# MEMORANDUM

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## Labour Supply Response
## of a Retirement Earnings Test Reform

**Erik Hernæs**
**Zhiyang Jia**

## Department of Economics
## University of Oslo

## Last 10 Memoranda

# Labour Supply Response of a Retirement Earnings Test Reform[*]

Erik Hernæs, Frisch Centre and Zhiyang Jia, Statistics Norway and Frisch Centre

Abstract:

Norwegian administrative data are used to evaluate the impact of a doubling of the threshold in the earnings test on the labour force activity. We find no impact on labour market participation, but positive effects on earnings. The effect increases with exposure to the reform and is stronger for individuals with earnings around the threshold and with high education. Individuals who remain active until retirement age respond more to the reform than those who left labour force earlier. The results indicate both substantial labour supply responsiveness among elderly, and heterogeneity with respect to preferences, labour market options or both.

JEL classification: J14; H55

Keywords: Retirement earnings test; Benefit entitlement; Labour supply behaviour; Heterogeneity;

# 1. Introduction

Demographic transition has led governments around the world to seek measures to encourage their workforces to delay retirement. One of the candidates for reform was the old age pension earnings test and one of the first to reform was the US, which in 1983 exempted workers aged 70-71 and in 2000 exempted workers above full retirement age from the Social Security earnings test.[1] The earnings test in the UK ("earnings rule") which implied 100 % withdrawal of pension against earnings in an interval corresponding roughly to between 21 and 35 hours per week[2] at average earnings, was abolished in 1989 (see Disney and Smith, 2002 for details, as well as overview of earnings tests in OECD countries). In a sequence of reforms, Japan has amended its earnings test to be more liberal for those between 60 and 65, and the social security benefit schedule has been revised so that actuarially fair payoffs are received until age 70. In Australia, the recent abolition of all benefits taxation from age 60 is designed to increase the labour force participation of older workers.

Considering the potential impact of this particular reform on elderly labour force participation, and the theoretical ambiguity of the labour supply response to changes in the earnings test, the earnings test reform has received remarkably little attention in the literature. Most studies to date have focused on the US 2000 repeal. Results vary, but the general thrust of recent analyses undertaken suggest that earnings test abolition leads to a quite significant increase in elder labour supply (Engelhardt and Kumar 2007; Friedberg 2000; Friedberg and Webb 2006; Song and Manchester 2007). Engelhardt and Kumar (2007) report a strong response from workers without higher education of up to 24 %. Michaud and van Soest (2007)

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[1] Legislated under the "Senior Citizens Freedom to Work Act". See Haider and Loughran (2008) for details.
[2] In an interval corresponding to less than 2 weekly hours at average earnings, the test implies 50 % withdrawal.

report increases in retirement age expectations. Gustman and Steinmeier (2004) use a structural labour supply model to examine the impacts of a simulated abolition of the remaining earnings test (on those aged 62-65), and estimate that the test reduces the share of married men who work full time by about 4 percentage points. In the most recently published study of the US reforms, Haider and Loughran (2008) utilize a variety of data sources, giving a lot attention to reconciling data sources. They conclude that the US earnings test in operation until 2000 did significantly reduce earnings of persons over the full retirement age, with the main effect for those at the lower end of the age bracket. They also point out the continuing impact of the earnings test in the US, as is still applies to those between 62 and full retirement age, which is scheduled to increase to 67 by 2022.

Disney and Smith (2002) confirm the impact of the earnings test in a study based on UK data for the abolishment of the earnings test in 1989. They estimate an increase of 3-4 hours per week for males and around half of that for females. For Canada, Baker and Benjamin (1999) find shifts from part time to full time work, which they tentatively attribute to fixed costs of work or labour market rigidities. The conclusion that an earnings test depresses work activity still comes through.

Norway is currently undertaking a comprehensive reform of retirement policy. Norway's public social security system provides benefits from age 67[3], but with an earnings test for those aged 67-69. Up to 1 January 2008, 40 % of earnings exceeding a threshold were deducted from the public pension. The threshold was around one sixth of average full time earnings up 1 January 2002, when it was doubled. Part of the ongoing pension reform is to eliminate the earnings test completely, and it was abolished for those aged 67 from 2008 and for those aged 68 from 2009. In the current system there is no deferral, so the earnings test can be viewed as a "real" tax.

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[3] Civil servants and about half of the private sector workers fall under the AFP system, which provides retirement benefits from age 62.

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This paper examines the labour market response to these measures. We analyze the changes in earnings following the reform implemented in 2002, which doubled the wage threshold for the earnings test. We employ unique data from administrative registers, spanning the years 1999 – 2003, covering many socioeconomic dimensions of the whole population and containing extensive information on employment and income. Although not containing hours of work, the data are very accurate on annual income with decomposition into earnings, capital income and pensions.

In broad terms, our analysis indicates a positive labour supply response to the earnings test reform. Like many analysts, we find bunching of people below thresholds and a corresponding movement of the peaks with the 2002 doubling of the threshold. The impact of the earnings test is also confirmed by a difference-in-difference analysis of this reform. However, we find no clear evidence that the reform increase the labour market participation. It seems that the effect is mostly on the intensive margin.

Individuals may need time to adjust their labour supply behaviour when facing a new threshold, especially those who have already left the labour market, suggesting that the reform will have different effect for different cohorts who are affected. The empirical evidence supports this hypothesis and indicates that the effect of the reform increases with the exposure to the earnings test reform. We also find that the effect was quite uneven over population. Men and persons with high education responded more strongly to the reform than women and person with low education. The strongest increase in the level of earnings was found among individuals with earnings around the threshold, where labour force participation was not significantly affected. In addition, our results suggest that the labour market status at age 66 can serve as a strong "predictor" for the response to the reform. Those who are still active in labour market at age 66: self employed and wage earners, react more strongly than those who are already out: early retirees and disability pensioners.

The paper is organized as follows. In Section 2 we give a brief introduction of the Norwegian pension system. In Section 3 we discuss the potential impact of the earnings test. Section 4 presents the data and in Section 5 we give a brief overview of elderly labour supply and a descriptive analysis of the impact of the 2002 reform. The difference in difference approach and estimation results are discussed in section 6. In Section 7 we look at the different responses from different subgroups. Section 8 concludes.

## 2. Institutional Settings

The backbone of Norway's retirement provision system is a mandatory, public, pay-as-you-go defined benefit plan, the National Insurance System (NIS), available from age 67[4]. The system is organized around a unit called the basic amount (G), which is adjusted usually once each year, in accordance with changes in the general income level. In 2008, one basic amount (1G) was 69108 NOK[5]. Benefits consist of a basic pension (1 G) and an earnings related pension. The earnings related pension is based on the average of the highest 20 years of earnings, with benefits currently set at 42 % of earnings between 1 and 6 G and 14 % of earnings between 6 and 12 G.[6] The NIS is therefore very progressive and redistributive. Stable earnings at the maximum pension accruing level (12 G), which in 2008 was approximately twice average full time earnings, imply a replacement rate of 33 %. In contrast, the replacement level is 60 % at stable earnings which just give the minimum pension.

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[4] An overview of the Norwegian National Insurance System can be found in The ministry of labour and social inclusion (2009a), and descriptions of the proposed reform in "Summary of Report No. 12 (2004-2005) to the Storting" (2005) and The ministry of labour and social inclusion (2009b)

[5] The average exchange rate in 2008 rate was 8.23 NOK per EURO. Average full time earnings in 2008 were around 410 000 NOK.

[6] Earnings from before 1 July 1992 and therefore gradually phased out, give percentages of 45 and 15, respectively.

In addition to the NIS, there are occupational pensions both in the public and in the private sector. The public sector pension is fully integrated with the NIS, so that the two combined give a pension which is 66 % of the final salary at full accrual which is 30 years.

In the private sector, the occupational pensions are firm based. In 2001, 85 per cent of all recent retirees received an occupational pension, adding an average of about 30 per cent to their NIS pension. Until 2001, only contributions to occupational pensions which were of the defined benefit type and which also complied with specifications in the legislation on these pensions, qualified as a tax deductible cost for the firms. As a consequence, almost all pensions were of this type during our observation period. Private sector occupational pensions of the DB type are like those in the public sector designed to supplement the NIS pension and target a (total) replacement rate defined as the sum of pre tax NIS and occupational pension divided by the final salary. The predominant replacement target is 66 per cent (Pedersen 2000).

There are also early retirement programs (AFP), available from age 62, covering the public sector and about half the private sector.

Up to 1 January 2008, when it was abolished for persons aged 67, there was an earnings test for persons aged 67-69. During our observation period, the test implied that the NIS pension was reduced by 40 per cent of earnings exceeding a certain threshold, which was 1 G up to 1 January 2002 and 2 G thereafter. The test for occupational pensions is more complex. For workers from the public sector, only earnings from continued public sector employment after age 67, with a wage rate above a special "retiree" wage rate, which is about two thirds of the average, leads to a reduction in occupational pension from the public sector. It then leads to a reduction also in the NIS pension. Earnings from the private sector do not influence neither the NIS pension nor the occupational pension of public sector retirees.

Workers with occupational pensions from the private sector can choose whether to receive their occupational pension unabridged or defer it with an actuarial adjustment.

For firms, contributions are taxed like wages. For employees, pensions are taxed under an EET paradigm (contributions and fund earnings are tax both Exempt and benefits are Taxed under the income tax). [7]

At age 67, all can apply for old age pension in the standard system (NIS). As they do so, they report expected earnings and the earnings test is applied. As the earnings test applies year by year and there is no adjustment of later NIS pension, there is no incentive not to take out what is left after the earnings test[8]. Unlike the case in the US with adjustment via deferral, the Norwegian test can unambiguously be viewed as a tax and we do not have to assume myopic behaviour as do for instance Friedberg and Webb (2006). Neither do the concerns arise in the Norwegian case about the standard of living at very advanced ages, which may happen if removal of the earnings test induces early take up at reduced level of benefits. This is an issue for the US (Gruber and Orszag 2003). The magnitude of this implied tax rate depends also on the impact on occupational pensions, as described above.

## 3. The Labour Supply Responses of the Earnings test

Standard economic theory depicts the earnings test as a tax on earnings for all those with earnings above the lower threshold where the earnings test starts to be effective (the exempt amount) and below the level where all NIS pension is exhausted. The earnings test therefore creates two kinks in the budget set. The lower kink will be at exempt amount, whereas the upper kink will be individual since it depends on the pension level.  See Disney and Smith

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[7] Tax rates on pension income are lower than tax rates on earnings.
[8] Some may have an incentive to continue working to increase their entitlements, either because they had less than the full number of years of accrual (40 years in the NIS and often 30 in public or private OP), or to improve the 20 best years in NIS or the final salary in the OP. This effect is likely to be small and is also not different from just before age 67.

(2002) and Friedberg (2000) for graphic illustrations of budget constraints under UK and US earnings test respectively.

Abolishment of the earnings test reduces the marginal tax on work and removes the kinks. First, there should be an intensive margin response, which is the net result of increased return to work (substitution effect) and increased net income (income effect). For those with so high earnings that all the benefits are taxed away only the income effect applies and we expect a reduction in earnings. This is the case only for very few, as can be seen from the empirical overview below. For those with earnings between the two kinks, the income effect and the substitution effect operate in opposite directions and the income effect increases with the level of earnings. The net effect is an empirical question. If there are rigidities for instance in the choice of working hours or fixed costs of working, also persons below the lower kink may be affected and we may have an effect also on the extensive margin (labour force participation). Some of the individuals with earnings much lower than the lower kink may not be active in labour market irrespective of the earnings test. For these individuals a reform of the earnings test will not have any effect. Thus, effects on earnings of abolishing the earnings test will be different across individuals. See Song and Manchester (2007) for similar arguments.

In addition, eliminating the earnings test may also have effect on younger workers' retirement plans and they may adjust their labour supply accordingly. However, evaluation of the long-run impact requires a dynamic life cycle model (as French 2005) of both labour supply and consumption behaviour, taking into account also that it may be more difficult to the (re)enter the labour market than to stay in. This is beyond the scope of this analysis, but we look at one aspect of labour market dynamics by conditioning on the labour force status at age 66.

## 4. Data

We base our analysis on administrative data, which are merged administrative registers received from Statistics Norway, with permission from the Norwegian Data Inspectorate. We use demographic data files, old age pension registry and tax return records. These files are linked by a unique personal identification number[9]. The files cover the whole population of Norway.

Demographic files contain both birth and death dates, gender, education and other demographic variables. The old age pension register records the date of the old age pension benefit taking up, accumulated pension rights, and actual pension paid. Tax return files record summary earnings from various sources, including pension income (sum of both NIS pension and OP pension), wage income, income from agriculture, and other pension giving income. The sum of all pension giving income, which essentially includes wages and self employed earnings and excludes capital income and pensions, is referred to as earnings in the following. In this study, we mainly use data from 1999-2003. However, for earnings history, we have also used data that date back to 1967.

As Song and Manchester (2007) mentioned, using administrative data provides advantages as well as disadvantages over other data used for studying the effects of the earnings test. The administrative data are not plagued by the self-reporting problems common in survey based records, which is particularly important in this context, since "accurate earnings data are crucial for analyzing responses around the test threshold". On the other hand, although we have data on education, detailed income by sources and information on family characteristics, our data miss some crucial information for labour supply models, such as hours of work and health status.

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[9] This number is encrypted version of the official personal identification number and is only used for internal linking of files at the Frisch Centre.

We limit our sample to all individuals who are of age 67 to 72 from year 2000 to 2003. Summary statistics are presented in Table 1.

**Table 1: Summary Statistics**

| Year | 2000 | 2001 | 2002 | 2003 | Total |
|---|---|---|---|---|---|
| Share of females | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 |
| Years of schooling | 9.30 | 9.42 | 9.55 | 9.87 | 9.53 |
| Financial wealth (1000 NOK) | 339 | 363 | 376 | 404 | 370 |
| Average pension points (for the NIS) | 3.05 | 3.08 | 3.11 | 3.15 | 3.10 |
| Share of individuals active in labour market[10] | 0.19 | 0.19 | 0.19 | 0.20 | 0.19 |
| Average earnings (1000 NOK) | 17 | 19 | 19 | 22 | 19 |
| Number of observations | 205162 | 201562 | 198450 | 197287 | 802461 |

# 5. Labour Market Behaviour of the Elderly and the 2002 Reform

We start our analysis by looking at the pattern of elderly labour market behaviour. We find that the majority of people (around 96 %) are registered as receiving old age pension as soon as they reach the eligibility age at age 67. Individuals reduce their labour market activities sharply after 67. The average earnings share out of total income drops sharply with age (figure 1), which implies pension income is the main income source for the individual over 67. The same pattern holds for both year 2000 and 2002.

Figure 2 shows the age specific transition probabilities from "not working" at age *t-1* to "working" at age *t* for the 1931-1934 cohorts from age 67 through 71. Working is defined as being active in the labour market, i.e. having annual earnings over 0.2G (see also footnote 10). As we expect, the probability declines with age. It is quite small, ranging from 1.4

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[10] Active in labour market is defined as having annual earnings over 0.2G (around 10,000 NOK). This corresponds to roughly work 2 hours per week at average wage rate.

percent to 2.5 percent, showing that very few in this age group actually re-enter the labour market. The numbers are very close to what Song and Manchester (2007) found on US data. In addition, there is no indication of pattern shift across the different cohorts.

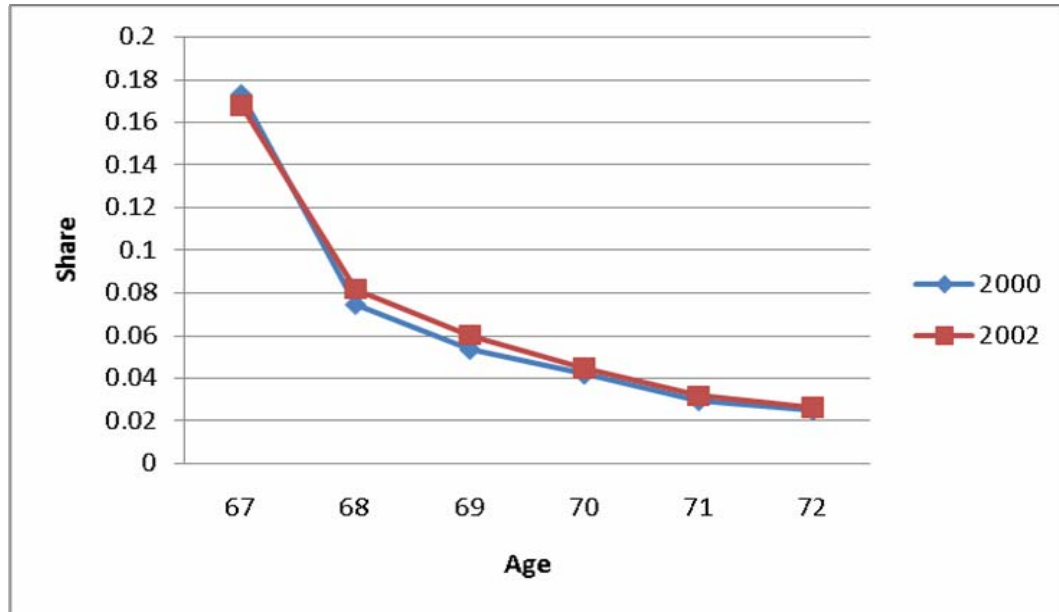**Figure 1: Share of earnings in total income by age and year**



**Figure 2. Transition probabilities from not working to working, by age and cohort**
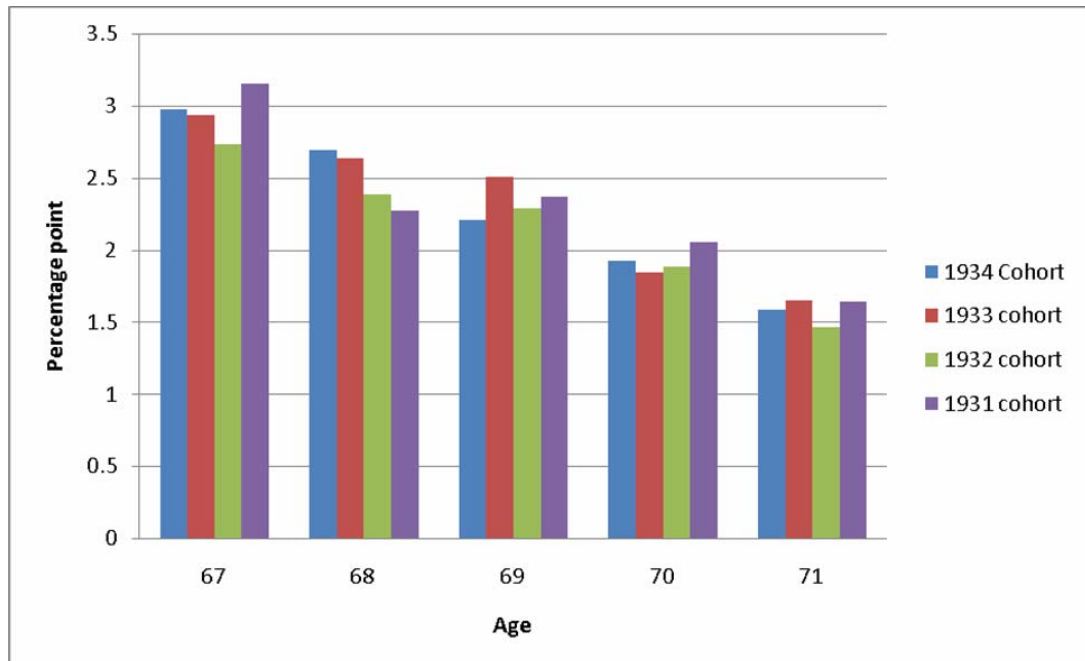
Figure 3 shows the distribution of positive earnings over different ages for the 1932 cohort. For 67 years old, earnings are imputed to be after the birthday and therefore subject to the test. For age 67 to 69, there are peaks around the earnings test threshold. The peak disappears when individuals reach age 70. This peak can be explained by the kinks in the budget constraints created by the earnings test. Individuals react to the earnings test by holding down their labour supply when the earnings test is present. Without the test we would expect a smooth decline. As discussed in section 3, this peak does not necessarily imply that a retirement earnings test reform, either raising the threshold or completely abolishing it, will increase the aggregate labour supply, since the effect varies across the earnings distribution. We expect that such a reform will increase the labour supply of individuals with earnings around the threshold (substitution effect dominates). For those with earnings above the threshold, the income effect becomes more important with higher earnings, until only the income effect remains for those with so high earnings that all the benefits are taxed away. For this group, labour supply may be reduced. However, there will be relatively few individuals in this group. For a pension from a stable, average full time earnings history to be taxed away, post-retirement earnings would have to be around 600 000 NOK, which is far out in the tail of the retirement earnings distribution and well outside the plots in Figure 3.

The increase in the earnings test threshold from 1 to 2 G from 1 January 2002 gives us a chance to look into how the earnings test affects elderly labour supply and earnings. Figure 4 shows the distribution of earnings for age groups 68 and 69, who both had a full year of exposure to the test, before and after the 2002 reform. The change of the earnings rule threshold had a clear impact on earnings for in both age groups. As expected the clusters around 1G disappears after the reform (year 2002), and is replaced by new clusters at the new threshold 2G. The new peaks are less prominent than the old ones, since there are fewer

**Figure 3. Distribution of earnings of 1932 cohort, by age.**
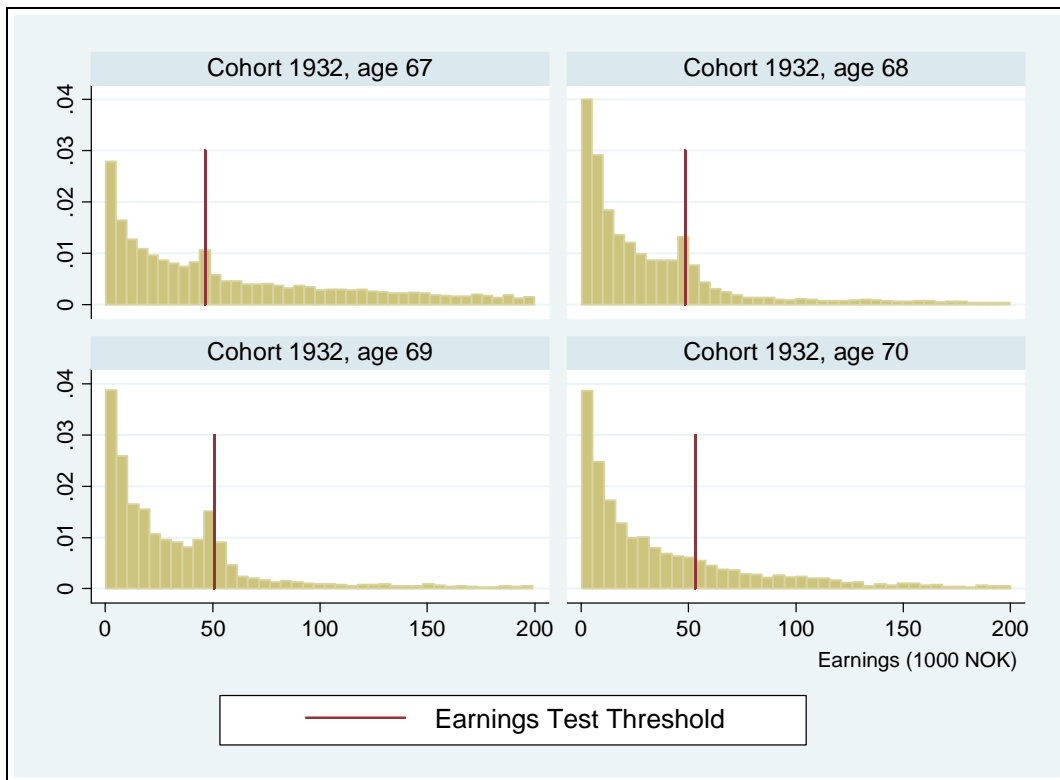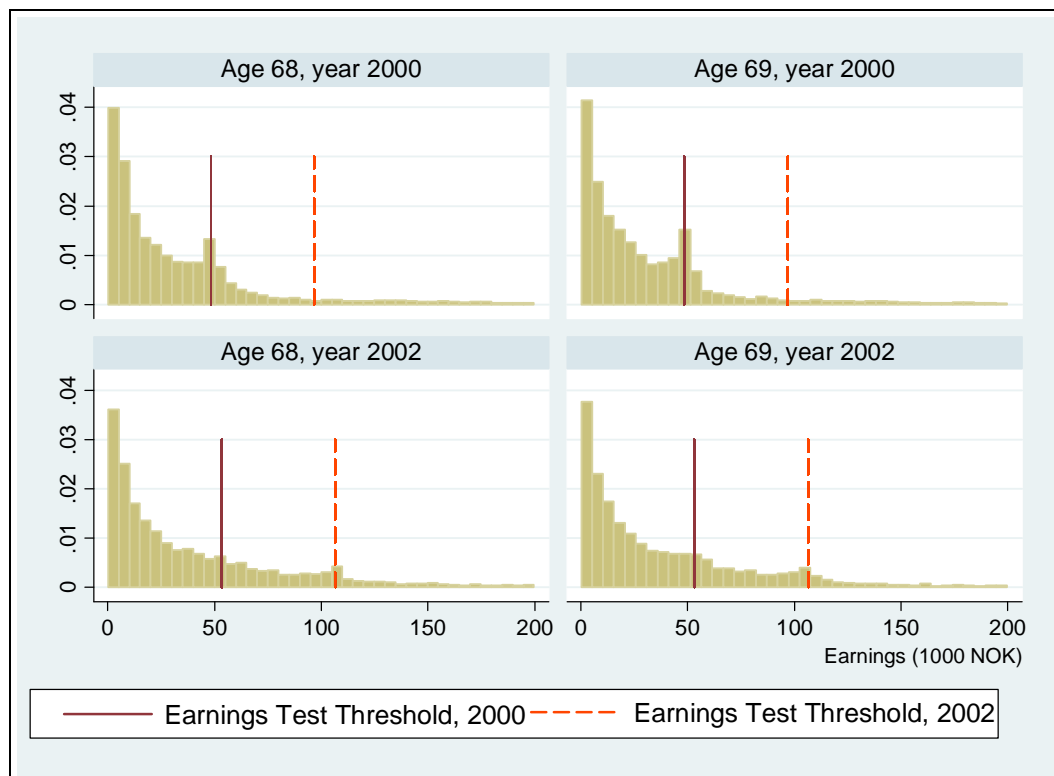


**Figure 4. Distribution of earnings before and after 2002 reform.**

individuals in this part of the earnings distribution and therefore affected by the earnings test rules after the 2002 reform.

# 6. Regression analysis

## 6.1 Model and Identification strategy.

To evaluate econometrically the effect of the doubling of the exempt amount in 2002, we compare the changes in earnings before and after the reform of two groups of individuals. Group 1 (the treatment group) consists those who were affected by the earnings rule change, namely those aged 67-69. Group 2 (the control group) consists of those who faced no earnings test during the study period, namely those aged $70^{11}$ to 72. A similar identification strategy was used by Song and Manchester (2007) and Disney and Smith (2002). The purpose of the control group is to account for important unobserved factors which influence the labour supply behaviour of all, for example, uncontrolled macro economic conditions which have a direct impact on labour demand, and/or a consequence of changed social norms – *e.g.* generally increased acceptance of post retirement employment.

Table 2 shows the average of earnings for both control group and treatment group over the period 2000-2003. As expected, we observe sizable increases in earnings for the treatment group after the reform. These increases are significantly larger than the differences between the two years before the reform. The differences for the control group are much smaller than those of treatment group, and they are of a similar magnitude as the differences between the two years before reform. Table 2 also suggests that there is sizable variation in labour supply behaviour of the elderly over different years, which can be seen as an indication of the importance of accounting for the year effects.

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[11] We assume earnings to have arisen after the birthday when they become 70 and no test applies, alternatively that they act as if this was the case, perhaps to preserve options of further work.

**Table 2: Earnings over years and ages (NOK)**

| Year | 67 | 68 | 69 | 70 | 71 | 72 |
|---|---|---|---|---|---|---|
| | Treatment Group | | | Control Group | | |
| 2000 | *44019* | *19983* | *14153* | 11141 | 8535 | 6502 |
| 2001 | *47253* | *22825* | *15847* | 12289 | 9059 | 7169 |
| 2002 | **46978** | **24892** | **17602** | 12779 | 8473 | 7330 |
| 2003 | **53415** | **25494** | **20139** | (14422) | 9792 | 7246 |
| Difference, from 2000 to 2001 | 3235 | 2842 | 1694 | 1149 | 524 | 667 |
| Difference, from 2000 to 2003 | 9396 | 5511 | 5986 | 3282 | 1257 | 743 |

Note: Earnings under an earning test with threshold 1 G is marked in italics and earnings under a 2 G threshold test are marked in bold. 70 years old in 2003 are put in parentheses since they were dropped from the analysis (see text).

The descriptive empirical evidence indicates that the 2002 reform encouraged some individuals to increase their earnings. To formalize this idea, we will make use of following regression model: for individual $i$ at year $t$=2000, …, 2003,

$$y_{it} = \alpha + X_{it}\beta + \sum_t \gamma_t D_t + \sum_t \lambda_t D_t \bullet \Delta_{it} + e_{it} \quad (1),$$

where the dependent variable $y_{it}$ can be a dummy variable which represents the decision on labour market participation or earnings level, $X_{it}$ denotes individual characteristics, including age and gender dummies and length of education. $D_t$ is the time dummy. $\Delta_{it}$ equals to 1 if individual $i$ belongs to the treatment group at year $t$. The interaction terms $D_t \bullet \Delta_{it}$ are included to capture the different changes of the treatment group at different years.

Our identification hinged on the important assumption that there are no shocks other than the retirement earnings test reform that affect the labour supply behaviour of the treatment group differently from the control group. If the model is correctly specified and the

control groups are appropriate, we expect that the estimates for the coefficients associated with the interaction terms prior to the 2002 reform should not be significantly different from zero. This can serve as a simple specification test for our difference-in-difference approach.

There is potentially a problem using those born after 1932 as our control group, since they were in the treatment age when the reform was introduced in 2002. As Disney and Smith (2002) point out, if there are employment dynamics such that labour supply decisions taken at age 67-69 affect labour supply decisions at age 70-72, the control group in the difference-in-difference approach will not be appropriate. Given this concern, the sample we used in the regression is the individuals aged 67-72 with positive earnings from year 2000 to 2003, except that 70 years old in 2003 are dropped since they were 69 years old in year 2002 when the reform was introduced and therefore affected.

## 6.2 Estimation results

**Effect on Labour Market Participations**

To evaluate the effect of the reform on labour market participation, we use a Probit specification. Using the same definition as in section 5, all individuals with annual earnings over 0.2G (around 1200 EUR) are classified as active in labour market.

Table 3 reports estimation results from the probit model. We have included the full set of interaction terms between treatment group and year dummies ($D_{2000}\Delta_{i,2000}$ is omitted to avoid perfect multicollinearity). As we can see from the table, the false treatment dummy $\lambda_{2001}$ is not significantly different from 0. In addition, none of the treatment variables seem to have a significant effect on labour market participation. The p value for the likelihood ratio test for $\lambda_{2003} = \lambda_{2002} = \lambda_{2001} = 0 (= \lambda_{2000})$ is 0.12 and we can not reject the hypothesis that the reform had no effect on labour force participation. This stands in contrast to what Engelhardt and Kumar (2007) find in the US. However, we have to keep in mind that the 2000 reform in

the US is a total abolishment of the earnings test, while the reform in Norway is just a shift of the threshold. Also, there is no deferral in Norway as in US, so the reform in Norway has a more clear cut interpretation as a tax.

**Table 3: Estimates of Marginal Effects on Labour Market Participation**

|  | Estimates | S.E |
| --- | --- | --- |
| Treatment dummy, 2001 | -0.0087 | 0.0102 |
| Treatment dummy, 2002 | -0.0215 | 0.0102 |
| Treatment dummy, 2003 | -0.0211 | 0.0113 |
|  |  |  |
| N | 713065 |  |
| Log Likelihood | -312255.4 |  |
| Pseudo R2 | 0.0897 |  |

Notes: The dependent variable is labour market participation (1, working; 0 not). Other covariates included in the probit regressions are a constant, female dummy, age and year dummies, average pension points, and financial wealth.

**Effect on Earnings**

The analysis of the effect on the earnings is more challenging, since a large fraction of sample have zero earnings. See a detailed discussion in Song and Manchester (2007). A selection specification which simultaneously account for both participation decision and earnings seem to be desirable here. However, given that the previous analysis indicated that there was no substantial change in participation over the observation periods, we have chosen to use a much simpler framework. We use quantile regression on observations with non zero earnings. This has two advantages compared to OLS. First, median regressions are more robust than mean regressions (OLS), since they do not impose the normality assumptions.

Second, OLS estimates will only capture the mean changes before and after reform and are not appropriate to capture the uneven impact over the earnings distribution depicted by theory.

Table 4 reports the median regression results on earnings (in 100,000 NOK). Again, we include the full set of interaction terms between treatment groups and years to test our identification assumption. We cannot reject the hypothesis the false treatment dummy is zero: $\lambda_{2001} = 0(= \lambda_{2000})$, while hypothesis $\lambda_{2002} = \lambda_{2003} = 0$ is rejected at 1% significance level, indicating that our specification do capture a positive effect of the retirement earnings test reform. This confirms our findings through the descriptive analysis above. After the reform, the median of non-pension earnings in the sample increased by 3680 NOK and 6360 NOK in 2002 and 2003 respectively.

**Table 4: Estimates of the Median Treatment Effects (100,000NOK)**

|  | *Estimates* | *S.E* |
|---|---|---|
| Treatment dummy, 2001 | 0.0082 | 0.0066 |
| Treatment dummy, 2002 | 0.0368 | 0.0066 |
| Treatment dummy, 2003 | 0.0636 | 0.0066 |
| N | 214817 | |
| Pseudo R2 | 0.045 | |

Notes: The dependent variable is earnings. Other covariates included in the median regressions are a constant, female dummy, age and year dummies, average pension points, and financial wealth.

The model is then estimated using quantile regression on 9 quintiles $p = 0.1, 0.2 \cdots 0.9$. In this specification, we include only one treatment variable to illustrate the uneven effect of the reform across the earnings distribution. The results are summarized in figure 5. We found

that the effect of the reform on earnings is quite small and not significant for lower quintiles (up to 40th conditional percentiles) in the earnings distribution. However, the effect on earnings in the higher quintiles (50th to 80th) is large, statistically significant and concentrated on 60th to 80th percentiles. At the 80th quantile, earnings increased by 13,300 NOK (15.9 % increase for a 68 year old male with 10 years education). The 60th percentile for a male with 10 year's education (close to the sample average) is around 43,900 NOK, while 80th percentile is around 97,100 NOK. The 2002 reform raised the earnings threshold from 53, 000 NOK to 106,000 NOK. The old threshold is very close to the 60th percentile. This corresponds well with what Song and Manchester (2007) found on US data. They argue that this result indicates the policy change "has affected the earnings distribution just below the threshold and upwards, as predicted by economic theory".

**Figure 5: Estimates of Quantile Treatment Effects of the Reform**
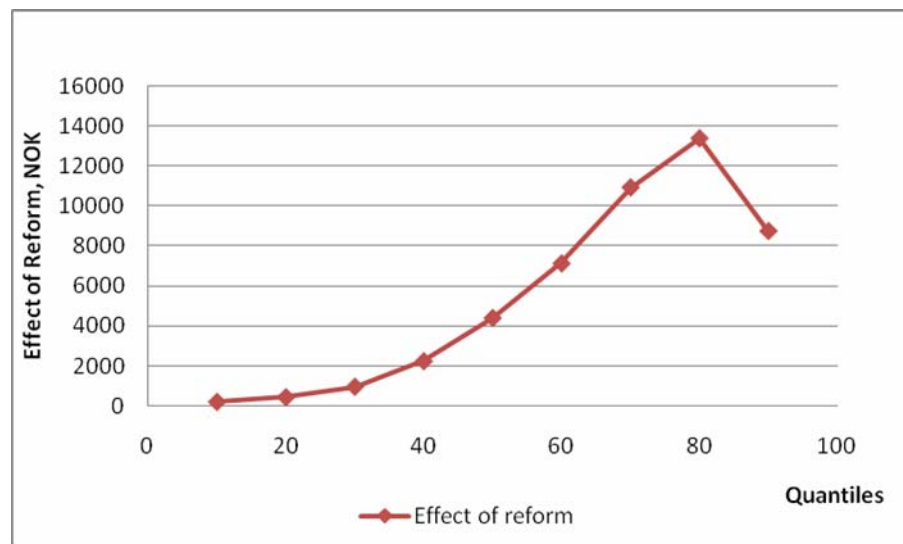
## 7. Heterogeneity in the responses to the reform

The quantile regression result presented above shows clearly the uneven impact of the reform. In the following, we will look more in detail to see how the effects vary over cohorts, gender, education level and previous labour market activities.

### 7.1 Exposure to the reform (birth cohorts)

Different cohorts have different exposure to the earnings test reform. Individuals born in 1933 were 69 years old at 2002 when the reform is implemented. The window of exposure for them is just one year, while for 1935 cohort it is three years. Obviously, the potential benefits of the reform are bigger for younger cohorts. Therefore the response from the old cohorts (which can be interpreted as the short run effect) should be smaller than the responses from younger cohorts who are exposed to the system when it is completely phased in. In addition, if individuals are forward looking, they may start planning years before they reach retirement age and make necessary adjustment to take advantage of the reform. This will also increase the response of those who have more exposure to the reform, namely the younger cohorts.

We construct cohort specific treatment dummies to investigate this econometrically. Note that here we only use the year of birth to define the exposure measures to the reform. We could have included information on month of birth to construct a finer measure, but that would have increased the number of the treatment dummies considerably, which is not practical[12]. The results are reported in Table 5. As we expected, there is a clear trend that the responses increase with the exposure. While the reform increased annual median earnings by 1640 NOK in the 1933 cohort, the increase was 12050 in the 1936 cohort. When the reform

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[12] Of course, we could restrict the effect to be linear in time, and use only one variable that represents the measure of exposure as did. However, we feel that this restriction is too strong.

was enacted, the 1933 cohort was 66 and many were still in their pre retirement job. They

may therefore have had better opportunities to plan for continued work, maybe even at their

"old" work place.

**Table 5: Estimates of the Median Treatment Effects for different cohorts (100,000NOK)**

|  | Estimates | S.E |
|---|---|---|
| Treatment dummy, 1933 cohort | 0.0164 | 0.0080 |
| Treatment dummy, 1934 cohort | 0.0272 | 0.0058 |
| Treatment dummy, 1935 cohort | 0.0511 | 0.0054 |
| Treatment dummy, 1936 cohort | 0.1205 | 0.0067 |
|  |  |  |
| N | 214817 |  |
| Pseudo R2 | 0.043 |  |

Notes: The dependent variable is non-pension earnings

Other covariates included in the median regressions are a constant, female

dummy, age and year dummies, average pension points, and financial wealth.

## 7.2 Gender and Education differences

There is empirical evidence that men and women have different retirement behaviour, see for

example Dahl, Nilsen and Vaage (2003) and Jia (2005). To investigate the role of gender in

the response to the reform, we interact gender and our treatment dummy in the median

regression.

The results suggest that women have a lower response than men (table 6). One

possible explanation is that women typically have much lower earnings. Among those with

positive earnings in our sample, the average earnings of women are only 2/3 of that of men[13].

As we discussed earlier, the response is most prominent from around the threshold and

upwards. Only around 30 % of the females are above that threshold, compared to 40 % of the

males. As a measure to increase elderly labour supply, the reform seems not to be able to

contribute to close the gaps between men and women. It remains to be seen, though, how the

effect will differ for younger cohorts with smaller gender differences in labour supply

behaviour and earnings history.

We also look at how the responses differ across educational groups. Based on years of

schooling, we generate dummy variables for high education (13 years and above), medium

education (10-12 years schooling) and low education.

We find no significant difference between the response of those with medium

education and those with low education (Table 6), but the high education individuals seem to

respond much more strongly than others. One possible reason may be that those who with

high investment in human capital may find it less attractive to leave labour force[14]. It may

also be due to individual differences in available options. Those with high education may be

more likely to find a job on the market or even to retain their old job, maybe part time. In

addition, those with high education may be more knowledgeable about the implication of the

reform of the earnings test rules and thus react more strongly.

Our results differ substantially from what Engelhardt and Kumar (2007) found on US

data, where they find those with low education to respond most strongly to the 2000 repeal of

the earnings test rule. They claim that low education is a proxy for high discount rate. Those

with high discount rate suffer most under retirement earnings test rule. The US retirement

earnings test is designed to be actuarially fair in such a way that lost benefits are returned to

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[13] For women it is 56500 NOK, for men it is 83760 NOK.

[14] Jia (2005) documents the similar pattern on data for early retirement behavior.

the retiree in later years. However, for individual who are myopic or have high discount rate, the system is far from "fair". So they are expected to react strongly to this. This is not the case with the Norwegian system, where there is no deferral. The discount factor should therefore not have a significant effect on our results.

**Table 6: Estimates of the Median Treatment Effects by gender and level of education (100,000 NOK)**

|  | *Estimates* | *S.E* |
|---|---|---|
| **Gender:** | | |
| Treatment dummy | 0.0538 | 0.0048 |
| Treatment dummy,  female | -0.0169 | 0.0045 |
| Pseudo R2 | 0.042 | |
| | | |
| **Educational level:** | | |
| Treatment dummy | 0.0311 | 0.0055 |
| Treatment dummy,  medium education | -0.0046 | 0.0047 |
| Treatment dummy,  high education | 0.1332 | 0.0060 |
| | | |
| Pseudo R2 | 0.043 | |

Notes: The dependent variable is earnings

Other covariates included in the median regressions are a constant, female dummy, age and year dummies, average pension points, and financial wealth.

## 7.3 Labour Market Status at age 66

We mentioned earlier that there is evidence in the literature that labour supply behaviour is positively correlated over time. In a structural model of post retirement labour supply behaviour the results below indicate that it is important to include a dummy for being active in labour market the year before. Friedberg and Webb (2006) also emphasized the importance of controlling for previous work experience when studying the effect earnings test. The reason is that the pre-retirement labour market status can provide useful information on important unobserved individual characteristics essential for the post-retirement employment decision, such as constraints in the choice set, health status of the individual, unexplained preference differences. It is thus of interest to divide the sample into sub groups according to the labour market status at 66.

We distinguish between four different groups: self employed, wage earners, early retirees through the AFP program, and individuals on disability pension. The model is then estimated separately on the four different groups. As we can see from Table 7, individuals in these groups differ substantially in education, financial wealth and past experience (represented by the average pension points).

**Table 7: Summary statistics and median treatment effects: subgroups on labour market status at 66**

| | AFP retirees | Disabled | Self- employed | Wage earners |
|---|---|---|---|---|
| Years of Schooling | 10.6 | 8.9 | 9.8 | 10.6 |
| Financial wealth (1000 NOK) | 331 | 221 | 780 | 604 |
| Average pension points | 4.04 | 2.46 | 3.33 | 3.77 |
| Share of female | 0.45 | 0.54 | 0.22 | 0.50 |
| | | | | |
| Median treatment effect | 0.0278 | 0.0214 | 0.0983 | 0.1279 |
| S.E. | 0.0088 | 0.0056 | 0.0234 | 0.0108 |

The estimated median treatment effect of the reform (reported in lower panel in Table 7) indicates that the labour market status at age 66 has a strong effect on the responsiveness to the reform. Wage earners are the most responsive group, followed closely by self employed. The responses from the AFP retirees are much smaller than from those of wage earners and self employed. The disabled have the smallest responses to the reform, but not much different from those of AFP retirees.

We believe that this result stems from two types of heterogeneity: one in the choice set constraints and the other in the preferences. On the demand side, people obviously have different opportunities. For some, it is possible to continue in their current job or with their current employer, maybe part time. University is good example, and maybe much of the public sector. Self-employed faces similar situations. For others it may be necessary to find a new job somewhere else or re-enter the labour market (for most retirees, AFP or disabled). In this situation, they are most likely to be constrained in the option of returning, and if possible, maybe to low paid and/or physically demanding jobs. This can partly explain the big difference in response between those who are still active in the labour market (wage earners

and self-employed) and those who are not (AFP retirees and disabled pensioners). In addition, health may play an important role here as well. Receiving disability pension is definitely an indication of bad health.

Alternatively or additionally, the difference may be a result of preference heterogeneity. Individuals who value leisure more tend to leave labour force early, either through AFP or through disability if that is an option. An increased marginal wage rate change generated by the retirement earnings test reform may then not be enough to induce them to return to the labour force. Unfortunately, with the data currently available, we are not able to decompose the heterogeneity by its cause: due to differences in preferences or options. Nonetheless, it is important to document this pattern.

## 8. Conclusion

The paper studies the effect of a reform of the retirement earnings test on earnings and labour supply behaviour of the elderly. Using administrative data from Norway, we first analyze the changes in participation and earnings following the increase in the earnings test threshold from 1 to 2 G in 2002. We see clearly from the data that there are earnings "humps" below thresholds. After the reform, the original "humps" around the old threshold disappeared, while new peaks are observed around the new threshold. We then use a difference-in-difference approach to quantify the effect of the reform. We find that the reform shifts the median of the conditional non-pension earnings distribution by 4400 NOK, but the effect is very uneven across the earnings distribution with the strongest effect in higher quantiles around the level of the threshold. There is no clear evidence that individuals also adjust their labour supply behaviour on the extensive margin.

We also find that the effect of the reform on earnings is larger for the younger cohorts. Since the year of birth can be seen as a measure of exposure to the reform, this result suggests

that the higher the degree of exposure is, the stronger the response. Men and person with high educated seemed to be the winner of this reform – they react much more strongly than women and persons with low education. Another interesting pattern is that the labour market status at 66 has a strong effect on the responsiveness to the reform.

The results indicate that heterogeneity plays an important role, either in options or in preferences. This should be further explored.

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