

Table 5. Effect of inducement to retire on labor market outcomes (5 year differences): 1975-2007

Estimating the parameters of Ibar					
	gamma	alpha	alpha / gamma	R ²	Implied Ibar weighting
1) Iterating over α with 0.25 intervals and regressing LFP of old on Ibar and covariates	1	9.5	9.5	0.5956	1*W+9.5*(W-PV)
2) Time series regression of LFP of old on Wbar and (W-PV)bar	-0.608 *** (0.174)	-5.781 * (3.241)	9.51	0.5956	-0.608*W-5.781*(W-PV) or 1*W+9.51*(W-PV)
Estimating inducement to retire on outcomes for the old and the young, using Ibar and covariates					
1) Using implied Ibar weighting from 1) above					
	Ibar		R ²		
	Coef	Std error			
LFP of old	-0.608 ***	(0.175)	0.5956		
Unemployment of young	0.020	(0.100)	0.7606		
Employment of young	0.169	(0.250)	0.7537		
School of young	-0.189	(0.307)	0.5471		
2) Using implied Ibar weighting from 2) above:					
1*W+9.51*(W-PV)					
	Ibar		R ²		
	Coef	Std error			
LFP of old	-0.608 ***	(0.175)	0.5956		
Unemployment of young	0.020	(0.100)	0.7606		
Employment of young	0.170	(0.250)	0.7538		
School of young	-0.190	(0.307)	0.5471		
3) Using implied Ibar weighting from 3) above:					
-0.608*W-5.781*(W-PV)					
	Ibar		R ²		
	Coef	Std error			
LFP of old	-1.000 ***	(0.288)	0.5956		
Unemployment of young	0.033	(0.164)	0.7606		
Employment of young	0.280	(0.412)	0.7538		
School of young	-0.313	(0.505)	0.5471		

Notes: Covariates include real GDP per capita, growth in real GDP per capita, the share of manufacturing in GDP, and the one-year difference in the share of it. All dependent variables are percent rates. Inducement measures are at 2005 prices, '000,000 Euro.

*** and * are significant at 1% and 10% levels, respectively

**THE LABOR SUPPLY EFFECT OF SOCIAL SECURITY EARNINGS
TEST REVISITED:
NEW EVIDENCE FROM ITS ELIMINATION AND REVIVAL IN
JAPAN***

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Abstract

Evidence on the effect of the social security earnings test on the labor supply of the elderly continues to be mixed. We utilize micro-level data compiled by the Japanese government in order to examine the labor supply effect for those aged 65-69 before and after two major reforms of the social security earnings test in Japan: its elimination in 1985 and its revival in 2002. We provide little evidence that the changes in the earnings test affected the wage distribution of the elderly after controlling for changes in the attributes of workers and firms. At the same time, the direct survey responses to the effect of the revival in 2002 reveals a large effect on the labor supply of the elderly. These empirical findings indicate the risk that a traditional bunch analysis underestimates the labor supply effect when it is obscured by measurement errors or labor market rigidities.

Keywords: social security earnings test, labor supply of the elderly, Japan, wage distribution, DiNardo-Fortin-Lemieux decomposition.

JEL Classification Codes: H55, J26.

1. Introduction

Downsizing the labor force is one of the major challenges for a country experiencing rapid aging and historically low birth rate, which will lead to a tremendous increase in social security benefits for retired persons and burden for the younger generation. As is often debated in the policy arena, a natural solution for mitigating the negative impacts of a decline in the labor force is to encourage the elderly to remain in the labor force for a longer period of time.

Japan shares the common concern of the effect of the rapid speed of aging on social security programs with other developed countries. Undoubtedly, the latest retirement age in the world is found in Japan, which is often considered as one of the most distinctive features of its labor market. Indeed, the effective retirement age for Japanese workers in the 2002–2007 period was 69.5 years for males and 66.5 years for females (OECD (2008)), both of which are higher than that in all European countries and the United States.¹ However, the current speed of aging in Japan is far more rapid as compared with that in other developed countries, which calls for a drastic reform in the labor supply of the elderly. The proportion of the elderly aged 65 and over exceeded 20 percent in 2005 and the speed of aging is expected to accelerate further. The share of the elderly is projected to exceed 30 percent in 2025 and reach 40 percent in 2050 (National Institute of Population and Social Security Research

¹ The effective retirement age is defined as a weighted average of net withdrawals from the labor market at different ages over a five-year period for workers initially aged 40 and over (OECD 2008).

2007). The extremely rapid pace of aging in Japan is likely to offset the positive effect of late retirement on overall labor force participation.

One popular view prevailing in the policy debates on the labor force participation of the elderly in Japan is that the social security earnings test (*Zaishoku Rorei Nenkin* scheme) is an important disincentive to paid work for the elderly through a high effective tax rate on work. This scheme is a part of the Employee's Pension Insurance (*EPI; Kosei Nenkin*) program, which is the core of the public pension scheme and covers approximately half the pensioners in Japan. The earnings test reduces immediate payments to social security benefits for EPI pensioners whose labor income exceeds a certain exemption threshold. Although benefits are subsequently increased in order to compensate for any such reduction, it is commonly viewed that the earnings test "punishes" the labor supply of the elderly, as in the United States (Gruber and Orszag 2003).

This study provides new evidence on the labor supply effect of the social security earnings test for workers aged between 65 and 69, focusing on two major episodes since the 1980s—the elimination of the earnings test in 1985 and its revival in 2002. We focus on workers aged 65–69 for two reasons. First, the target age group for enhancing labor force participation in Japan is now shifting to those aged 65–69, whose labor force participation is lower than that for those aged 60–64.² The mandatory retirement age, which is effectively

² The labor force participation rate for males in 2007 was 93.1 percent for workers aged 55–59, 74.4 percent for those aged 60–64, and 48.5 percent for those aged 65–69; the labor force participation rate for females in the same year was 60.8 percent for those aged 55–59, 42.2 percent for those aged between

equivalent to the eligibility age for public pension benefits, is now in transition from 60 to 65, and the labor force participation is expected to increase for workers aged 60–64³.

Second and more importantly, the rule of the earnings test is simple for workers aged 65–69 with a single threshold and rate of benefit reduction. Moreover, the history of the revisions is clear: it was abolished in 1985 and revived in 2002. In contrast, for workers aged 60–64 years, the earnings test has multiple thresholds and the reduction rates differ across earnings brackets. In addition, their revisions have been gradual, thereby making it difficult to precisely examine the labor supply effect of the revisions of the earnings test.

We view these reforms as clean natural experiments for examining the effect of the revisions of earning test rules with regard to the labor supply of the elderly. This study is empowered by a large micro-level dataset from the *Survey on Employment of the Elderly* (Konenreisha Shugyo Jittai Chosa, henceforth SEE) compiled by the Japanese government with information on both employment status and social security eligibility. This study provides new evidence on the labor supply effect of the social security earnings tests in Japan, thereby enabling us to contribute to the vast literature in certain new aspects. First and most importantly, we adopt two different approaches for examining the labor supply effect of the revision of the earnings test rule. One is to examine the changes in wage distributions before and after the reforms, an idea similar to a bunch analysis, which has been frequently used in

60–64, and 25.8 percent for those aged 65–69.

³ Shimizutani and Yokoyama (2008) showed that the average tenure for Japanese workers has increased since the 1990s due to the extension of mandatory retirement from 55 to 60 years.

the literature (e.g., Friedberg 2000, Haider and Loughran 2008). The other is to utilize direct survey responses to the revival of the earnings test in 2002, which is unique in the literature. In the 2004 survey, the SEE explicitly asked the respondents how the earnings test discouraged them from working. This feature enables us to examine the labor supply effect of the rule revisions in terms of both the direct survey responses and change in wage distributions, which reinforce our empirical results. While some may argue that survey responses are subjectively biased, the advantage is that we are able to directly measure the discouraging effect for those who quit working altogether and the degree of circumventing a higher effective tax on labor income for incumbent workers under the earnings test rule. This approach complements the traditional bunch analysis and prevents us from underestimating the labor supply effect of the earnings test when measurement errors and labor market rigidities are serious, an aspect emphasized in a recent work by Haider and Loughran (2008).

Second, we employ an alternative econometric technique for examining the change in the wage distributions before and after the reforms. Contrary to preceding empirical studies, the interval of the timing of our dataset is every four or five years, and we are not able to employ a straightforward application of the bunch analysis. Instead, we examine the change in whole wage distributions using the methodology of DiNardo Fortin and Lemieux (1996), which permits us to decompose the change in the wage (wage plus second-tier benefits for the 2002 revival) distributions into two parts: the change in the distributions of the attributes

of workers and firms and the change in the effect of the attributes on wage (wage and second-tier benefits for the 2002 revival). We compare the actual distributions before the reforms with the counter-factual distribution after the reforms, controlling for the changes in the attributes of workers and firms.⁴

Third, we endeavor to extract lessons from the Japanese experience, which are useful for other countries in two aspects. One is to examine two major and clean episodes of the elimination and revival of the earnings test, whose effect on work incentives for the elderly may be asymmetric. To our knowledge, there have been few studies that deal with both repeal and recurrence episodes outside Japan. The other is to relate the sensitivity of work incentive to pension benefits with late retirement in Japan. If we find a large labor supply effect of the rule revisions on work incentives, the highest elderly labor force participation in the world may become even higher on account of lowering disincentives. If this is not the case, the decision to work among the elderly in Japan is less likely to be sensitive to benefits and other factors are more responsible for the late retirement age.

Here, we present a preview of our empirical results. By examining the changes in the wage distributions for those aged 65–69 before and after the elimination of the earnings test in 1985 and its revival in 2002, we provide little evidence that the revisions in the earnings test affected the wage distribution of the elderly. In other words, the elimination and revival

⁴ Lemieux (2002) applied this methodology for examining the effect of change in minimum wage on wage distribution.

of the earnings test did not alter the labor supply decisions of the elderly. However, this is not the end of the story. The survey response to the revival in 2002 reveals a large effect on the labor supply of the elderly. The earnings test discouraged a larger share of people aged 65–69 from working, and the labor income earned by incumbent workers was not close to the threshold. Our empirical findings reveal that a traditional bunch analysis has a pitfall of underestimating the labor supply effect when it is obscured by measurement errors or labor market rigidities.

This paper proceeds as follows. The next section overviews previous research on the labor supply effect of the social security earnings test. Section 3 briefly describes the revisions in the earning rule in Japan. Section 4 explains the dataset used in this study. Section 5 presents the results of the bunch analysis using histograms and decomposition analysis of the wage distribution before and after the elimination and revival of the earnings test. Section 6 uses the survey responses to the revisions of the earnings test and compares the results with those in the previous section. The last section summarizes our findings.

2. Previous studies

Despite the popular view that emphasizes the disincentive effect of social security earnings tests on elderly workers, it is fair to state that a large volume of empirical

investigation has not reached a consensus on this issue. While a majority of the vast existing literature found a small effect of the earnings test on the labor supply of the elderly⁵, the conclusion are rather mixed.

The effect of the social security earnings test is often analyzed in a standard textbook labor supply framework with a kinked budget constraint, which corresponds to the threshold (Friedberg 2000). Contrary to the prevailing view, the theory suggests that the elimination of the social security earnings test is unlikely to substantially increase labor supply among retirees since a change in the earnings test shifts the budget constraint, which in turn invites both income and substitution effects and makes the net effect ambiguous (Borjas 2005). In other words, *a priori* it is not possible to predict the sign and magnitude of an earnings test rule on labor supply, and the net effect depends on whether the substitution or income effect dominates, which is an issue that must be empirically examined.

As Gruber and Orszag (2003) summarized, there have been two branches of studies that examine labor supply effects. One is to employ a "bunch analysis" for examining earnings concentration at the threshold of the earnings tests. The other type employs sophisticated econometric analyses of the aggregate impacts of the earnings test on the conditional hours worked by elderly workers of the kinked budget constraint, which requires a variety of structural assumptions.

⁵ For example, Burtless and Moffitt (1985) and Gustman and Steinmeier (1985) performed simulations and suggested that the elimination of the earning tests would only have minor effects on labor supply. The revision of the earnings test rule in the United States is summarized in Table 1 of Gruber and Orszag (2003).

Since the number of works in the literature is tremendous, we will focus on several important works published recently after 2000. Along with a majority of the existing large literature that found a small labor supply effect of the earnings test, Gruber and Orszag (2003) utilized the changes in the earnings test over the past three decades in order to identify the effect of exogenous changes in the test rule on labor supply and benefits receipt. By performing both graphical analysis of breaks in labor supply trends and reduced-form regression estimates based on a difference-in-difference approach, they found no robust influence on the labor supply decisions of men and some more suggestive evidence affecting the labor supply decisions of women.

In contrast, two recent studies found a sizable labor supply effect of the earnings test. Friedberg (2000) performed both bunch analysis and structural model estimation of the aggregate impacts of the earnings test on elderly workers of the kinked budget constraint and uncovered a substantial response by workers to three past changes in the earnings test rules. She found that the earnings distribution is clearly concentrated just below the threshold and confirmed that the bunching has shifted in response to the revision of the earnings test. Moreover, the structural estimation yielded sizable impacts of the elimination of the earnings test on number of hours worked by workers aged 65 and over. Haider and Loughran (2008) also found a consistent and substantial response to the earnings test, particularly for younger men, and insisted that the response to the earnings test in survey data is obfuscated by

measurement errors and labor market rigidities.

In addition, there are numerous other studies conducted outside the United States. For example, Disney and Tanner (2002) examined the effect of the elimination of the earnings test in the United Kingdom and Baker and Benjamin (1999) in Canada; both studies found that the elimination of the earnings test increased the employment and earnings of affected male workers. In Japan as well, there were numerous studies on the labor supply effect of the social security earnings test up until around 2000; however, there has been little research on the topic since then. While a majority of the studies found a significant labor supply effect of the earnings test, Ogawa (1998) and Iwamoto (2000) built econometric models in order to simulate the effect of the earnings test and found a sizable effect on labor supply. In contrast, Abe (1998) employed a difference-in-difference estimation in order to estimate the labor supply effect for workers aged 60–64 in the 1989 reform and found little effect of a change in the earnings test rule on the labor supply of these workers. It is fair to conclude that evidence on the labor supply effect of the social security earnings test is still mixed and has not reached a consensus.

3. The social security earnings test in Japan

This section overviews the revisions of the social security earnings test rule, focusing

on that for workers aged 65–69 since the 1980s. The earnings test, which is known as the *Zaishoku Rorei Nenkin* program, was introduced in Japan for the first time in 1965 and has been revised every 4–6 years. Among the three types of public pension programs in Japan, the earnings test rule is applied to the beneficiaries of the Employees' Pension Insurance (EPI; *Kosei Nenkin*) program, which is applicable to employees in the private sector and includes 48 percent of all pensioners in Japan.⁶ The pensioners under the other two types of public pension are exempted from earnings tests—the National Pension Insurance (NPI; *Kokumin Nenkin*) for self-employed persons (45.5 percent) and Mutual Aid Insurance (*Kyosai Nenkin*) for employees in the public sector and private schools (6.5 percent).

In this paper, we confine our interest to EPI pensioners aged 65–69. The revisions of the earnings test rule for workers in this age group are rather evident. The earnings test for workers aged 65–69 was eliminated in 1985 and revived in 2002. Under the earnings test between 1980 and 1984, 1 yen of the social security benefit was withheld for every 5 yen earned above 156,000 yen for workers aged 65–69, thereby indicating a marginal tax rate of 20 percent for those who earned labor income amounting to over 156,000 yen.⁷

In 1985, the earnings test rule for workers aged 65–69 was eliminated; however, reduced rates continued to be applied to workers aged 60–64. While the earnings test rule for workers aged 60–64 was revised again in 1989, 1992, and 1996, there was no earnings test for

⁶ The figures for the share of EPI, NPI, and MAI pensioners have been obtained from Komamura (2007).

⁷ During the same period, the effective rate was higher for workers aged 60–64, whose rate was 20 percent below 95,000 yen, 50 percent for 95,000–130,000 yen, 80 percent for 130,000–155,000 yen and 100 percent for 155,000 yen and over.

workers aged 65–69 between 1985 and 2002. In 2002, the earnings test for workers aged 65–69 was revived. According to the Ministry of Labor, Health and Welfare (MLHW 2002), the revival aimed to improve the fiscal balances of the social security programs and the labor supply effect was largely ignored. After 2002, 1 yen of social security benefits was withheld for every 2 yen if the sum of earned income and second-tier social security benefits is above 370,000 yen. Hence, workers who earned over 370,000 yen from labor income and pension benefits faced a marginal tax rate of 50 percent. It must be noted that the sum of labor income and second-tier benefits, not just labor income, has been tested since 2002.⁸ The first-tier pension benefits are not earnings tested for workers aged 65–69, although it is tested for workers aged 60–64. The rule was slightly revised in 2004 to include bonuses as labor income and change the reduction rate correspondingly; however, there has been virtually no change in the rule since 2002.

4. Data description

This study uses micro-level data from the SEE compiled by the MLHW. The Survey has been performed in 1983, 1988, 1992, 1996, 2000, and 2004. We utilize microlevel data from the SEE in 1983, 1988, 2000 and 2004 to examine the effect of the 1985 abolishment

⁸ In 2002, the effective rule was revised for workers aged 60–64 too. In this reform, the threshold for 60 percent rate increased from 340,000 yen to 370,000 yen. In 2007, the earnings test began to be applied to workers aged 70 and over.

and the 2002 revival of the earnings test for those aged 65 and over. The individuals in the sample were aged between 55 and 69 randomly chosen from all regions in Japan. The workers aged 65-69 occupied one third of the total number of the individuals in the samples; 7,186 in 1983, 6,702 in 1988, 6,060 in 2000 and 5,260 in 2004.⁹

The SEE is only large-scale dataset compiled by the Japanese government providing detailed information on both employment status (including labor income) and social security eligibility and benefits.¹⁰ The SEE contains a variety of variables that are indispensable for examining the labor supply effect of the earnings test including demographics and employment status of the individual (age, sex health status, type of job, monthly wage, working days per week, and hours worked per day, etc.) and characteristics of firms (firm size, prefecture, etc). Another distinguished feature of the SEE is that it asks the respondents whether the social security earnings test discourages them from working in the 2004 survey. We use this unique information obtained through the survey response to complement what we observed in the change in wage distributions.

First, we must identify those eligible for the EPI benefit because the earnings test is applicable only to them. The 1983, 1988, and 2000 surveys asked whether a respondent

⁹ The total sample size was 26,954 in the 1983 survey, 26,290 in the 1988 survey, 19,595 in the 2000 survey, and 17,853 in the 2004 survey.

¹⁰ There are other large-scale datasets on employment collected by the government, represented by *Labor Force Survey* (Rodo Ryoku Chosa) or *Basic Survey on Employment Structure* (Shugyo Kozo Kihon Chosa) with a large number of observations randomly selected from all regions in Japan. Even if we confine the sample to the elderly, their sample sizes are quite large; however, there is no information on pension eligibility, which is indispensable to this study.

actually receives the EPI benefit presently, while the 2004 survey asked whether a respondent actually receives benefits regardless of type of pension program except private pension programs. In addition, the 1983 and 2004 surveys asked the respondent whether he/she is eligible for the EPI benefit, which permits us to identify EPI pensioners directly. However, it is difficult to identify precisely who is an EPI pensioner in 1988 and 2000 based on the information in the dataset, so we assume that all the individuals who are actually receiving benefits from EPI are eligible for EPI benefits. While it is possible that this definition excludes those who are eligible for EPI benefits but do not currently receive any EPI benefit, we believe that this definition is reasonable because the number of such individuals is limited.¹¹ When we compare the wage distributions between 1983 and 1988, we employ the same definition of EPI eligibility as that in 1983. In the case of the 2004 survey, we use the eligibility information in the dataset since the 2004 survey does not permit us to identify EPI or other benefits.

Further, we exclude the individuals whose monthly wages or non-wages in the month prior to the surveys exceeded a million yen. Moreover, we confine our sample to individuals who responded that they were healthy because those with an adverse subjective health status are less likely to work at full ability and be subjected to the earnings test. We do not employ a difference-in-difference approach by using workers aged 60–64 as a control group because all

¹¹ In the 1983 survey, we compare the respondents who were eligible and those who actually received pension benefits and found that the correlation coefficient is 0.93.

the changes in the earnings test rule for workers aged 65–69 have been accompanied with those for workers aged 60–64. While it is a good idea to use individuals aged 70 and over as a control group, the individuals in the sample of our dataset are aged between 55 and 69 only.

The sample size after these adjustments is 651 in 1983, 697 in 1988, 986 in 2000, and 890 in 2004. The summary statistics of the variables used in the decomposition analysis will be provided in the Appendix Table¹².

5. Bunch and decomposition analysis of the wage distribution

In this section, we confine our sample to the individuals who actually worked in the month prior to the survey months and perform two types of analysis. First, we perform a bunch analysis by comparing the histogram of monthly labor income (including second-tier benefits in 2000 and 2004) before and after the elimination (1983 and 1988) and the revival (2000 and 2004) of the earnings test. Second, we perform a decomposition analysis in order to explore what accounted for the change in the income distributions before and after the reforms in the earnings test.

Figure 1 compares the distributions of the monthly wage between 1983 and 1988. In each year, the SEE asked respondents to report their monthly labor income (in an integer

¹² The classifications of type of job vary in each survey and we adjusted to make them comparable between 1983 and 1998 and between 2000 and 2004. Since the data on firm size is not available in the 2004 survey, we exclude it as an independent variable.

number with a unit of 10,000 yen) that they earned in May, merely one month prior to June, when the survey was conducted.¹³ The range in the X-axis is from zero to 1,000,000 yen (100 ten thousand yen) and each cell stands for a 10,000 yen bracket. If the social security earnings tests restrain labor supply, we would observe a bunch below the threshold (156,000 yen) in 1983 but not in 1988 after the earnings test was eliminated.

First, we observe that the most frequent cell in 1983 was 100,000 yen, accounting for 10.8 percent. The cumulative frequency exceeds 50 percent (the median) in the cell of 120,000 yen. What is interesting is the concentration in the cell of 150,000 yen just below 156,000 yen, which was the threshold prior to 1985. The frequency for the cell of 150,000 yen in 1983 is 7.8 percent and the cumulative frequency is close to 70 percent at the cell. In 1988, it is also evident that the cell with the greatest frequency is the cell of 100,000 yen (9.5 percent), which exceeds the median, followed by 150,000 yen (7.3 percent). Thus, we notice that the share "just below" the threshold prior to the elimination of the earnings test measured in the cell of 150,000 yen declined only slightly (0.5 percentage points). At the same time, we notice the possibility of reporting errors since large frequency is observed in the cells with a multiple of 50,000 yen in the histogram. If we expand the range of "below the threshold" for the broader cells of between 100,000 yen and 150,000 yen, the share of those measured in the broader cells declined by 5.8 percentage points from 31.3 percent. These observations

¹³ The time interval is short and the information is reliable. This is also the case for the surveys in 2000 and 2004, which were performed in October and asked the respondents to report their labor income in September.

indicate that the bunch that was observed below the threshold disappeared in response to the elimination of the earnings test in 1985.

Figure 2 represents the histogram of the monthly wage and the full second-tier benefit in 2000 and 2004. If the earnings test creates a bunch, we would not see it below the threshold (370,000 yen) in 2000 but in 2004 after the earnings test was revived in 2002. The full second-tier benefits for each individual in 2004 are calculated in the pension formula.¹⁴ Since the second-tier benefits are not necessarily in an integer value measured in a 10,000 yen bracket, we take a broader range as "below the threshold" for identifying a bunch. The share of individuals whose monthly wage and full second-tier benefit are between 300,000 yen and 370,000 yen was 12.3 percent in 2000 and 10.1 percent in 2004. In both years, the median is located at approximately 210,000 yen; further, the cumulative frequency below 370,000 yen was 83.6 percent in 2000 and 81.0 percent in 2004. These observations indicate that, contrary to the prediction of a bunch analysis, the share of the individuals below the threshold declined after the revival of the earnings test.

¹⁴ The methodology of calculation is summarized as follows. P_F is denoted as the full second-tier pension benefit, P_A as the actual second-tier pension benefit, and W as wage, all of which are on a monthly basis. In the 2004 survey, the data provides the sum of public pensions (first and second tiers) and employer-provided pension programs (third tier). P_A is computed by subtracting the full basic pension benefits (66,208 yen per month in 2004) from the sum of the first- and second-tier benefits. Under the earnings test, a person eligible for the full benefit is entitled to receive P_F when W is zero and $P_F + W$ when the sum of P_F and W is less than 370,000 yen ($P_A = P_F$). When the sum of P_F and W exceeds 370,000 yen, a marginal tax of 50 percent is applied to the additional benefit, i.e., P_A is calculated as $18,500 + 0.5P_F - 0.5W$. What we know in the dataset is W and P_A , and P_F is computed as $W + 2 \times (P_A - 18,500)$. Finally, when monthly wage exceeds the sum of the full second-tier pension benefits, 370,000, second-tier pension benefits are reduced to zero. Since we assume that all the persons are eligible for full benefits of the first tier, a limited number of individuals in the sample, who were excluded from the estimation, show a negative value for the sum of wage and second-tier benefits. Moreover, we compute the second-tier benefit assuming no third-tier benefit. See footnote 15.

In brief, the share of the individuals whose wage was below the threshold declined between 1983 and 1988, after the elimination of the earnings test in 1985. This change indicates that the elimination of the earnings test eliminated the bunch, although the share of “just below the threshold” remained unchanged. In contrast, it appears that this is not the case for the revival of the earnings test in 2002 because we do not observe any new bunch below the threshold in 2004.

It may be tempting to conclude that the elimination of the earnings test in 1985 affected the labor supply of the elderly and the revival in 2002 did not. However, it is possible that numerous factors other than the revisions of the earnings test contributed to the change in the distributions between 1983 and 1988 or between 2000 and 2004, which may have obscured the effect of the earnings test reforms. In order to address this issue, we employ a DiNardo Fortin and Lemieux decomposition (DiNardo, Fortin and Lemieux (1996), Dinardo (2002), Lemieux (2002)). This is a semi-parametric approach and visually decomposes the change in wage distributions into two parts: the change in the distributions of the attributes and in the effect of attributes on wage distributions.

First, we compare the actual wage distribution in 1983 (before elimination) with the counter-factual distribution defined as what the density of wage would have been in 1988 (after elimination) if the attributes of workers and firms had remained at their 1983 level. Second, we compare the actual distribution of the sum of wages and full second-tier benefit