to 65 in 2013, while the eligibility age for the wage-proportional component will remain at 60. In addition, the eligibility age for the wage-proportional component is scheduled to rise by one year every three years from 2013, reaching 65 in 2025. For female beneficiaries, the eligibility age had been 55 until 1985, and then was gradually raised to 60 in 1999 to catch up with men. Their eligibility ages are set to increase, albeit with a five-year lag for men: from 2006 for the flat-rate benefit and from 2018 for the wage-proportional benefit.

In Japan, there has been no eligibility age that is exactly equivalent to a so-called "early retirement" age widely observed in other advanced countries, and there has been no attempt to lower the eligibility age. However, there is a means-tested *Zaishoku* pension scheme for the EPI program, which is applied to those who stay in the labor force after the eligibility age. Some preceding research studies find disincentive effects of this scheme on the willingness of the elderly to work, but its impact on the overall labor force of the elderly remains mixed and is yet to be examined in detail.

2.2 Employment policies for the elderly

The employment policies for the elderly have been reformed in accordance with social security reforms, especially aiming to expand job opportunities for the elderly whose eligibility ages were extended. For example, the government revised the Employment Measures Law in 1973 to include a declaration clause on raising the mandatory retirement age and to introduce a subsidy paid to employers who extend the mandatory retirement age to 60. In 1986, the Law Concerning Stabilization of Employment of Older Persons introduced a new endeavor clause on extending the mandatory retirement age to 60 or over, and changed it as the obligatory target.

This trend of extending the mandatory retirement age continued. In response to a scheduled rise in the eligibility age for EPI benefits in the 1994 Pension Reform, the government established a new type of wage subsidy, Continued Employment Benefit for Older Workers, to compensate for the reduced wages of older workers who continue to be employed after the mandatory retirement age. This wage subsidy is intended to encourage the old to continue working after retiring from their primary jobs, rather than extending the mandatory retirement age. The government also revised the Employment Measures Law in 2000 and 2004, which includes an obligatory clause that requires firms to raise the mandatory retirement age to 65 or above by 2013 or to completely abolish it.

As a result, the distribution of mandatory retirement ages has been changing substantially over the past decades as demonstrated in **Figure 2**, which is based on the "Survey on Employment Management" (*Koyo Kanri Chosa*) compiled by the Ministry of Health, Labour and Welfare (MHLW). The share of firms that had a mandatory retirement scheme was less than 50 percent until around 1980, and a significant portion of those firms set the retirement age at 55. After that, the proportion of firms with mandatory retirement steadily increased to above 90 percent in the mid-1990s. The most dominant retirement age is now 60, and some firms have started extending it further to 65[3].

2.3 Current issues

As suggested by our brief overview on social security reforms and employment policies for the elderly, there has been virtually no policy intention among Japanese policymakers to link the employment of old and young. Their main concern has consistently been how to encourage the old to stay longer in the labor market in accordance with a rise in the eligibility age for pension benefits. Contrary to some European countries, which observe

[3] It should be noted that this survey covers only firms employing 30 and more workers, and many smaller firms have no mandatory retirement age.

active policy debates to use social security provisions to create jobs for the young, there seem to have been virtually no such arguments in Japan both in the policy arena and in academia. This observation supports the view that changes to social security programs in Japan have not been endogenous with respect to the employment of the young, and that any change in specific provisions has not been correlated with job creation for the young.

To be sure, unemployment among the young has been rising sharply since the early 1990s, reflecting the sluggish economy, which made firms more cautious about recruiting new graduates under strong cost-cutting pressures. The unemployment rate for those aged 15-24 was around five percent in the early 1990s and has tracked an upward trend during the decade, reaching 10.3 percent in 2003[4]. Similar to some European countries that suffer from a high unemployment rate among the young, the historically high level of unemployment among the young captured a lot of political and social attention in Japan. Indeed, several policy measures have been proposed to increase job opportunities for the young, such as provision of job skills, expansion of temporary workers, and strengthening job matching for the young. However, the deteriorated labor market conditions for the young has not front-loaded social security reforms or induced the government to provide job opportunities through legislative changes on plan provisions.

One of the important reasons for the absence of debate in Japan, we speculate, is that employment of the old and that of the young are not substitutes. The Japanese labor market is characterized by the prevalence of a long-term employment practice (called "lifetime employment"). A large volume of previous studies discusses how Japanese firms, especially larger ones, hire new school graduates and that most of workers stay with the same firm for decades to gain firm-specific human capital that contributes to the

[4] The unemployment rate for those aged 15-24 resumed its fall in 2004, but remained at around eight percent, well above the average during the early 1990s.

productivity of the firm (see Aoki, Patrick and Sheard, 1994). Shimizutani and Yokoyama (2008) show that the average years of tenure of Japanese workers became even longer after 1990 under the long recession. These arguments suggest that there is a large productivity gap between young and older workers, and that thus they are not substitutes.

3. Long-term employment trends

3.1 Three age groups

This section graphically overviews the long-term trends of employment and unemployment by age bracket in Japan since 1960. We present the employment trends of three age groups in terms of three employment measures (labor force participation, employment, and unemployment), pooling genders. The data construction and data sources of the main variables in this section are explained in **Appendix 1**.

In what follows, to examine if employment of the old "crowds-out" employment of younger persons we define three age groups: "young" (aged 20-24), "prime age" (aged 25-54), and "old" (aged 55-69) as follows.

- "Young" refers to people aged 20-24.Of those graduating from high school, about half continue on to junior colleges and universities (51 percent in 2007). Most students complete undergraduate programs by the age of 24. Unfortunately, there are no official data on the number of people enrolled in schools by age, so we tentatively assume that those who are out of the labor force at ages 20-24 are in school (colleges, graduate, and vocational schools).
- "Prime age" refers those aged 25-54. They form the core of the labor force in Japan. The mandatory retirement age had been 55 for 20 percent or more of total employed workers until the mid-1980s (see later).

- "Old" refers to those aged 55-69. The mandatory retirement age was extended from 55 to 60 in the 1990s, and now is in a transition process to 65, although adoption of the mandatory retirement age of 65 is optional and the adoption rate varies by industry and firm size. We should also keep in mind that the mandatory retirement age means the age at which a person leaves his/her "prime work." in Japan. Retired workers are sometimes provided an opportunity to be employed by the same or affiliated firms with lower incomes but flexible working conditions[5].

3.2 Long-term trends of employment and unemployment

Figure 3 presents long-term trends of the LFP of the old, as well as the LFP and unemployment of the young between 1965 and 2005, pooling genders. The LFP and unemployment are expressed as a percentage of the total population for each age group. The figure also shows the dates of key social security reforms with dotted lines for reference, which correspond to those in Table 1.

We confirm the following facts. First, there is no relationship between the LFP or unemployment of the young and the dates of social security reforms, which have been exogenously determined by laws. This is also the case for the 1985 Reform, which was the largest revision to the social security programs in Japan. Second, the LFP of the old and the LFP of the young have been moving in parallel over the medium term, although over the long term the former shows an upward trend (probably due to extended mandatory retirement ages) and the latter shows a downward trend (probably due to increasing demand for higher educational attainment). Third, we find no clear correlation in the short-term movements of the old LFP and the unemployment of the young, while both of

[5] Unfortunately, we cannot distinguish changes in the routes to retirement due to a lack of information available from published statistics. Indeed, OECD (2004) shows that the effective retirement age, which is defined as the average age at which workers aged 40 or above retire, is 70 and 66 years old for Japanese males and females, respectively, for 1997-2002.

them have long-term upward trends.

Figure 4 compares the LFP of the old, the unemployment of the young, and the unemployment of the prime age group. If the LFP of the old and that of the younger age groups are substitutes, the LFP of the old and the unemployment of the younger age groups would have moved in the same directions. To be sure, such movements are observed around 1980 and during the 1990s. During the mid-1960s and the mid-1970s, however, a reduction in the LFP of the old was not accompanied by a fall in the unemployment of the younger age groups. Moreover, the LFP of the old and unemployment in the younger age groups have been moving clearly in opposite directions since around 2000. Such observations confirm that unemployment in the younger age groups has been uncorrelated with the LFP of the old.

Figure 5 compares long-term trends in LFP of the old, young, and prime age groups. The LFP of the prime age group shows a moderate upward trend, while the LFP curves of the young and old show cyclical movements. This fact suggests that employment adjustments by Japanese firms tend to concentrate on employment of the young and old, keeping the core labor force of the prime age group intact against cyclical fluctuations of business conditions.

In all, Figures 3-5 do not support the view that jobs for the old crowd out jobs for the young. Rather, employment of the old and employment of the young tend to move in the same direction. This is presumably the main reason why Japanese policymakers have never considered early retirement policies to promote employment of the young.

3.4 OLS regressions for the direct relationship

Next, we run several regressions to reveal the direct relationship between the LFP of the old and the employment/unemployment of the younger age groups. There are five dependent variables: unemployment (UE), employment (EMP): and in-school (SCH) for the young, and unemployment (UE) and employment (EMP) for the prime age group. The key independent variable is the LFP or employment of the old. When using the LFP of the old in a regression, all labor force variables are measured as a rate of the total population of each age group, and men and women are combined. First, we use only the LFP or employment of the old as an explanatory variable with no controls, and then add real GDP per capita, its growth, and manufacturing share as controls.

We consider four specifications for OLS regressions:

- regress levels on levels;
- regress the dependent variables on a three-year lag of elderly LFP or employment;
- take the five-year differences for all the RHS and LHS variables; and,
- take the log of all variables and take five-year differences.

Table 2 summarizes the regression results when we take the LFP of the old as the key independent variable. Reported are the estimated coefficients on the LFP of the old. The upper and lower panels present the results with no controls and with controls, respectively. The following facts are noteworthy.

Regarding the unemployment of the young, the results are mixed: three of eight specifications show significant and positive coefficients while others have negative but insignificant ones. Mixed results are also observed for unemployment in the prime age group. In addition to the three specifications, a significant *negative* coefficient is observed in the five-year lag difference model. Hence, we cannot obtain definite results on the relationship between the LFP of the old and the unemployment of the younger age groups.

Turning to the employment of the young, we do not find any significant correlation with the LFP of the old if we include no controls. With controls, however, all specifications produce significant and positive coefficients. In the case of the employment of the prime age group, in all specifications, the coefficients are positive and significant both with and without controls. These results indicate that the LEP of the old and employment of the younger age groups move in the same direction and contradict the view that employment of the old and employment of the younger age groups are substitutes. If we take in-school rate as a dependent variable, we do not obtain any significant coefficient if we include no controls, but we have significant and negative coefficients in two specifications with controls. This negative correlation could be spurious because a long-term uptrend of the in-school rate probably reflects a long-term increase of demand for higher education. In fact, there is no significant correlation within the difference specifications.

Table 3 reports the estimated coefficients when we replace the LFP of the old with their employment. While the basic picture remains the same as that shown in Table 2, we find the following facts. First, the UE models tend to have negative and even significant coefficients for both the young and the prime age groups in more cases. This implies little possibility that the LFP of the old caused unemployment in the younger age groups. Second, when we regress EMP of the young on the LFP of the old, we observe three significant, positive coefficients. These results also support the view that employment of the old and that of the younger age groups tend to move in the same direction.

4. Inducements to retire and labor market outcomes

4.1 Incentive measures: SSW and PV

In this section we investigate the relationship between inducements for the old to exit the labor force and the employment and unemployment of the young. To facilitate this analysis, we construct a simple summary indicator of the inducement of the old to leave the labor force. The indicator should capture key aspects of inducements such as eligibility age, benefit level given eligibility, and change in the benefit if the receipt of benefits is delayed (essentially an actuarial adjustment when retirement is delayed).

The core for constructing the inducement indicator is EPI benefits. Most NPI members are self-employed and their retirement decisions are not closely linked to social security benefits, and flat-rate NPI benefits are not means-tested and adjusted actuarially fairly if claimed at ages other than the normal eligibility age of 65. Moreover, the MAI, which covers employees in the public sector, has almost the same benefit scheme as the EPI, so we can reasonably treat MAI pensioners as if they were EPI members[6].

The basic strategy for constructing inducement measures is as follows. First, we construct social security wealth, *SSW* (see **Appendix 2**, which explains in detail how to construct it). If one retires at age *a* and the eligibility age is a^*, social security benefit received at age a, *B*(*a*) is calculated as:

$$B(a) = C + k * CAMI(a, m) \text{ if } a \geq a^*; =0 \text{ if } a < a^*$$

where *C* is a constant term corresponding to the basic pension benefit, *k* is a benefit multiplier, and *CAMI* (*a*, *m*) is the career average monthly income at age *a* and with months of service *m*. The values of *a* and *m* are estimated from published data. Then, (gross) *SSW* at age a, *W*(*a*), is calculated as:

$$W(a) = \sum_{i=a}^{D} \pi(i) B(i),$$

where $\pi(a)$ is a cumulative discount factor that reflects both interest rate (which is assumed to be three percent) and mortality (which is available from official statistics). *D* is the maximum age, which we set at 100.

At age *a*, one can expect social security benefit and SSW if he/she retires at age *a*+*j* as

[6] Meanwhile, we are forced to ignore the impact of the means-tested *Zaishoku* benefits and wage subsidies on the elderly's decisions to retire, due to a lack of data available from official statistics. A more comprehensive analysis, which takes into account multiple benefit schemes, should be an important topic for future research.

$$B(a+j)=C+k[m*CAMI(a,m)+wage(a+j)]/(m+12j),$$

$$W(a+j)=\sum_{i=a+j}^{D}\pi(j)B(j),$$

where wage is the projected wage based on cross-section data at the year when one is aged *a*. We then calculate the peak value for each age, *PV*(*a*) defined as

$$PV(a)=\max[W(a), W(a+1), \cdots, W(D)]$$

That is, *PV*(*a*) is the maximum value of SSW, which is obtained by adjusting the timing of retirement. We take into account a change in *C* and *k* reflecting each social security reform when calculating SSW and PV. In actual estimations, we choose the cohort born in 1935 as the base cohort, and use its fixed earnings trajectories to address possible endogeneity of earnings in response to social security reforms.

4.2 Inducement measure

The next task is to construct the inducement measure utilizing SSW, PV, and labor force participation. Assuming that at given age *a* and year *y*, SSW per capita, proportion of people in the labor force, and number of retirees are given as *W*(*a*, *y*), *LFP*(*a*, y), and *P*(*a*, *y*), respectively. Then, averaging *W*(*a*, *y*) over different age groups —specifically over 55 and 69—we have the annual average SSW, which is denoted by $\overline{W}(y)$, such that

$$\overline{W}(y)=\sum_{a=55}^{69}\left[\frac{P(a,y)}{\sum_{a=55}^{69}P(a,y)}\right]\left[\frac{\sum_{t=0}^{a-55}W(a,y)*LFP(a-t,y-t-1)}{\sum_{t=0}^{a-55}LFP(a-t,y-t-1)}\right], \quad (1)$$

which gauges the overall generosity of social security benefits at each year.

It is reasonable to assume that an individual considers not only the level of SSW by itself, but also potential gains from postponing retirement when deciding to continue working or retire. Hence, we additionally consider *W*(*a*, *y*)-*PV*(*a*, *y*), which is the difference between the SSW an individual obtains by retiring at age *a* and the maximum SSW he or she can obtain by postponing retirement from that age. In Japan, the value of *W(a, y)-PV(a, y)* is expected to be negative before the eligibility age, and zero beyond that. As in the case of SSW, we obtain the annual average of *W(a, y)-PV(a, y)*:

$$\overline{[W-PV]}(y)=\sum_{a=55}^{69}\left[\frac{P(a,y)}{\sum_{a=55}^{69}P(a,y)}\right]\left[\frac{\sum_{t=0}^{a-55}[W(a,y)-PV(a,y)]*LFP(a-t,y-t-1)}{\sum_{t=0}^{a-55}LFP(a-t,y-t-1)}\right] \quad (2)$$

Finally, we combine SSW and its potential gain from postponing retirement to construct the inclusive incentive measure, which is defined as:

$$I(a,y)\equiv W(a,y)+\alpha[W(a,y)-PV(a,y)],$$

where *α* is a nonnegative parameter. In addition, averaging *I(a, y)* over age, we calculate its annual average as

$$\bar{I}(y)=\overline{W}(y)+\alpha\overline{[W-PV]}(y). \quad (3)$$

A higher value of SSW itself makes an individual more inclined to retire, but its disincentive effect is partly offset by potential gains from postponing retirement. Putting these two factors together, the inclusive incentive indicator captures the net effect of social security benefits. The value of the weight on $\overline{W-PV}$, *α*, should be estimated empirically as discussed in the next subsection.

It is useful to examine whether annual average incentives are consistent with the expected effects of past reforms. **Figure 6** depicts the LFP-weighted averages of male and female $\overline{W}$ at 2005 prices for the 1935 cohort. Because $\overline{W-PV}$ is almost flat compared to $\overline{W}$, it suffices to look at $\overline{W}$ to capture the long-term trend of the inducement of retire.

The figure shows that the level of $\overline{W}$ continued to rise until the mid-1980s, then started to decline gradually, and has remained roughly stable since the late 1980s. This trend is consistent with the history of social security reforms, which is summarized in Table 1. Until the mid-1980s, the government had continued to increase the generosity of the programs by increasing the flat-rate benefit as well as the benefit multiplier for the wage-proportional benefit. The 1985 Reform, however, decisively changed the policy direction by reducing the generosity of the benefit formulae. Since the 1989 Reform, the government has been raising the flat-rate benefit but subduing the overall generosity of the program by reducing the benefit multiplier, postponing the eligibility age, and reducing the benefit indexation.

4.3 Estimation methodologies

We now move to the relationship between the measure for inducement to retire and employment and unemployment of younger age groups. **Figures 7** compares the trends of unemployment and $\overline{W}$. There seems to have been a negative correlation between the two since the late 1980s, but a clear upward trend in the unemployment rate makes it difficult to interpret the relationship. **Figure 8** replaces unemployment with employment and compares it with $\overline{W}$. We find that until the 1990s employment of the young and $\overline{W}$ moved in opposite directions, while there seems to be no clear relationship between employment of the prime age group and $\overline{W}$. We have to control other factors that are likely to affect labor market outcomes, however, to precisely capture the impact of the inducement to retire on labor outcomes of the younger age groups,

In addition, we have to estimate the weight on $\overline{W-PV}$, α, in eq. (2). We use two methods. The first method is the iteration procedure. The estimation model here is given by

$$LFP_{OLD}(y) = \delta\bar{I}(y) + X_y\beta + e_y = \delta\{\overline{W}(y) + \alpha[\overline{W-PV}](y)\} + X_y\beta + e_y, \quad (4)$$

where X_y is a vector of covariates. We iterate over α with 0.25 intervals starting at zero and regress LFP of the old on $\bar{I}$ and on covariates to search the value of α that gives the highest R^2. δ is expected to be negative.

The second is the regression procedure. The estimation model in this case is given by

$$LFP_{OLD}(y) = \delta_1 \overline{W}(y) + \delta_2 \left[\overline{W - PV}\right](y) + X_y \beta + e_y. \quad (5)$$

We regress LFP of the old on $\overline{W}$ and $\overline{W-PV}$ as well as covariates to estimate coefficients on $\overline{W}$ and $\overline{W-PV}$ separately, that is, δ_1 and δ_2. Then, we obtain the implied weight, α, by calculating δ_2/δ_1.

After estimating α based on either of these two methods, we regress labor market outcomes on the estimated $\overline{I}$, which is based on either of the two methods, and covariates. We conduct these two procedures using not only the levels for all variables in eqs. (4) and (5) but also their five-year differences, because most of the variables have strong time trends. In all estimation models, we use real GDP per capita, its growth rate, share of manufacturing in GDP, and one-year difference in the share of the elderly of total population. The estimation period is between 1975 and 2007 due to data limitations. As already implied by Figures 7 and 8, regressions based on the levels might lead to a spurious relationship between inducement measure and labor market outcomes.

4.4 Estimation results

Table 4 presents estimation results using the level of each variable. The upper panel summarizes the estimated parameters of $\overline{I}$. The first method obtains 8.75 for the estimated value of α. The second method obtains -0.512 and -4.419 for the estimated values of δ_1 and δ_2, respectively, implying that α is equal to 8.63, which is very close to 8.75. These high estimated values of α suggest that a change in $\overline{W-PV}$ affects the elderly's retirement decision much more than a change in $\overline{W}$ per se[7]. This means that the elderly are much more sensitive to potential gains from postponing retirement than the level of social security wealth obtained by retiring at each age.

[7] Actually, we compare two cases: the first assuming that each individual is completely liquidity constrained so that $W(a, y)$ is treated as zero before the (first) eligibility age, and the second assuming that there is no liquidity constraint so that $W(a, y)$ is not treated as zero. We focus on the latter case, which makes a much better fit in the model and obtains reasonable coefficients.

The lower panel shows the effects of the inducement to retire on outcomes for the old and the young. We regress the LFP of the old, and unemployment, employment, and in-school of the young at the level of estimated $\bar{I}$ (based on estimated α) and covariates. In addition, we consider three cases: 1) using implied $\bar{I}$ weighing from the iteration procedure ($\bar{I}=\overline{W}+8.75\overline{W-PV}$); 2) using implied $\bar{I}$ weighing from the regression procedure ($\bar{I}=\overline{W}+8.63\overline{W-PV}$); and, 3) using the estimated regression coefficients directly ($\bar{I}=0.512\overline{W}+4.4719\overline{W-PV}$), which is expected to obtain -1 as the coefficient on $\bar{I}$.

The following findings are noteworthy. First, using the weights on $\overline{W}$ and $\overline{W-PV}$ determined by the iteration procedure (α=8.75) or by the regression procedure (converted by the ratio translation to 1 and 8.75) yields essentially the same results. This fact is confirmed by comparing the results reported in 1) and 2) in the lower panel. Second, the implied $\bar{I}$ is very strongly related to the LFP of the old. The coefficient of implied $\bar{I}$ is very significant and stable across specifications, indicating that our measure of the inducement to retire successfully captures the impact on the elderly's decisions on retirement. Third, the coefficients on the implied $\bar{I}$ are significantly positive in the unemployment models. At the same time, however, we obtain positive and significant coefficients in the LFP models, suggesting that these level-on-level regressions capture spurious correlations between the inducement to retire for the elderly and labor market outcome for the young. Finally, the coefficients on the old LFP in the in-school models are negative and significant, which is difficult to understand.

The estimation results based on five-year differences of all variables, which are summarized in **Table 5,** help us to check the robustness of the results based on the levels. We again obtain a relatively high value of α, which is 9.5 in the iteration procedure and 9.51 in the regression procedure. This confirms that the elderly are more sensitive to potential gains from postponing retirement than social security wealth. Regarding the impact on labor market outcomes, we obtain very significant and negative coefficients on the LFP of the old across models as reported in Table 4.

However, all the coefficients in the models of young unemployment, employment, and in-school turn insignificant in sharp contrast to the results reported in Table 4. There is no coefficient on the inducement measure that is statistically significant. This result indicates that the results from the level-on-level regressions are misleading, and that inducements to retire for the elderly do not significantly affect the labor market outcome for the young.

6. Conclusion

We examined whether social security programs in Japan induce a withdrawal of the elderly from the labor force and create jobs for the young. First, we provided a historical overview of past social security reforms and employment policies for the elderly. Following this overview, we investigated the direct relationship between employment/unemployment of the young and employment of the old. Second, we explored whether social security induced a withdrawal of the old from the labor force and created jobs for the young.

The key messages are summarized as follows. First, our historical overview suggests that young unemployment issues have not motivated social security reforms and that changes in provisions are not endogenous with respect to young employment/unemployment. Second, the employment of the young tends to be positively, not negatively, associated with the LFP of the old. Third, the inducement to retire for the elderly does not significantly affect the labor market outcome for the young. These findings confirm that there is no serious trade-off between the old and the young in the labor force.

References

Aoki, Masahiko, Hugh Patrick, and Paul Sheard (1994), "The Japanese Main Bank System: An Introductory Overview," in: M. Aoki and H. Patrick, eds., *The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies*, Oxford: Clarendon Press.

Komamura, Kohei (2007), "The 2004 Pension Reform and the Impact Aging in Japan," *The Japanese Journal of Social Security Policy*, Vol.6, No.1, pp.144-156.

National Institute of Population and Social Security Research (2007), *Selected Demographic Indicators for Japan* (http://www.ipss.go.jp/index-e.html).

OECD (2004), *Ageing and Employment Policies-Japan*, Paris.

Oshio, Takashi and Satoshi Shimizutani (2006), "Social Security and Well-being of the Old in Japan," NBER International Social Security Project (Phase IV), forthcoming.

Shimizutani, Satoshi and Izumi Yokoyama (2008), "Has Japan's Long-Term Employment Practice Survived? New Evidence Emerging Since the 1990s," *Industrial and Labor Relations Review, forthcoming.*

Appendix 1. Data description

This appendix summarizes the data construction and data sources for the main variables used in the figures and tables.

(1) Labor force, employment, and unemployment

The numbers of labor force, employment, and unemployment are available from the "Labor Force Survey" (*Rodoryoku Chosa*) compiled by the Ministry of Internal Affairs and Communications. This Survey has the LFP and other employment data by five-year age brackets. We sum up the figures in published tables to make those data for the young, prime age, and old groups in each year.

(2) GDP per capita

The annual GDP data in 2005 constant prices is available from the "Annual Report on National Accounts" (*Kokumin Keizai Keisan Nenpo*) published by the Economic and Social Research Institute, Cabinet Office. The population data for each year are available from the *Annual Report on Population Estimates* (*Jinko Suikei Nenpo*) compiled by the Ministry of Internal Affairs and Communications.

(3) Real wages (monthly salary in real terms)

The data on nominal regular monthly wage are taken from the "Basic Survey on Wage Structure" (*Chingin Kozo Kihon Tokei Chosa*), which is compiled by the Ministry of Health, Labor and Wealth (MHLW). The Survey contains the most comprehensive wage data in Japan, and provides tabulations on the average and population weights by (mostly) five-year age brackets. Nominal wage is converted into real terms by CPI.

Appendix 2. Construction of social security wealth (SSW)

This appendix provides a detailed description of data used to construct SSW, as well as the limitations of the data and calculations.

I. Data descriptions and sources

(1) Eligibility ages

First, we define the eligibility ages for receiving pension benefits. Information on eligibility age for each cohort is available from the MHLW. We consider the eligibility ages for both the flat-rate and wage-proportional pension benefits for the Employees' Pension Insurance program. See **Figure 1**.

(2) Months of premium contributions

Second, we collect the months of premium contributions. The "Annual Report of the Social Insurance Agency" (*Shakai Hoken Cho Jigyo Nenpo*) provides the average months of contributions for the retired who initially claim benefits. For simplicity we assume that these figures are entirely for those who retired at the eligibility age, because most beneficiaries start to receive benefits at the eligibility age. Indeed, 79.3% of EPI beneficiaries initially claimed their benefit at age 60 (which was the first eligibility age) in 2005 according to the latest "Annual Report."

There were no data before 1988 except averages of pooled genders for 1981-1985 and for 1971 (from "Annual report on Health and Welfare" published by MHLW). Hence, we first interpolate data for pooled genders for 1986 and 1987 using the figures in 1985 and 1988. Second, we interpolate data for 1972-1980 and for 1960-1970 using the trend after 1971. Third, we estimate the data for each gender using information on the proportion of those for males to the total for 1988-1992, and then calculate the corresponding figures for females.

(3) Career average monthly income (CAMI)

Third, we compute the career average monthly income (CAMI) for each gender. The data are available from the "Annual Report of the Social Insurance Agency." Similar to the months of contributions, there were no data before 1988 except averages of pooled genders for 1981-1985. Because the proportion of the CAMI for workers before retirement to that for those who began to receive pension benefits was stable, we estimate the CAMI for retirees for 1960-1980 by multiplying the CAMI for workers (taken from the "Annual Report") by the proportion between the two for the 1988-1993 period for each gender.

(4) Pension benefit formula and insurance premiums

The "Recalculation of Fiscal Conditions" provides a formula to compute benefit levels. We assume that each change in the formula is effective in the following calendar year and insurance premium rate is common for all generations in a given year. See **Table 1**.

(6) Wage rates for the old

We calculate wage rates (excluding bonus payments) for those aged 55 to 69 in each age bracket by gender in each year. The "Basic Survey on Wage Structure" contains monthly nominal regular wages for five-year age brackets by gender, but not a more disaggregated level for those aged 65 and over. To estimate the average wage for each age, we assume that (i) the regular wages for each age between 55 and 59 is identical to the average of the age bracket; (ii) that for age 60 is equal to the average for the 60-64 bracket; and, (iii) that for those aged 68 and over is equal to the average for the 65 and over bracket. We obtain data for those aged 61-67 from a linear interpolation using data on those aged 60 and 68. Further, we assume that nominal wage for each age corresponds to that paid one year from birthday because most of the elderly are in the secondary labor market.

(7) Mortality rates

The mortality rate by each age and gender has been available annually since 1996 from the MHLW. Before 1996, published data were available for five-year age brackets only. We interpolate the death rate for each age using the age pattern in 1996. We assume that all persons die at age 100.

II. Computation of SSW

We next compute SSW, following the steps below. Unfortunately, we cannot create the incentive measure separately by marital status or deciles of earnings distribution due to data limitations. Moreover, we cannot consider the weight for each route to retirement due to data availability.

(1) Estimation of wages received when not retired

We use the "Basic Survey on Wage Structure" to construct data on the monthly regular wages for each age 55-80 in a given year (ignoring bonus payments). We estimate earnings trajectories for the cohort born in 1935 and apply their earnings trajectories to other cohorts.

(2) Estimation of pension benefits

We obtain the average months of contributions and the average CAMI in a given year for those who reach the eligible age in each year from the "Annual Report of the Social Insurance Agency." Hence, it is straightforward to estimate pension benefits if they start to receive them at the eligible age. Otherwise, we recalculate the months of contributions (for example, if a person extends a year to receive benefits, we add 12 months to months of contributions) and the CAMI (based on estimated wages, see **(1)** to obtain the pension benefits for each retired age.

(3) Discount rates

We compute cumulative discount rates based on the mortality and the interest rates. First, we calculate the probability of survival after 55 for each age by (1-mortality rate) in a given year (assuming that the person survives at 55) for each gender, using data on the mortality rate for each age bracket in a given year. Second, we add a three-percent interest rate to this probability of survival to obtain the aggregate discount rates.

(4) Social security wealth (SSW)

Assuming that all pensioners continue to receive the same benefit as that initially claimed at retirement until age 100, we compute the gross SSW by multiplying benefits and cumulative discount rates obtained from **(3)**. No one is entitled to receive any benefits before the eligibility age. To compute net SSW, we consider insurance premiums to be paid during work until age 65. The current value of premiums is calculated by multiplying monthly regular wages by half of the premium rate and discounted by the discount factor. We then compute cumulative amount of present value of the premiums until retirement.

Table 1. Changes in social security benefits in key reforms

Social security reform	Employees' Pension Insurance			National Pension Insurance	
	Wage-proportional benefit	Flat-rate benefit (annual, yen)		Flat-rate benefit (annual, yen)	
	Benefit multiplier (/1000)	Nominal	2005 prices	Nominal	2005 prices
1954	5	24,000	[127,292]	-	-
1959	6	24,000	[127,620]	42,000	[223,336]
1965	10	120,000	[473,412]	96,000	[378,730]
1969	10	192,000	[624,086]	153,600	[499,269]
1973	10	480,000	[1,185,185]	384,000	[948,148]
1976	10	624,000	[1,022,951]	624,000	[1,022,951]
1980	10	984,000	[1,279,584]	806,400	[1,048,635]
1985	7.5	600,000	[681,044]	600,000	[681,044]
1989	7.5	666,000	[729,463]	666,000	[729,463]
1994	7.5	780,000	[773,810]	780,000	[773,810]
2000	7.125	804,200	[786,888]	804,200	[786,888]
2004	7.125	804,200	[801,795]	804,200	[801,795]

(Note) 1 Flat-rate benefits in this table are calculated for beneficiaries who are assumed to have contributed premimus for 40 years in 1965 and after, while they were fixed regardless of years of contributions in 1954 and 59 reforms. During 1965 and 1980, the upper limit of years of contribution was 25 years.

Figure 1-a. Eligibility ages for EPI benefits: Males

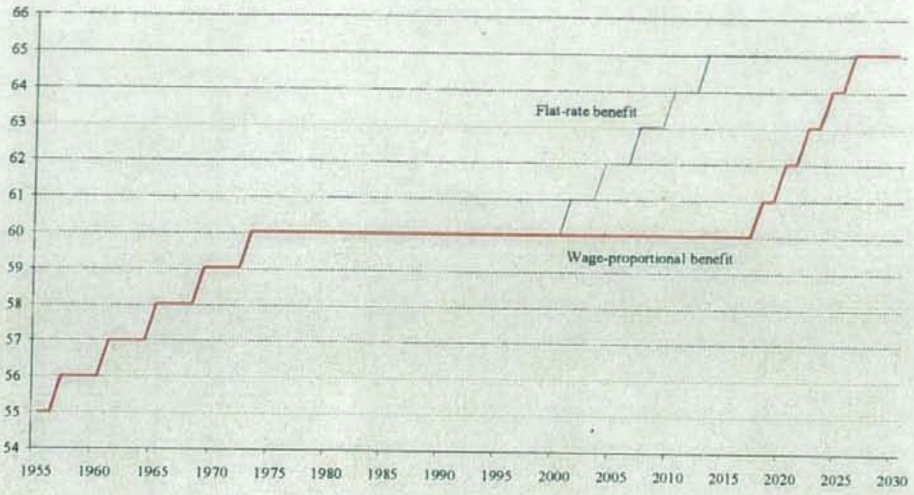


Figure 1-b. Eligibility ages for EPI benefits: Females

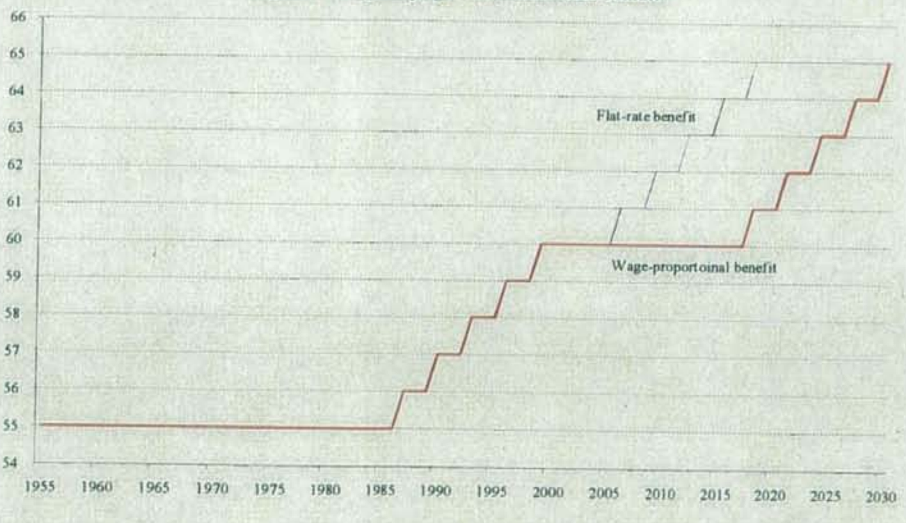
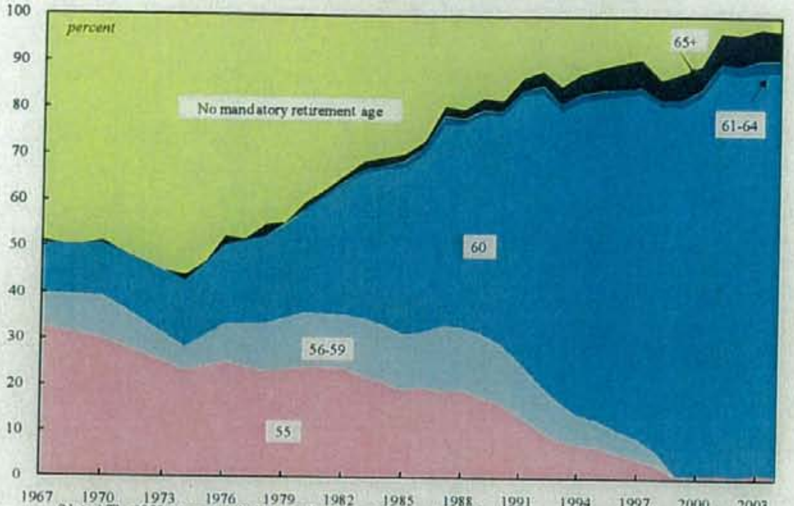
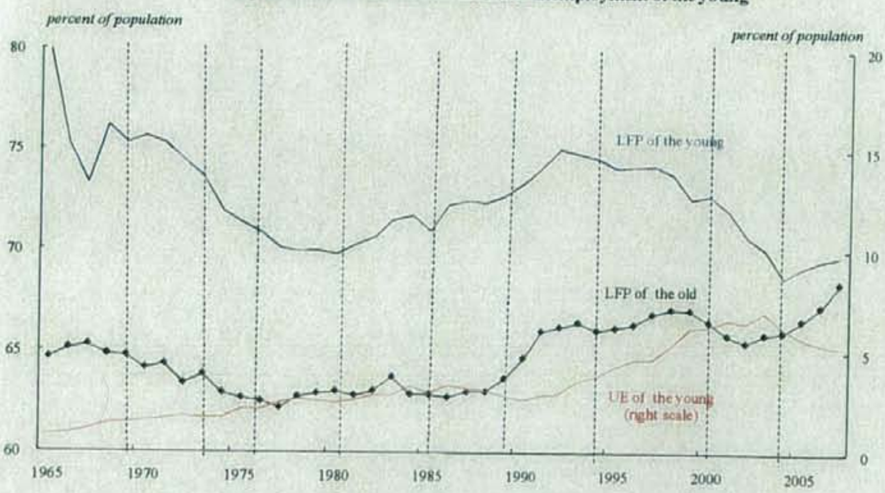


Figure 2. Distribution of mandatry retirement ages set by firms



(Notes) The "55" category includes a small number of firms with mandatory retirement age of 54 and younger. Figures are for firms with 30 or more employees
(Source) Surveys on Employment Management, MHLW

Figure 3. LFP of the old and LFP and unemployment of the young



(Note) Dotted lines indicate the dates of key social security reforms