted by means of an accrual rate dependent on the years of contributions. After 30 years of contribution, pension income is adjusted by 8%; 31-34 years is adjusted by 7.5%; 35-37 years is adjusted by 7%; 38-39 is adjusted by 6.5%; and 40 years or more is adjusted by 6%. In the comparison the accrual rate of 35 years of contribution is used, 7%. Late retirement is only adjusted by an accrual rate of 2% in case of 35 years of contributions. Next to the Netherlands, Spain has the highest pension replacement rate in the case studies. The replacement rate of 81.2% provides retirees in Spain with a relatively wealthy pension benefit.

4.11.2. Demography

On average Spain has a low percentage of people aged younger than 15 and the percentage of people aged 65 or older is only 0.9% higher than the average of the 15 OECD countries. Nevertheless, in total this results in a dependency ratio of 31.2%. The dependency ratio of Spain belongs to the lowest dependency ratios and implies that less independent people pay for the dependent population. The life expectancy for Spanish male is 77.8. The low effective retirement age of 61.4 causes Spanish male to spend on average 16.4 years in retirement.

4.11.3. Participation rate

The participation rate of older workers in Spain belongs to the category with the average participation rates for older workers. The participation rate equals 44.6%, and shows that a low effective retirement age does not necessarily result in a low participation rate among older workers. Other factors need to be taken into account too. The high replacement rate and accrual rates make it

more attractive to defer retirement and consequently could give an explanation for the low effective retirement age and average participation rate.

4.12. Sweden

4.12.1. Pension system

In the first tier, a pension is received based upon the earnings from the second tier. If the second tier earnings are low, a pension from the first tier is received. In the second tier, pensions are collected publicly and privately. Via a notional account, contributions are collected and pension benefits are publicly determined on the basis of the life expectancy upon retirement. Besides, Sweden adopts a pension system that uses a combination of a defined benefit and defined contribution system. The early retirement age is 61 and the statutory retirement is 65. The effective retirement age of 65.7 is above the statutory retirement age. Adjustment for early retirement is only possible in the second tier. The notional accounts are automatically adjusted when one retires, taking into account both early and late retirement. The defined benefit and contribution system is adjusted by an accrual rate of 6%, but only for early retirement. Late retirement is not possible under this system. For the comparison, the accrual rate of the defined benefit and contribution system of 6% is used for early retirement. The pension replacement rate of 62.1% is around the average of 61.4% for the 15 OECD countries.

4.12.2. Demography

Sweden has a dependency ratio of 34.3%, which is 1.1% above the average of 33.2%. The old population accounts for 17.4% of the population, whereas the young population accounts for 16.9% of the population. The life expectancy equals 78.9 and is among the highest in the comparison. Nevertheless, with the effective retirement age of 65.7 the average years spend in retirement (13.2) is still around the average of 13.8.

4.12.3. Participation rate

After Iceland, Sweden has the highest participation rate among workers aged 25-54 and workers aged 55-64. The participation rate among older workers of 70.1% could be caused by the actuarially adjustment of the notional accounts upon early and late retirement.

4.13. Turkey

4.13.1. Pension system

The first tier minimum benefit is only accessible when there is no other form of social security applicable. It serves as a safety net for the poorer retirees. In the second tier a public defined benefit system supplies retirees with a pension benefit upon retirement. The statutory retirement age was 45 in 2004 and is expected to be 60 in 2030. Recent retirees are entitled to pension benefits at the

age of 60. Early retirement is exceptional and only possible in certain industries. Late retirement is possible, but pension benefits are not actuarially adjusted, the contributions only increase. The pension replacement rate is 72.5% and is 11.1% above the average of 61.4%.

4.13.2. Demography

The difference between the young and old dependent population in Turkey is large. The young population is 27.7% of the population, whereas the old population is only 6%. The dependency ratio of 33.7% is in line with the average of the OECD countries, but taken separately the difference are substantial. After Poland, Turkey has the lowest life expectancy (71.1). The effective retirement age of 63.5 causes Turkish male to spend only 7.6 years in retirement.

4.13.3. Participation rate

In the comparison Turkey has the lowest participation rate among older workers. The participation rate for workers aged 55-64 is 29.4%. The low participation can be explained by the low statutory retirement age, as more incentives are created to retire than to continue working. The replacement rate of 72.5% shows that it is relatively attractive to retire.

4.14. United Kingdom

4.14.1. Pension system

In the first tier the United Kingdom adopts a basic pension and income dependent pension benefit. The basic pension is offered after 40 years of contribution, whereas the income dependent pension is received when the retiree has an income below a certain minimum. In the second tier, a public defined benefit system is adopted. Nevertheless, many employees adopt a private defined benefit or contribution system. Early retirement is not possible under the public system, but can be accessed under the private system. The statutory retirement age equals 65, and the effective retirement age is 63.2. Late retirement is possible against an accrual rate of 10.4% for each deferred year. The pension replacement rate of 30.2% is the lowest replacement rate in the comparison.

4.14.2. Demography

The dependent population in the United Kingdom only barely deviates from the average of 33.2. The young population accounts for 17.6% of the population, and the old population accounts for 16% of the population, resulting in a dependency ratio of 33.6%. Furthermore, the life expectancy is 77.3. The average amount of years spend in retirement (14.1) differs only 0.3% from the average (13.8).

4.14.3. Participation rate

In the United Kingdom 57.4% of the workers aging 55-64 still participate in the labour market. The participation rate of the United Kingdom belongs to the average category.

4.15. United States

4.15.1. Pension system

In the first tier, pensions are provided to people with an income from different resources below a certain minimum. In the second tier, the benefits upon retirement are based on the earnings during the working stage. Dependent on the value of the earnings, the pension benefit is adjusted progressively, meaning that retirees with low earnings are subject to a relatively higher pension benefit than retirees with higher earnings. The early retirement age is 62 and the statutory retirement age is 65. The statutory retirement is subject to increase to 67 over the upcoming years. The effective retirement age is 64.6, which is in between the early and statutory retirement age. Adjustment of pensions is possible upon early retirement. Under the assumption that the statutory retirement age is increased, the first three years of early pension are adjusted by 6⅔% and after three years the pension benefits are adjusted by 5%. In 2007 it is only possible to retire three years early as the statutory retirement is still 65 and the early retirement is 62. Therefore, the accrual rate of 6⅔% is used for early retirement. Late retirement is adjusted by an accrual rate of 7.5% in 2006 and 2007, and from 2008 on the pension benefits are adjusted by 8%. As the case studies compare data from 2007, the accrual rate for late retirement of 2007 is used.

4.15.2. Demography

The United States has a relatively high percentage of people aged younger than 15 and a relatively low percentage of people aged 65 years or older in comparison to the other countries. The young population accounts for 20.4% of the population, and the old population accounts for 12.6% of the population. However, the dependency ratio of 33% is still close to the average of 33.2%. The life expectancy in the US is 75.4, consequently 10.8 years are spend in retirement with an effective retirement age of 64.6.

4.15.3. Participation rate

The participation rate of older workers in the US is among the highest in the comparison; the participation rate of workers aged 55-64 is 61.8%.

5. Results comparative analysis

The case studies show that pension systems and demography vary considerably across countries. Nevertheless, the comparison of the case studies provides an estimation of the effect of the statutory retirement age in the Netherlands from 65 to 67.

First of all, the comparison demonstrates that the differences in the way the tiers are developed in the countries does not affect the effective retirement age nor participation rates. The effective

retirement age and participation rates are independent of the first tier and second tier pension allowances.

Furthermore, the early retirement differs from 60 to 65. Denmark, France, Poland, Turkey and the United States do not offer the opportunity to retire early. Assuming that the early retirement age is equal to the statutory retirement age in these countries, there are five countries with an early retirement age of 60. Three countries are in the lowest participation rate category, Turkey, France and Italy. Besides, Poland has only adjusted its early retirement age in 1999 and counts for people born after 1949, implying that the effects of the increase are not visible yet, and therefore one can assume that the early retirement age is still 60. Further, Turkey only changed its statutory retirement age from 45 to 60 in 2004. The countries with a low participation rate show that a relation exist between the height of the early retirement age and the participation rate. Nevertheless, the Netherlands and Japan also adopt an early retirement age of 60 and they belong to the average and highest participation rate, respectively. Furthermore, high early retirement ages in Denmark and the United Kingdom show average participation rates and average effective retirement ages. Therefore, based on the case studies we can conclude that there is no positive relation between the early retirement age and the effective retirement age or participation rate.

In contradiction to the early retirement age, the statutory retirement age differs less across the countries. Turkey and France adopt a statutory retirement age of 60 (where Turkey only changed the retirement age in 2004), Iceland uses 67, whereas all the other countries adopt an age of 65. With a statutory retirement age of 67, Iceland also possesses the highest participation rate and effective retirement age. Furthermore, with a statutory retirement age of 60, Turkey and France also belong to the countries with the lowest participation rate and a low effective retirement age. The participation rate and effective retirement age among the countries with a statutory retirement age of 65 vary substantially. Nevertheless, Iceland shows that having a high statutory retirement age indicates an increase in the effective retirement age and participation, whereas Turkey and France show that a low statutory age results in a low participation rate and a low effective retirement age. Nevertheless, as there is much variation in the participation rates and effective retirement ages among the countries that adopt a statutory retirement of 65, we can conclude that the statutory retirement age only weakly affects the effective retirement age and participation rate.

The pension replacement rate differs substantially across countries. The United Kingdom has a pension replacement rate of 30.8%, whereas the Netherlands has a replacement rate of 81.9%. Figure 7 in the Appendix gives a graphical overview of the pension replacement rates. A high replacement rate could imply that a country's government provides retirees with a high pension

benefit. Nevertheless, there is no relation between the pension systems and the replacement rate. In the case studies there is no clear relationship between the replacement rate and the effective retirement age or participation rates, either.

Moreover, several countries adopt a pension accrual rate for early or late retirement, or both. Upon early retirement, pension is negatively adjusted by a predetermined percentage, while upon late retirement pension benefits are positively adjusted by a predetermined percentage. When countries do not adopt a pension adjustment this implies that an implicit tax is paid on working when deferring retirement. The four countries with a participation rate greater than 60% have an accrual rate for early retirement of at least 6% and belong to the countries with the highest accrual rates for early retirement. Spain, on the other hand, shows that a high accrual rate for early retirement (7%) does not necessarily result in a high participation rate (44.6%). Nevertheless, the accrual rate for late retirement is only 2%, whereas the countries with a high participation rate have a high accrual rate for both early and late retirement. The case studies show that the four countries with a participation rate higher than 60% (Sweden, US, Japan and Iceland) belong to the countries with the highest accrual rate for late retirement. Iceland has an accrual rate of 7% for early retirement and 9% for late retirement and has the highest participation rate. Countries without a pension accrual rate for late retirement, like Turkey and Poland have the lowest participation rates and a relatively low effective retirement age. The Netherlands, on the other hand, neither adopts an accrual rate for early nor late retirement, but it has a participation rate of 50.1%. Therefore, one could conclude that the accrual rates do not affect participation rates. However, Denmark and the United Kingdom score higher in the average category of participation rates and effective retirement ages and they adopt an actuarially adjusted pension and an accrual rate of 10.4%, respectively. Empirical evidence that the accrual rate affects the labour participation found by Blöndal and Scarpetta (1999) is approved in the case studies. The accrual rates affect the participation rate and effective retirement age, but only when both early and late retirement rates are adopted.

The dependency ratios differ widely across the countries in the three categories of participation rates. The dependency ratios differ from 29% to 35%, where the low participation rate countries have dependency ratios ranging from 29% to 34.8. Figure 10 in the Appendix gives a graphical overview of the dependency ratios. The high participation rate countries have dependency ratios ranging from 32.5% to 35%. Japan and Sweden both have a high dependency ratio and also have a high participation rate, but as Iceland and the United States show to have a dependency ratio below average, it is concluded that the dependency ratio does not affect the labour participation nor the effective retirement age. Furthermore, when separating the dependent populations in the dependency ratio, it is found that variation between the different categories still exists.

Life expectancy differs from 71 in Poland to 79.2 in Japan. The low and average participation rates differ in their life expectancy, but the high participation rates score highest on life expectancy, except for the United States. Sweden, Japan and Iceland have a life expectancy of 78.9; 79.2; and 79.4; respectively. As the life expectancy differs across the low and average participation categories, and only shows an effect in the high participation rates category, only a weak effect exists of the life expectancy on the labour participation.

As a result of the comparison of the case studies, the effective retirement age is shown to affect the participation rate and the combination of the two gives a representation of what the effects on the labour participation of the workers aged older than 65 are. In the comparison is found that the statutory retirement age and life expectancy weakly affect the participation of old-age workers and effective retirement age. Moreover, the accrual rates for early and late retirement accumulated are found to affect the participation rate and effective retirement age.

When increasing the statutory retirement age to 67 in the Netherlands, we can conclude that this slightly increases the participation rate of workers aged 55-64 and the effective retirement age. Together, the labour participation of workers aged 55-64 and the effective retirement age indicate that the labour participation among workers aged older than 65 increases. Nevertheless, as shown in the comparison of the case studies, the effect is only small. In order for the raise of the statutory retirement age to be effective, additional measures have to be implemented.

The Netherlands does not provide retirees with an accrual rate for pension benefits upon early or late retirement. The comparison of the case studies explains that an accrual rate for both early and late retirement affects the participation rate. Additional to increasing the statutory retirement age, the Netherlands should also implement accrual rates for early and late retirement.

Besides the comparison of all the case studies, the comparison of the Netherlands and Iceland finds many similarities. The demography in the Netherlands is comparable to the demography in Iceland. The dependency ratio of the Netherlands is 32.6%, whereas Iceland has a dependency ratio of 32.5%. The life expectancy is 78 in the Netherlands, while Iceland has a life expectancy of 79.4. Furthermore, the pension system in the Netherland is comparable to the pension system in Iceland. Both countries have a basis pension in the first tier and a private defined benefit system in the second tier, but Iceland expands the first tier with a resource-tested element. The pension replacement rate in the Netherlands is 81.9%, whereas the replacement rate in Iceland is 77.5%.

The demography in Iceland and the Netherlands are shown to be similar and the pension system shows some similarities in the different tiers and replacement rates. However, in the Netherlands the

early and statutory retirement ages are 60 and 65, respectively, whereas in Iceland the early and statutory retirement age are 62 and 67, respectively. Iceland already applies a higher early and statutory retirement age. By taking into account the similarities across the countries, it is assumed that a higher statutory retirement age in the Netherlands also results in a higher participation rate among older workers. Moreover, Iceland applies an accrual rate for early and late retirement. In the comparison of the case studies it is shown that the adjustment of the pension benefits in early and late retirement increases the participation rate. When taking into account the comparison of the case studies and the similarities of the characteristics of the pension system and demography between Iceland and the Netherlands, an increase in the statutory retirement age, together with an adjustment for early and late retirement, will cause the participation rate to increase.

6. Empirical analysis

6.1. Methodology
Additional to the comparative analysis, an empirical analysis is done to predict the effects of the increase of the statutory retirement age on the labour participation. The empirical research uses the same data as the comparative analysis, indicating that it is uses cross-sectional data, as the data is extracted from 15 countries and only observes the year 2007. To predict the effects of the statutory retirement age on the labour participation rate in the Netherlands the method of least squares is used. The least squares method provides a linear model based on the cross-sectional data.

Based on the literature and the results derived from the case studies, two models are designed to test the effect of the increase of the statutory retirement age on the labour participation. The two models are executed in two age groups of labour participation, where the first is the labour participation in the age group 55-64 in 2007 (OECD). The latter is the age group 65-69 and is obtained with the extrapolation of the labour participation in the age group 25-54 and 55-64. In the case studies a combination of the effective retirement age and the labour participation rate was used to measure the effects on the labour participation in the older segment. However, here it is assumed that the labour participation develops linearly, and hence the known labour participation is extrapolated. Even though data for the age group 15-24 is available, this group is not included in the extrapolation as the effect of the increase from the age group 15-24 to 25-54 is higher than the increase from the age group 25-54 to 55-64 and therefore predicts a growth, instead of decline beyond the age of 65. Table 14 in the Appendix provides the extrapolation of 25-54 and 55-64, and additionally, Table 15 in the Appendix provides the extrapolation of the age groups 15-24, 25-54 and 55-64. The extrapolation is based on the formula:

$$y_x = x_2 + \{x_x - x_2\} \times \left\{\frac{y_2 - y_1}{x_2 - x_1}\right\}$$

x_1 and x_2 represent the average age in the age group 25-54 and 55-64, respectively. In order to extrapolate the labour participation, it is assumed that the average age is the median age in the age group. Therefore, x_1 is 40 (25-54) and x_2 is 60 (55-64). y_1 and y_2 represent the labour participation rate in the age groups in percentages. y_x is the labour participation of the extrapolated age group and x_x is the median age in the extrapolated age group. Further, Table 14 and 15 in the Appendix also give the labour participation for the age group 65-74 and 75-84. Nevertheless, the age group 65-69 gives the most accurate representation of the labour participation, taking into account that few people work beyond the statutory retirement age.

Based on the results from the case studies, two models are designed to measure the effects on the labour participation for both groups. The first model uses the statutory retirement age as the only independent variable and the labour participation as the dependent variable. It shows the effects of the statutory retirement age, without controlling for other variables. The second model is derived from the results in the case studies and by the examination of all the variables. Both models are regressed on the labour participation of the age group 55-64 and 65-69. Since the age group 65-69 is extrapolated on the basis of the age group 55-64, similar results are expected to be found.

The examination of the variables finds that all variables, except for the tiers and accrual rates, are quantitative, whereas the tiers and accrual rates are qualitative. The quantitative variables are converted into scale variables and the qualitative variables are converted into nominal variables. Table 16 in the Appendix provides an overview of the values of the nominal variables.

When including all variables, the tolerance level drops below 0.20 and implies multicollinearity, according to Menard (1995). Therefore, it is not possible to control for every variable used in the case studies. Correlation of the labour participation and each independent variable separately, demonstrates that the statutory retirement age, effective retirement age, late accrual rate and life expectancy age are significantly correlated with the labour participation. Table 17 in the Appendix shows the correlation matrix with the correlations between all variables. The case studies find similar results, with the addition of the early accrual rate. Hence, the statutory retirement age, effective retirement age, early and late accrual rate, and life expectancy are used as a starting point for the second model.

Additionally, the correlation matrix indicates that correlation exist among the variables. Generalization of the data requires the independent variables to be independent of the variables excluded from the model. If correlated variables are excluded from the model, the prediction

becomes unreliable. the When including the statutory retirement age, effective retirement age, early and late accrual rate, and life expectancy, correlation at a 5% significance level requires adding the pension replacement rate to prevent correlation with excluded variables. When excluding the life expectancy, the early accrual rate is not required as it is only correlated with the life expectancy (5%) and early retirement age (10%). Nevertheless, the life expectancy is significantly correlated at a 5% significance level with the labour participation rate and should therefore be included in the model.

If correlation at a 10% significance level was used to determine the variables in the model, this would result in adopting all variables, except for tier 1, tier 2 (public or private) and tier 2 (system). The inclusion of more variables causes the tolerance level to drop below 0.20 and implies multicollinearity. Therefore, a significance level of 5% for the correlation is used to determine the independent variables in the model and results in the statutory retirement age, effective retirement age, pension replacement rate, early accrual rate, late accrual rate and life expectancy as the independent variables. The labour participation of the age groups 55-64 and 65-69 are the dependent variables in the regression.

The predicted value in the first model is measured by the least square regression line:

$$\widehat{\text{Labour participation}}_i = b_0 + b_1 \text{Statutory retirement age}_i + \varepsilon_i$$

Subsequently, the second model is predicted by the least square regression line:

$$\widehat{\text{Labour participation}}_i = b_0 + b_1 \text{Statutory retirement age}_i + b_2 \text{Effective retirement age}_i + b_3 \text{Pension replacement rate}_i + b_4 \text{Early accrual rate}_i + b_5 \text{Late accrual rate}_i + b_6 \text{Life expectancy}_i + \varepsilon_i$$

The results provide us with a prediction of the effects of the statutory retirement age in two age groups with the use of two least square regressions in each age group. $\widehat{\text{Labour participation}}_i$ is the predicted outcome, b_0 is the intercept with y-axis, b_1 is the coefficient that predicts the effects of the statutory retirement age, b_2 is the coefficient that predicts the effect of the effective retirement age, and so on. ε_i is the residual term and predicts the difference between the actual outcome and the predicted outcome. The accuracy of the model is measured by the goodness-of-fit, correlation requirements and residual analysis. The goodness-of-fit indicates if the regression line fits the actual data. The goodness-of-fit is assessed by the adjusted R^2 and the F-Ratio. The adjusted R^2 demonstrates how much variability in the predicted value of the labour participation is accounted for when the data was derived from every country in the world, instead of the 15 countries in the model. It is used instead of the R^2, as it gives a better indication of the generalization accuracy of the model. When measuring the effects in the Netherlands, generalization of the model improves the reliability

of the prediction. When the adjusted R^2 approaches 1, it is assumed that much variability in the dependent variable is accounted for by the model. Furthermore, the F-Ratio is the ratio between the average variability explained by the model to the average variability not explained by the model. A high F-Ratio indicates a small difference between the model and the observed data. In order to have an appropriate goodness-of-fit, the adjusted R^2 requires being high and the F-Ratio is required to be significant. However, if the R^2 is low, a significant F-Ratio still fulfils the goodness-of-fit.

Further, the independent variables require to be uncorrelated (no multicollinearity), the variables excluded from the model are uncorrelated with variables included in the model and the outcomes of the regression require being independent.

In the residual analysis, the residuals are assessed on the basis of three criteria. First of all, the residual terms are required to be independent. The Durbin-Watson score measures the autocorrelation in residual terms. A score of 1 or lower, or 3 or higher indicates autocorrelation between the residuals, whereas a value of 2 indicates that the residual terms are uncorrelated. Secondly, the variances of the residual terms are required to be constant, indicating homoskedasticity. Third, the residual terms need to be normal distributed.

When the model fulfills the above mentioned criteria, the least square regression line provides an accurate prediction of the actual data.

6.2. Results

With the use of the data obtained by the case studies in 15 countries, four regressions are executed in accordance with the least squares regression method. Table 18 in the Appendix gives an overview of the mean, standard deviation, minimum and maximum of the variables obtained from the case studies. The first two regressions are executed on the labour participation for the age group 55-64. The results are shown in Table 9.

Table 9 – Dependent variable: participation rate 55-64, model 1

	B	SE B	β
Constant	-262.315	123.323	
Statutory retirement age	4.865	1.912	0.577**
Adjusted R^2	0.281	13.4853	
Durbin-Watson	2.439		
F-Ratio	6.474**		

Notes:
B   Unstandardized Coefficient
SE B   Standard Error Unstandardized Coefficient
β   Standardized Coefficient

** Statistical significant at a 5% significance level.

The results from the least square regression with the statutory retirement age as the only predictor and the labour participation in the age group 55-64 tells that the statutory retirement age has a significant effect at a 5% significance level on the labour participation. The statutory retirement age coefficient adopts a value of 4.865

Based on the regression the predicted labour participation is measured with the formula underneath.

$$\widehat{\text{Labour participation}}_{55-64} = -262.315 + 4.865 \text{ Statutory retirement age}_{55-64} + \varepsilon_{55-64}$$

The assessment of the goodness-of-fit finds that the line fits the actual data. The goodness-of-fit is measured by the adjusted R^2 and the F-Ratio. The adjusted R^2 is 0.281, indicating that 0.281 of the variability in the labour participation is explained by the model. The F-Ratio of 6.474 is significant at 5% significance level. Although the adjusted R^2 is low, the significant F-Ratio indicates that the line fits the actual data. Furthermore, for a cross-sectional analysis the adjusted R^2 of 0.281 is still relatively high.

Table 17 in the Appendix shows that the statutory retirement is age is not significantly correlated with the other variables, so no correlation occurs with variables excluded from the model. As only one predictor value is adopted, multicollinearity is impossible. Since the observed values are used from 15 separate countries, which differ significantly the outcome variables are expected to be independent.

Furthermore, analysis of the residuals finds that the Durbin Watson score is 2.439. The value is close enough to two to conclude that the residual terms are uncorrelated. The assessment of homoskedasticity in the model by plotting the standardized predicted values of the labour participation against the standardized residuals between the data predicted by the model and the observed data, shows the presence of hetereoskedasticity as the variances provide unequal values and are centered towards the right. Thirdly, the normal probability plot of the residuals shows that the residuals are gathered around the normal distribution line, resulting in a normal distribution of the residuals.

Based on the goodness-of-fit, correlation in the model and residuals analysis, it is concluded that the first regression results in a moderate model for prediction. The homoskedasticity could result in a bias in the model. Consequently, the model could give an inaccurate prediction of the labour participation.

In contradiction to the first model with one predictor, the second model includes six predictors. Adding more predictors could eliminate the problem of heteroskedasticity in the variances of the

residual terms. The statutory retirement age is controlled for the effects of the effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy. The model is based on the case studies and the results from the correlation between the variables. Table 10 provides the regression output.

Table 10 - Dependent variable: participation rate 55-64, model 2

	B	SE B	β
Constant	-230.295	89.209	
Statutory retirement age	0.677	1.134	0.08
Effective retirement age	1.974	0.66	0.397**
Pension replacement rate	0.221	0.126	0.247
Early accrual rate	0.204	0.704	0.038
Late accrual rate	2.654	0.795	0.596**
Life expectancy	1.136	0.915	0.184
Adjusted R²	0.837	6.4268	
Durbin-Watson	1.945		
F-Ratio	12.956***		

Notes:
B   Unstandardized Coefficient
SE B   Standard Error Unstandardized Coefficient
β   Standardized Coefficient
** Statistical significant at a 5% significance level; *** at 1% level.

When including the control variables, the statutory retirement age coefficient is 0.677, and is not significant anymore. However, the effective retirement age and the late accrual rate significantly affect the labour participation at a 5% significance level. The effective retirement age coefficient is 1.974 and the late accrual rate coefficient is 2.654. The pension replacement rate, early accrual rate and life expectancy have no significant effect, but as they are correlated with variables included in the model, they are required in the model to prevent correlation with variables excluded from the model, leading to an unreliable prediction. The formula underneath calculates the predicted value of the labour participation in the age group 55-64.

$$\widehat{\text{Labour participation}}_{55-64} =$$
$$-230.295 + 0.677 \text{ Statutory retirement age}_{55-64} + 1.974 \text{ Effective retirement age}_{55-64} +$$
$$0.221 \text{ Pension replacement rate}_{55-64} + 0.204 \text{ Early accrual rate}_{55-64} +$$
$$2.654 \text{ Late accrual rate}_{55-64} + 1.136 \text{ Life expectancy}_{55-64} + \varepsilon_{55-64}$$

The examination of the goodness-of-fit of the model with the use of the R² and the F-Ratio, finds that the adjusted R² has a value of 0.837; 0.837 of the variability in the predicted labour participation rate is explained by the model. The F-Ratio of 12.956 is significant at a 1% significance level. The high adjusted R² and the significant F-Ratio indicate that the regression model fits the actual data. In

comparison to the first model, the second model gives a more accurate predicted value since it obtains a higher adjusted R² and a F-Ratio significant at significance level of 1%.

The second model uses the results from the case studies and the inclusion of correlated variables to determine the variables adopted in the model. Therefore, all variables correlated at a 5% significance level are adopted in the model. When including correlated variables in the model, one could expect multicollinearity. Nevertheless, the lowest tolerance level is 0.366 and exceeds 0.20, indicating that no multicollinearity occurs in the model.

Furthermore, the residual terms are required to be independent and normal distributed, and their variances need to be constant. The Durbin-Watson score of 1.945 indicates that the residual terms are independent. The normal probability plot shows that the residuals are close to the normal distribution line, implying normal distribution of the residuals. Plotting the standardized predicted values against the standardized residual values of the predicted outcome, gives an evenly dispersion in the graph. Therefore, the variances show homoskedasticity.

Based on the assessment above, the second model regressed on the labour participation rate in the age group 55-64 gives a good prediction of the effect of the statutory retirement age on the labour participation, controlled for the five other predictors.

The third regression is based on the first model, but is regressed on the labour participation rate in the age group 65-69. The values of the predictor remain similar to the first regression. Table 11 shows the regression output.

Table 11 - Dependent variable: participation rate 65-69, model 1

	B	SE B	β
Constant	-320.704	157.182	
Statutory retirement age	5.617	2.437	0.539**
Adjusted R²	0.235	17.18773	
Durbin-Watson	2.336		
F-Ratio	5.312**		

Notes:
B   Unstandardized Coefficient
SE B   Standard Error Unstandardized Coefficient
β   Standardized Coefficient
** Statistical significant at a 5% significance level.

The regression output shows similar results as the regression on the labour participation in the age group 55-64. The statutory retirement age significantly affects the labour participation at a 5% significance level. The formula underneath gives the prediction based on the regression output.

$$\widehat{\text{Labour participation}}_{65-69} = -320.704 + 5.617 \text{Statutory retirement age}_{65-69} + \varepsilon_{65-69}$$

Assessing the predictive value of the line in relation to the actual data, the goodness-of-fit examines the R^2 and F-Ratio. Again, the adjusted R^2 is low, but for a cross-sectional analysis it is still relatively high. Only 0.235 of the variance in the model is explained by the statutory retirement age. However, the F-Ratio of 5.312 is significant at a 5% significance level. Therefore, the line of best fit gives a good representation of the actual data.

Since the third regression adopts one predictor, multicollinearity is impossible. The correlation matrix demonstrates that the statutory retirement age is uncorrelated with other variables excluded from the model. Additionally, the assumption holds that the outcome variables are independent, as they are collected from 15 separate countries.

Furthermore, the Durbin-Watson score of 2.336 indicates that the residuals are independent. The normal probability plot shows that a normal distribution of the residual terms. However, plotting the standardized predicted values against the standardized residual values shows that the points are mainly centered to the right, implying heteroskedasticity, while homoskedasticity indicates that the variables are scattered around the graph. There is no homoskedasticity in the residuals, implying that the variances in the residuals differ, while constant variance is requested for accurate predictions.

Although the regression model shows a proper goodness-of-fit, the absence of homoskedasticity diminishes the accuracy of the model and should be taken into account when interpreting the prediction value of the labour participation with the use of the formula provided.

The fourth regression controls for the effects of the effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy, while regressing the statutory retirement age on the labour participation of the age group 65-69. Table 12 provides the results of the regression.

Table 12 - Dependent variable: participation rate 65-69, model 2

	B	SE B	β
Constant	-284.999	105.6	
Statutory retirement age	0.416	1.343	0.04
Effective retirement age	2.973	0.781	0.484***
Pension replacement rate	0.267	0.15	0.112
Early accrual rate	0.341	0.833	0.051
Late accrual rate	3.139	0.941	0.571**
Life expectancy	1.048	1.083	0.137
Adjusted R²	0.85	7.60765	
Durbin-Watson	1.949		
F-Ratio	14.425***		

Notes:
B   Unstandardized Coefficient
SE B   Standard Error Unstandardized Coefficient
β   Standardized Coefficient
** Statistical significant at a 5% significance level; *** at 1% level.

The regression output shows that the statutory retirement age does not significantly affect the labour participation when adding control variables. The coefficient of statutory retirement age is 0.416. The effective retirement age and late accrual rate coefficient take on the value of 2.973 and 3.139, and have a significant effect at a 1% and 5% significance level, respectively. The coefficient of the pension replacement rate, early accrual rate and life expectancy are not significant. The formula underneath represents the least squares regression line.

$$\widehat{\text{Labour participation}}_{65-69} =$$
$$-284.999 + 0.416 \text{ Statutory retirement age}_{65-69} + 2.973 \text{ Effective retirement age}_{65-69} +$$
$$0.267 \text{ Pension replacement rate}_{65-69} + 0.341 \text{ Early accrual rate}_{65-69} +$$
$$3.139 \text{ Late accrual rate}_{65-69} + 1.048 \text{ Life expectancy}_{65-69} + \varepsilon_{65-69}$$

The goodness-of-fit assessment finds that the predicted line gives a good representation of the actual data. The adjusted R² is 0.85, indicating that the variables in the model explain 0.85 of the variability in the outcome of the labour participation. The adjusted R² approaches 1, and hence most variability in the outcome is explained by the model. Furthermore, the F-Ratio of 14.425 with a significance level of 1% emphasizes the conclusion drawn from the high R².

In the second model all variables correlated at a 5% significance level are used as predictors in the model, to prevent exclusion of correlated variables. Furthermore, the tolerance level in the second regression gives evidence that no multicollinearity exists. As the models use similar predictors, it holds for the fourth regression that no multicollinearity occurs in the model and the labour

participation is based on the labour participation in the age groups 25-54 and 55-64, which are independently determined.

Analysis of the residuals finds that the Durbin-Watson score is 1.949. The score is close to 2, resulting in independent residuals. The variances of the residuals are constant, as the points on the plot of the standardized predicted values against the standardized residuals are evenly scattered around the graph, resulting in homoskedasticity. Plotting the normal probability plot shows that the residuals follow the normal distribution line. Consequently, the residuals are found to be normal distributed.

The goodness-of-fit, correlation requirements and residual analysis demonstrate that the second model regressed on the labour participation of the age group 65-69 provides a good prediction of the effect of the statutory retirement age on the labour participation, controlling for effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy.

7. Discussion

The comparative case studies divide the 15 countries in three categories. The categories correspond to the countries with a labour participation rate lower than 40%, between 40% and 60%, and over 60%. Based on the division the effects of an increase on the statutory retirement age are examined. Furthermore, to predict the effect on the old-age labour participation, the effects on the effective retirement age are also examined. The comparative research finds that the statutory retirement age and life expectancy weakly affects the labour participation, whereas the effective retirement age and accrual rates affect the labour participation rate to a larger extent.

Based on the results from the case studies and the correlations between the variables, the regression models for the empirical research are designed. The first model finds that the statutory retirement age significantly affects the labour participation in both age groups. In the age group 55-64, an increase of the statutory retirement by one year, results in an increase of the labour participation by 4.865 percentage points. The labour participation in the age group 65-69 increases by 5.617 percentage points if the statutory retirement age is increased by one year. An increase in the statutory retirement age from 65 to 67 will result in an increase of the labour participation of 9.73 percentage points in the age group 55-64, and an increase of 11.234 percentage points in the age group 65-69 in the first model.

However, the first model does not control for other variables and might omit significant effects. Therefore, the second model controls for variables which are found to be effective in the case studies and correlate with the labour participation, or are included because they correlate with variables included in the model. When including additional variables, the statutory retirement age is not

significant. An increase of the statutory retirement age by one year, results in an increase of 0.677 percentage points in the labour participation in the age group 55-64, and an increase of 0.416 percentage points in the age group 65-69, holding all variables constant. An increase of the statutory retirement from 65 to 67 increases the labour participation by 1.354 percentage points in the age group 55-64, and by 0.832 percentage points in the age group 65-69. Nevertheless, the effects are not found to be significant. However, controlling for the variables effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy, the effective retirement age and late accrual rate significantly affect the labour participation in both age groups. An increase of the effective retirement age by one year causes the labour participation to increase by 1.974 percentage points in age group 55-64 and by 2.973 percentage points in the age group 65-69. However, an increasing old-age labour participation meanwhile implies an increasing effective retirement age. The late accrual rate is significant at a 5% significance level in both age groups. An increase of the late accrual rate by 1% causes the labour participation to increase by 2.654 percentage points in the age group 55-64 and by 3.139 percentage points in the age group 65-69. The pension replacement rate, early accrual rate and life expectancy are not significant.

The results above demonstrate similar results for the labour participation rate in the age group 55-64 and 65-69. The participation rate in the age group 65-69 is partly based on the age group 55-64, which could give an explanation to the similarity in the results. The regressions show that the statutory retirement age significantly affects the labour participation, when not controlled for the pension system and demography. The inclusion of the variables effective retirement age, pension replacement rate, early and late accrual rates, and life expectancy gives evidence to a significant effect of the effective retirement age and late accrual rates in both age groups. Furthermore, in both age groups, the statutory retirement age does not significantly affect the labour participation when the control variables are included. In order for the increase of the statutory retirement age to be effective the late accrual rate should increase. The effective retirement age is a result of the retirement decision of the employees, and thus cannot be determined by a pension reform. Furthermore, a higher effective retirement age implies that the labour participation in an older age group increases. Therefore, no direct adaptations can be made to the effective retirement age.

Based on the case studies it is found that the statutory retirement age, effective retirement age, accrual rates and life expectancy influence the labour participation. The empirical research only finds significant effect for the effective retirement age and late accrual rate. The case study is based on the dividing the countries in three categories of participation rates. The empirical study runs regressions where independent variables are regressed on the labour participation, while controlling for the other variables in the meanwhile. The case study only researches the effects of the variables on the

labour participation separately. Therefore, it is concluded that the statutory retirement age does not affect the labour participation. The increase of the statutory retirement age from 65 to 67 is only effective when the late accrual rate is increased simultaneously.

8. Conclusion

This paper provides a comparative and empirical analysis to examine the effects of the increase of the statutory retirement age on the labour participation of old-age workers in the Netherlands. With the use of 15 case studies, the effects are predicted in a comparative analysis. Consequently, the results from the comparative analysis are used to execute an empirical analysis.

The literature shows that financial, cyclical, social, and employability incentives are taken into account in the retirement decision. In the literature evidence is found for the incentives embedded in the old-age pension system; standard retirement age; pension replacement rate; pension accrual rate; and implicit tax on working. Furthermore, the literature also finds evidence for leisure and wealth incentives. The cyclical incentives are shown to have a small effect only. However, the social incentives are found to be significant in the literature. Additionally, discouragement, health deterioration and pleasure of working are shown to affect the retirement decision. Peer behaviour and caring for a relative is a reason for retirement, but only occasionally. The investment in human capital is found to have a significant effect on the employability of older workers.

Nevertheless, the financial incentives are shown to be most significant when examining retirement incentives. As financial incentives are embedded in the pension systems, the pension systems are the most important indicators when examining the labour participation. Besides the pension systems, demography is also taken into account, as every country is exposed to a different demography.

The case studies show that pension systems and demography differ considerably across countries. Besides, it demonstrates that the statutory retirement age and life expectancy have a weak effect on the labour participation of old-age workers. Furthermore, the accrual rates for early and late retirement affect the labour participation to a larger extent.

Consequently, the empirical analysis uses the results of the case studies to execute four regressions based on two models in the age groups 55-64 and 65-69. The regressions demonstrate that the statutory retirement age affects the labour participation, when not controlled for other variables. However, when the variables effective retirement age, pension replacement rate, early and late accrual rate, and life expectancy are added in the regression, the statutory retirement age does not significantly affect the labour participation rate. Instead, the effective retirement age and late accrual

rate are found to significantly affect the labour participation rate. Concluding, an increase of the statutory retirement age alone does not affect the labour participation rate of old-age workers in the Netherlands, but a simultaneous increase of the late accrual rate is required for the increase to be effective.

Bibliography

Books

- Menard, S. 1995. *Applied logistic regression analysis.* Thousand Oaks, CA: Sage.

Articles

- Auer, P., and Fortuny, M. 2000. Ageing of the Labour Force in OECD Countries: Economic and Social Consequences, *Employment paper 2000/2*
- Berkel, B., Börsch-Supan, A. 2003. Pension reform in Germany: The impact on retirement decisions, *FinanzArchiv* Vol. 60, no. 3: 393-421.
- Blöndal, S. and Scarpetta, S. 1999. The retirement decision in OECD countries, *OECD Economics Department Working Papers* No. 202
- Blöndal, S. and Scarpetta, S. 1997. Early retirement in OECD countries: the role of Social Security systems, *OECD Economic Studies* No. 29: 7-54
- Börsch-Supan, A. 2000. Incentive effects of social security on labor force participation: evidence in Germany and across Europe, *NBER Working Paper* Vol. 6780
- Brown, C. 2006. The Role of Conventional Retirement Age in Retirement Decisions *Michigan Retirement Research Center Working Paper* No. 120
- De Nederlandse Bank. 2008. Vroegpensioen, de levensloopregeling en het vermogen van Nederlandse huishoudens, *Kwartaalbericht maart 2008*
- Duval, R. 2003. Retirement behaviour in OECD countries: impact of old-age pension schemes and other social transfer programmes, *OECD Economics Studies* No. 37: 7-48.
- Euwals, R., Van Vuuren, D.J., Wolthoff, R.P. 2005. Early Retirement Behaviour in the Netherlands-Evidence from a Policy Reform, *IZA Discussion Paper* No. 1992.
- Farber, H., Haltiwanger, J., Abraham, K.G. 1997. The Changing Face of Job Loss in the United States, 1981-1995, *Brooking Papers on Economic Activity. Microeconomics* Vol. 1997: 55-142
- Field, G.S., Mitchell, O.S. 1984. Economic Determinants of the Optimal Retirement Age: An Empirical Investigation, *The Journal of Human Resources* Vol. 19, No. 2: 245-262
- Gustman, A.L., Steinmeier, T.L. 1985. The 1983 Social Security Reforms and Labor Supply Adjustments of Older Individuals in the Long Run *Journal of Labour Economics* Vol. 3, No. 2
- Gustman, A.L., Steinmeir, T.L. 2004. The Social Security Retirement Earnings Test, Retirement and Benefit Claiming, *NBER Working Paper* No. 10905.
- Lumsdaine, R.L., Mitchell, O.S. 1999. New Developments in the Economic Analysis of Retirement. *Handbook of Labor Economics* Vol. 3: 3261-3307.
- Martins, J. Gonand, F., Antolin, P. De la Maisonneuve, C., Yoo, K.Y. 2005. The Impact of Ageing on Demand, Factor Markets and Growth. *Economics Working Papers* No. 420
- OECD. 2006. Live longer, work longer *Ageing and Employment Policies*
- OECD. 2007. Pensions at a Glance: Public Policies across OECD countries
- Pingle, J.F. 2006. Social Security's Delayed Retirement Credit and the Labor Supply of Older Men, *Finance and Economics Discussion Series* No.37.
- Sap, J., Schippers, J. and Nijssen, J. Langer doorwerken en flexibel pensioen – second draft
- Streefkerk, M. 2009. Budgettaire en ecnomische effect AOW-plan Groen Links, *CPB Notiitie*

Internet references

- OECD. 2007. Ageing and Employment Policies - Statistics on average effective age of retirement.
  http://www.oecd.org/document/47/0,3343,en_2649_34747_39371887_1_1_1_1,00.html
- OECD. 2010. Country statistical profiles 2010.
  http://stats.oecd.org/Index.aspx?DatasetCode=CSP2010
- CBS. 2009. Investment climate; old-age dependency ratio, international comparison,
  http://statline.cbs.nl/StatWeb/publication/default.aspx?VW=T&DM=SLEN&PA=71445eng&LA=EN
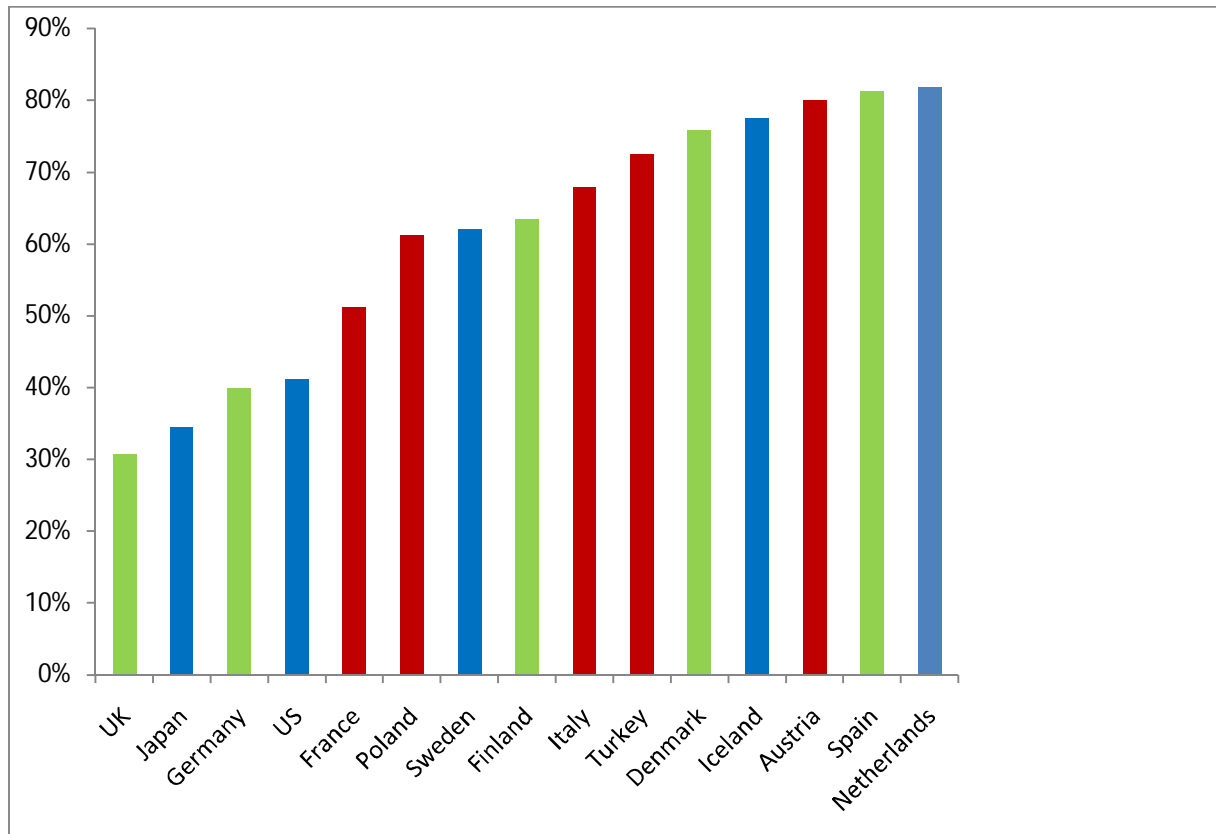
Appendix: Figures and Tables

Figure 7 - Early, statutory and effective retirement age, and life expectancy
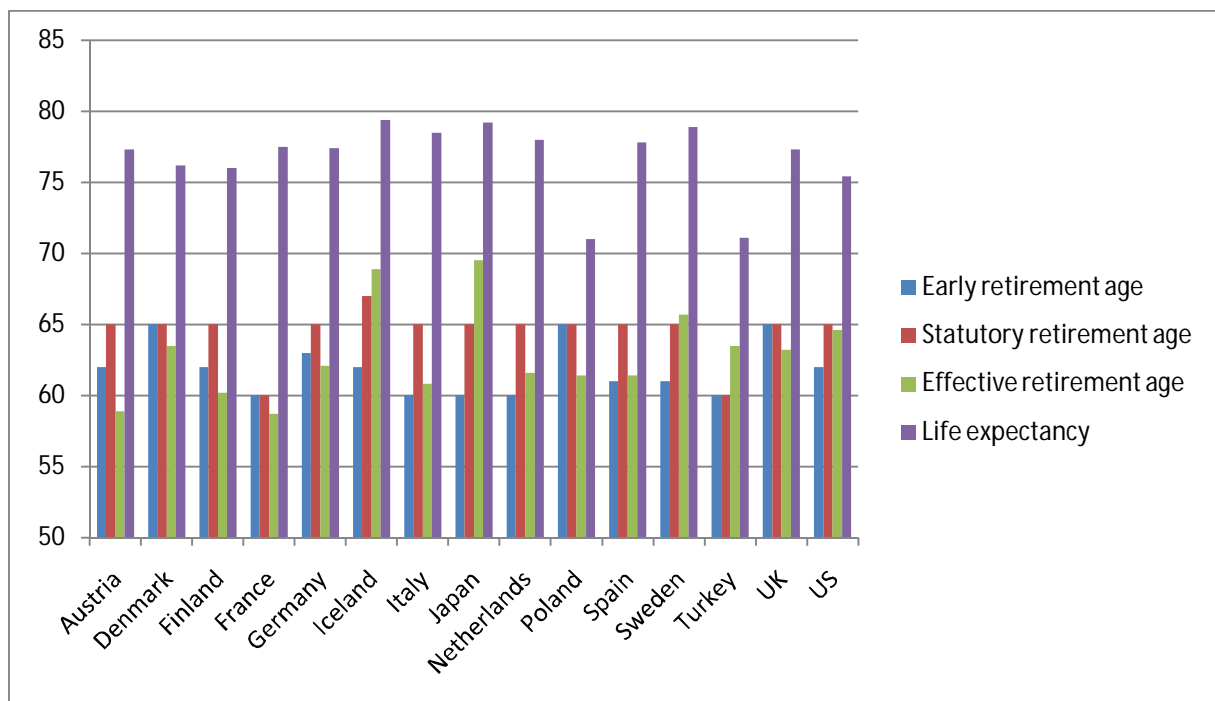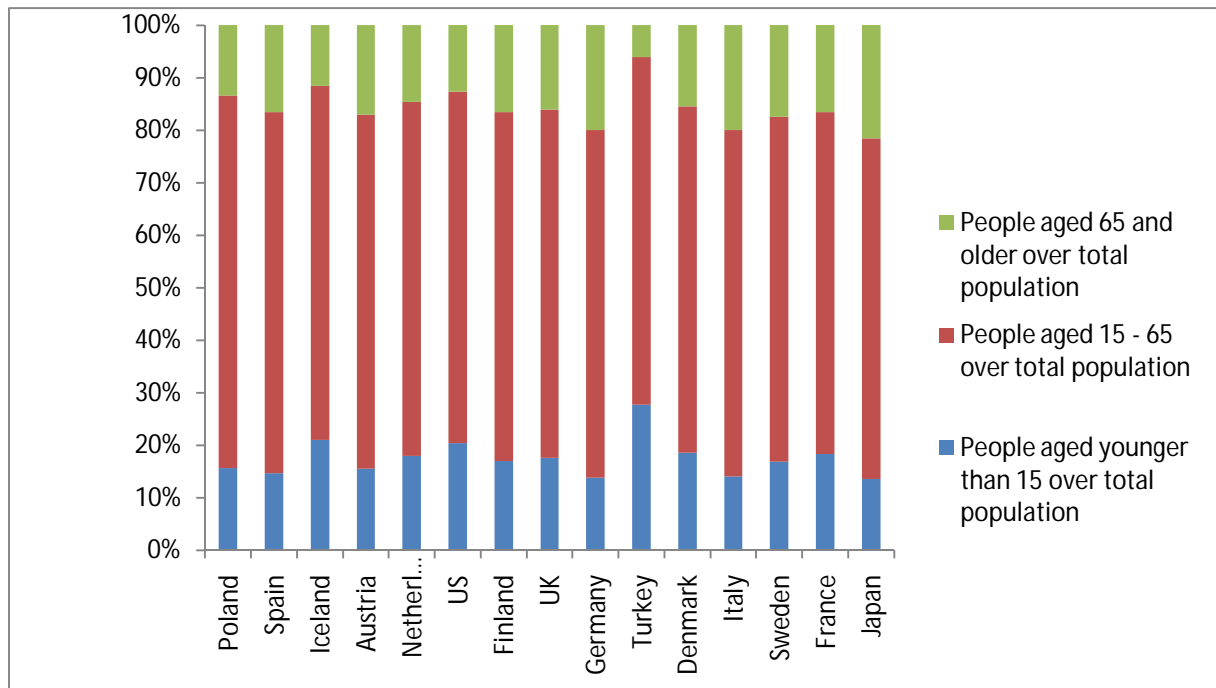

Source: OECD (2010)

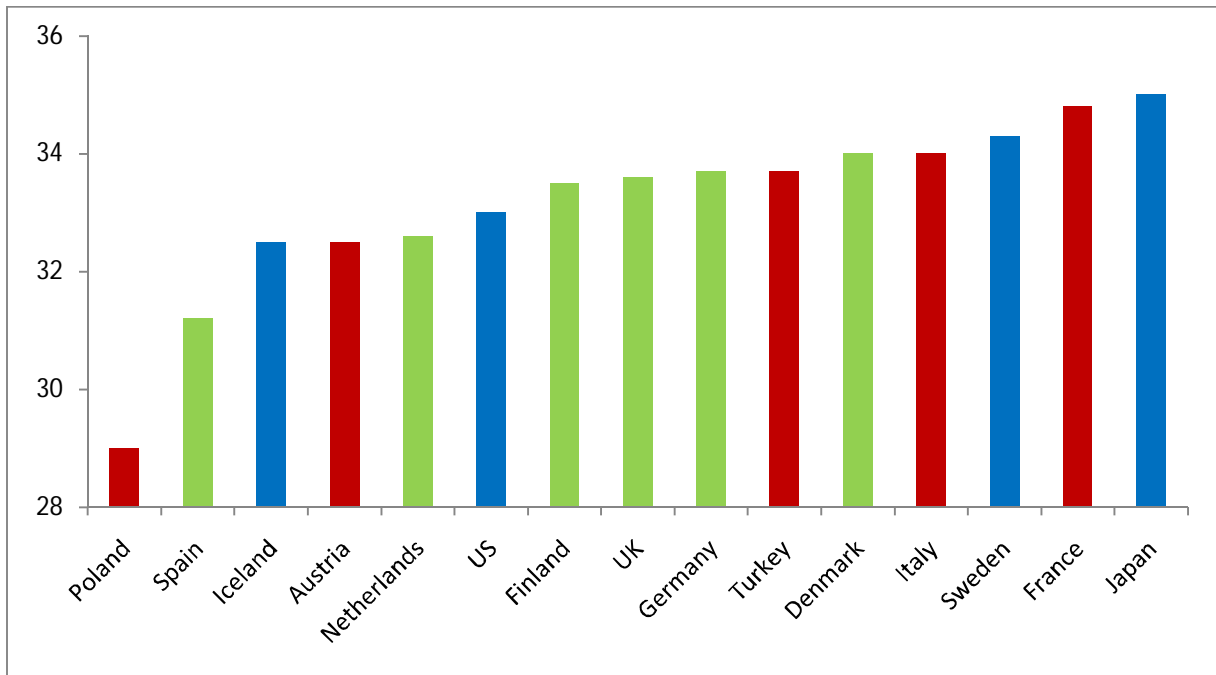**Figure 8 - Pension replacement rate**
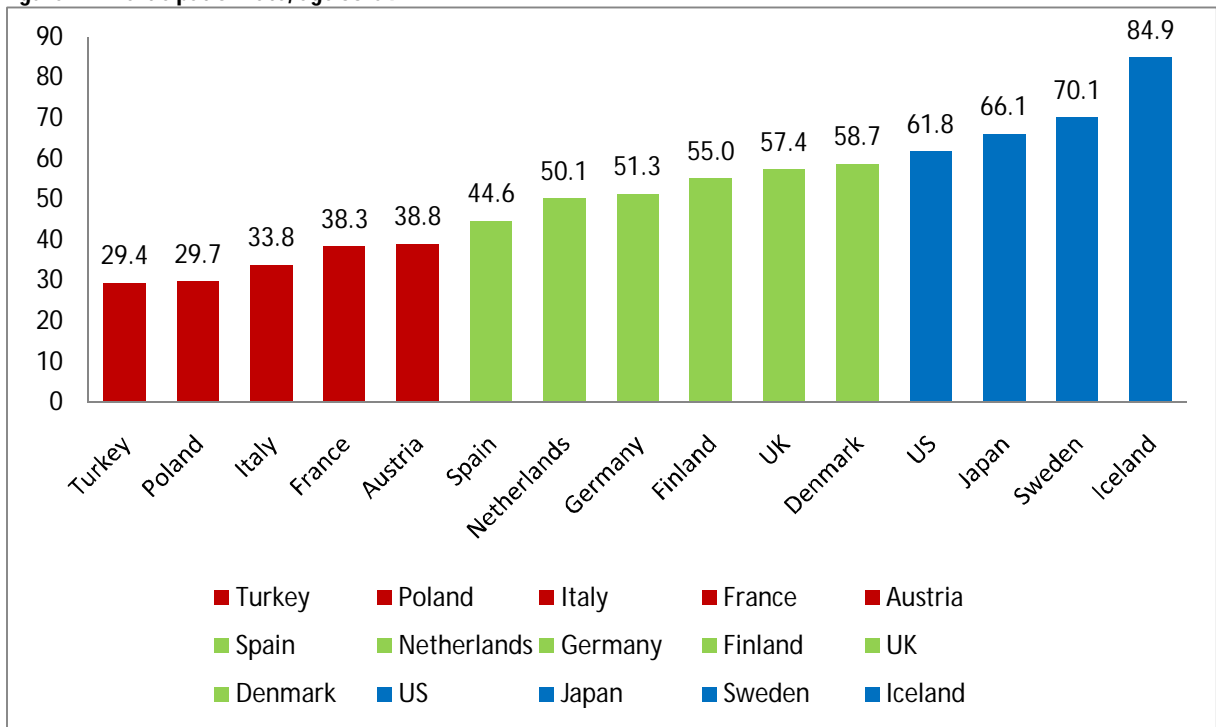

Source: OECD (2007)

Figure 9 - Age composition

Source: OECD (2010)

Figure 10 - Dependency ratio

Source: OECD (2010)

Figure 11 - Participation rate, age 55-64

Source: OECD (2010)

Table 13 - Participation rate per age group, 15-24, 25-54 and 55-64

	15-24	25-54	55-64
Austria	55.2	84.0	38.8
Denmark	67.4	86.1	58.7
Finland	46.4	83.3	55
France	30.1	82.1	38.3
Germany	45.9	80.3	51.3
Iceland	74.3	89.4	84.9
Italy	24.7	73.5	33.8
Japan	41.4	80.2	66.1
Netherlands	65.4	83.6	50.1
Poland	25.8	74.9	29.7
Spain	42.9	76.8	44.6
Sweden	46.3	86.1	70.1
Turkey	30.4	54.2	29.4
UK	55.9	81.3	57.4
US	53.1	79.9	61.8
Average	47.0	79.7	51.3

Source: OECD (2010)

Table 14 - Extrapolation of the labour participation in the age group 25-54 and 55-64 to the age group 65-69, 65-74 and 75-84

	25-54	55-64	65-69	65-74	75-84
Austria	84.0	38.8	23.0	16.2	-6.4
Denmark	86.1	58.7	49.1	45.0	31.3
Finland	83.3	55.0	45.1	40.9	26.7
France	82.1	38.3	23.0	16.4	-5.5
Germany	80.3	51.3	41.2	36.8	22.3
Iceland	89.4	84.9	83.3	82.7	80.4
Italy	73.5	33.8	19.9	14.0	-5.9
Japan	80.2	66.1	61.2	59.1	52.0
Netherlands	83.6	50.1	38.4	33.4	16.6
Poland	74.9	29.7	13.9	7.1	-15.5
Spain	76.8	44.6	33.3	28.5	12.4
Sweden	86.1	70.1	64.5	62.1	54.1
Turkey	54.2	29.4	20.7	17.0	4.6
UK	81.3	57.4	49.0	45.5	33.5
US	79.9	61.8	55.5	52.8	43.7

Table 15 - Extrapolation of the labour participation in the age group 15-24, 25-54 and 55-64 to the age group 65-69, 65-74 and 75-84

	15-24	25-54	55-64	65-69	65-74	75-84
Austria	55.2	84.0	38.8	48.3	47.0	42.9
Denmark	67.4	86.1	58.7	64.9	64.2	62.0
Finland	46.4	83.3	55.0	67.4	68.0	70.2
France	30.1	82.1	38.3	55.7	56.3	58.4
Germany	45.9	80.3	51.3	62.8	63.2	64.6
Iceland	74.3	89.4	84.9	90.0	90.8	93.5
Italy	24.7	73.5	33.8	50.1	50.8	53.1
Japan	41.4	80.2	66.1	79.2	81.1	87.3
Netherlands	65.4	83.6	50.1	56.0	54.9	51.1
Poland	25.8	74.9	29.7	46.1	46.4	47.4
Spain	42.9	76.8	44.6	55.9	56.0	56.5
Sweden	46.3	86.1	70.1	83.6	85.4	91.3
Turkey	30.4	54.2	29.4	37.3	37.3	37.0
UK	55.9	81.3	57.4	65.9	66.0	66.4
US	53.1	79.9	61.8	70.8	71.5	73.6

Table 16 – Values nominal variables

	Tier 1	Tier 2 - Public or Private	Tier 2 - System	Accrual rates
1	Basic	Public	DB	Early
2	Minimum	Private	DC	Late
3	RT	Public + Private	Points	Both
4	Basic + Minimum		NDC	None
5	Basic + RT		DB + Points	
6	Minimum + RT		NDC + DC	
7			NDC + DB + DC	

Table 17 - Correlation matrix

	Participation rate 55-64	Participation rate 65-69	Statutory retirement age	Early retirement age	Effective retirement age	Pension replacement rate	Tier 1	Tier 2 - Public or private	Tier 2 - System	Early accrual rate	Late accrual rate	Accrual rate	Dependency ratio
Participation rate 55-64	1.000												
Participation rate 65-69	.994	1.000											
Statutory retirement age	.577**	.539**	1.000										
Early retirement age	.098	.069	.381	1.000									
Effective retirement age	.756***	.805***	.359	-.036	1.000								
Pension replacement rate	-.187	-.200	.059	-.198	-.248	1.000							
Tier 1	.150	.116	-.167	.303	-.111	-.056	1.000						
Tier 2 - Public or private	.205	.185	.292	.303	.230	.280	-.099	1.000					
Tier 2 - System	-.199	-.225	-.159	.051	-.165	-.090	.101	.605**	1.000				
Early accrual rate	.385	.374	.209	-.467*	.192	-.067	.064	-.260	.024	1.000			
Late accrual rate	.81***	.802***	.421	.358	.563**	-.549**	.312	-.129	-.282	.280	1.000		
Accrual rate	-.130	-.107	-.263	-.149	.032	.174	-.425	.297	-.026	-.228	-.298	1.000	
Dependency ratio	.294	.309	-.306	-.398	.216	-.360	.231	-.408	-.067	.220	.377	-.422	1.000
Life expectancy	.594**	.549**	.437	-.308	.262	-.056	.159	-.139	-.086	.561**	.442*	-.475*	.473*

* Statistical significant at a 10% significance level; ** at 5% level; *** at 1% level.

Table 18 - Descriptive Statistics

	Mean	Standard Deviation	Minimum	Maximum
Participation rate 55-64	51.33	15.905	29.4	84.9
Participation rate 65-69	41.41	19.567	13.9	83.3
Statutory retirement age	64.47	1.885	60.0	67.0
Early retirement age	61.87	1.885	60.0	65.0
Effective retirement age	62.93	3.199	58.7	69.5
Pension replacement rate	61.41	17.805	30.8	81.9
Tier 1	Minimum	-	-	-
Tier 2 - Public or private	Public	-	-	-
Tier 2 - System	DB	-	-	-
Early accrual rate	3.86	2.962	0.0	7
Late accrual rate	4.59	3.572	0.0	10.4
Accrual rate	Both	-	-	-
Dependency ratio	33.16	1.513	29.0	35.0
Life expectancy	76.73	2.572	71.0	79.4