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ABSTRACT

Retirement Expectations, Pension Reforms and their Effect on Private Wealth Accumulation*

We estimate the effect of pension reforms on households' expectations of retirement outcomes and private wealth accumulation decisions exploiting a decade of Italian pension reforms as a source of exogenous variation in expected pension wealth. Two parameters are crucial to estimate pension wealth: the age at which workers expect to retire and the expected ratio of pension benefits to pre-retirement income. The Survey of Household Income and Wealth, a large random sample of the Italian population, elicits these expectations during a period of intense pension reforms between 1989 and 2002. These reforms had different consequences for different cohorts and employment groups, providing a quasi-experimental framework to study the effect of social security arrangements on expectations of retirement outcomes and household saving decisions. Our main findings are that workers have revised expectations in the direction suggested by the reform and that there is substantial offset between private wealth and perceived pension wealth.

JEL Classification: E21 and H55
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Retirement expectations, pension reforms, and their impact on private wealth accumulation

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1. Introduction

In all industrialized countries pension benefits represent a major component of retirement income, and therefore social security arrangements can have important effects on households' intertemporal choices. One of the most important issues in this area is to what extent individuals perceive and react to changes in pension legislation. Do people increase their saving and labor supply in response to a reduction in pension benefits? Is private wealth a good substitute for mandated accumulation in the form of social security contributions?

Answers to these questions usually proceed in two steps. In a first step, researchers estimate expected pension wealth, that is, the expected present discounted value of future benefits that workers are entitled to. In a second step, expected pension wealth is related to discretionary wealth and/or labor supply behavior. Difficult methodological problems are encountered at each of these steps. The first step requires a model of the way in which individuals form expectations about future pension legislation. The second step requires to control for the possible endogeneity of expected pension wealth, and specifically of labor supply and retirement decisions, with respect to discretionary wealth accumulation decisions.

Even in the simplest scenarios, estimating future pension benefits is a difficult task. For the working population, expected pension wealth depends, among other variables, on the age at which workers expect to retire and on the expected ratio of pension benefits to pre-retirement earnings (the replacement rate). The standard approach taken in the literature is to estimate these variables from current and projected legislation on pension eligibility rules, accrual rates of contributions, productivity growth and mortality projections. The estimated pension wealth is then used for simulation analysis, to project the future path of social expenditures, or for estimating the impact of pension wealth on retirement decisions and private accumulation. Feldstein (1974) pioneered the analysis of the displacement effect of pension wealth on national saving using U.S. time series data. Since then, a growing literature has used individual level data to provide evidence on the degree of substitution between discretionary accumulation and pension wealth in the U.S. and other countries imputing pension wealth from legislation. Recent attempts include Gale (1998), Attanasio and Brugiavini (2003), and Attanasio and Rohwedder (2003) who use, respectively, U.S., Italian and

U.K. microeconomic data and find that pension wealth crowds out discretionary saving, but at a rate of considerably less than one-for-one.[1]

A different approach to analyzing the impact of social security on individual decisions relies on subjective expectations of retirement ages and benefits (Bernheim, 1990; Gustman and Steinmeier, 2001). This literature has been concerned with a rather different set of issues, which are, to a large extent, preliminary to the analysis of the effect of pension wealth on private wealth accumulation. Specifically, it analyses the degree of workers' information about the retirement benefits they are entitled to, the relation between planned and actual retirement age, and the determinants of the probability distribution of expected retirement age (Disney and Tanner, 1999; Dominitz, Manski and Heinz, 2002).

The Survey of Household Income and Wealth (SHIW), a large representative survey of the Italian population carried out by the Bank of Italy, elicits retirement age and replacement rate expectations from 1989 to 2002. This is not the only survey eliciting such expectations but, to our knowledge, it is the only survey in which this information is available for an extended period spanning a set of intense pension reforms. During the period, the Italian government enacted three reforms (in 1992, 1995, and 1997), whose ultimate effect was to reduce the replacement rate of young workers relative to older cohorts. This paper attempts to estimate the impact of these reforms on people's perceptions about their future replacement rate – a convenient summary index of the generosity of the pension system.

The analysis then focuses on the relation between expected pension wealth and private wealth. The reforms differently various cohorts and employment groups, providing an exogenous source of variability in pension wealth and an ideal instrument to estimate the offset between private and pension wealth.

Our framework calls attention to the fact that the effect of pension reforms on individual decisions depends on the extent to which people understand and react to the changes implied by the reform. The standard life-cycle hypothesis posits that a reduction in expected pension benefits should increase private wealth during the working life one-for-one. This offset is what Feldstein calls the substitution effect – pension wealth crowds out discretionary wealth. There are several

[1] Gruber and Wise (1999) use estimates of pension wealth to calculate the effects of pension arrangements on the retirement decision and on the labor force participation of the elderly.

potential counter-effects to a complete crowding out. Bequest motives, short-sightedness, liquidity constraints, risk associated with future reforms, and non-marketable future benefits are among the most cited reasons to explain why the offset between private and pension wealth might well be less than one-for-one. But there is another element that is potentially important: when pension reforms represent a permanent shift, individuals might not change their behavior, or adjust only partially to the new economic environment, because they are not informed, do not understand how the reform will affect their benefits or because changes in expectations occur slowly. This is one of the elements that we investigate here.

In doing this we answer two relevant policy questions. First, to what extent do pension reforms affect workers' expectations? Second, provided that expectations are revised, how do these revisions affect retirement decisions and discretionary wealth accumulation? Previous literature does not distinguish between these two questions, and looks directly at the link between pension arrangements and saving decisions. Answering the first question is quite important in understanding to what extent people offset reductions in pension wealth after major pension reforms. As we shall see, answers to the first question also provide important empirical tools to address the second question.

The paper is organized as follows. Section 2 illustrates the Italian pension reforms of the last decade and discusses previous evidence. Section 3 presents the data on expectations on retirement outcomes available in the 1989-2002 Survey of Household Income and Wealth, providing the ground for our instrumental variables approach. Section 4 estimates the impact of pension reforms on the expected replacement rate exploiting the ample variability in the effects of the legislation on different demographic and economic groups. The main finding is that workers have revised expectations in the direction suggested by the reform, but the adjustment is far from complete. Section 5 relates discretionary wealth to expected pension wealth, using the variations in the effects of the reforms over time and across demographic groups, to construct an instrument for pension wealth. The empirical estimates suggest an offset between private wealth and expected pension wealth of about 50 percent.

Although the estimated substitution coefficient is on the high side of current estimates, we find that so far the Italian pension reforms of the 1990s had limited impact on private wealth accumulation, because people have revised only in part their expected pension wealth after the

reform. Section 6 concludes by drawing attention to the crucial role of financial information and suggesting that in the coming decades a problem of inadequate savings could emerge for the cohorts most affected by the reforms.

2. The Italian pension system: a decade of reforms

Until recently, the Italian social security system featured high replacement rates, earnings-based benefits, indexation of pensions to real earnings and cost of living, generous provisions for early retirement, and a large number of social pensions (i.e., old-age income assistance). These features of the social security system were gradually implemented and extended during the post-war period, and especially between 1967 and 1975. The result was that the ratio of pension benefits to GNP reached almost 16 percent in 1992, the highest value among industrialized countries.

The late eighties and early nineties saw increasing alarm over the growing imbalance of the social security system expressed not only by economists and in official government documents, but also in the media. In the second half of 1992 the Amato government presented a fiscal package containing a major reform of the social security system. In 1995 Italy underwent a second major reform of the social security system, known as Dini reform. Social security legislation was further refined in December of 1997 by the Prodi government.

The main features of the reforms were an increase in the retirement age and minimum years of contribution for pension eligibility, abolishment of seniority pensions for all those who started working after 1995, a gradual reduction in pension benefits, and indexation of pension benefits to prices rather than to wages. The three reforms maintained the generous provisions of the pre-1992 regime for the relatively old workers, who in 1995 had at least 18 years of contributions, and different rules for private employees, public sector employees and self-employed.

Although the current regime combines some features of each of the three reforms, we do not detail their specific aspects.[2] In fact, we compare pension regimes and individual expectations *before the 1992 reform* and *after the 1997 reform*, omitting the transitional years between the

[2] Brugiavini (1999) provides ample details on the specific features of the sequence of the three Italian pension reforms.

Amato and Prodi reforms (1992-1997). Our dataset allows us to observe workers in two regimes, one with generous provisions (before the Amato reform, or simply the pre-reform period) and one – ten years later - with much lower benefits (after the Prodi reform, or the post-reform period), at least for some categories of workers. We regard the availability of low frequency microeconomic data as a major improvement with respect to previous evidence.

The top panel of Table 1 compares statutory retirement ages in the pre-1992 regime with the post-1997 regime. For brevity we refer to workers with more than 18 years of contributions in 1995 as the "old", to those with less than 18 years of contributions in 1995 as the "middle aged", and to those who started working after 1995 as the "young". In the new regime the young are entitled to a flexible retirement age (from 57 to 65), subject to incentives. For those already working in 1995 (the old and the middle-aged), the reform raises minimum retirement age for old age pensions of private sector employees (65 for men and 60 for women), but not for public employees and self-employed. For the old and middle aged, the reform raises minimum years of contributions for both seniority pensions and old age pensions; for the young, whose pension award formula is entirely contribution based (see below) the minimum years of contributions is just 5 years.

The shift to the new regime dramatically altered the pension award formula for new cohorts, but retained the main features of the pre-1992 formula for older workers. As indicated in the lower panel of Table 1, for the young the reform introduced contributions-based pension benefits. Specifically, in the new regime the pension is proportional to contributions, capitalized on the basis of a 5 years moving average of GDP growth. Since the contribution rate is 33 percent for private and public employees and 20 percent for the self-employed, in the new regime the self-employed will receive substantially lower pensions than employees. Actuarial equilibrium of the system is guaranteed by multiplying the sum of the contributions by a coefficient that takes into account life expectancy at retirement. The contributions-based model has identical minimum retirement age for males and females, in both old age and seniority pensions. However, the new regime applies only to the young cohorts, who entered the labor market after 1995, and will presumably start to retire after the year 2030.

For older workers, pensions are still computed using the earnings model. For the private sector, for instance, the pension is obtained as the number of years of contributions, times 2 percent of the average of the last 10 years of salaries. For the middle-aged (less than 18 years of

contributions as of 1995), pensions are computed according to a "pro-rata model": earnings-related for working years before 1995, and contribution-related afterwards. The Appendix provides further details on pension award formula before and after the reform, and of the specific provisions for public and private employees and self-employed.

While Table 1 provides a qualitative assessment of the pension reform, in order to show the magnitudes involved, in Table 2 we compute statutory replacement rates of before and after the reform of a worker retiring at 62 years, after 37 years of contributions. The example posits that the growth rate of individual earnings is 2 percent, and that the aggregate GDP growth rate is 1.5 percent. We distinguish between three categories of workers (private, public, self-employed), three cohorts (old, middle-age, young) and two periods (before and after the reform). The replacement rate is defined as the ratio of the first year's pension to the last year's earnings.[3]

In the pre-reform regime the replacement rates were the same for old, middle-aged and young workers, because the earnings model applied to all. However, in that regime replacement rates did differ considerably across occupational groups: 71.1 percent for private employees, 86.2 percent for public employees and 67.8 percent for the self-employed. The higher rates for public employees reflect more generous accrual rates (see Table 1) and pension award formulas (pensionable earnings were just the last salary).

After the reform workers are distinguished according to the number of years of contributions in 1995. In our example we still posit that each worker plans to retire after 37 years of work, but distinguish between an old worker with 27 years of contributions in 1995, a middle-aged with 10 years of contributions in 1995, and a young person who starts working in 1996. After the reform, the replacement rates of old private employees and self-employed are practically unaffected (-1 and -0.9 percent), while that of the old public employees falls by 5 percentage points. This differential effect is largely due to the reduced accrual rate of public employees (from 2.33 to 2 percent).

In contrast, middle-aged and especially young workers experience a much more dramatic reduction in replacement rates due to the reform. For private employees the change is –7.1 points for the middle-aged and –9.4 for the young; for public employees, –19.3 and –24.5 percent, respectively; and for the self-employed –22.6 and –30.4.

[3] We do not distinguish here between males and females, because the same pension accrual formula applies to both groups.

In summary, Table 2 shows that the reform has reduced pension benefits for the middle aged and the young, and for all cohorts of public employees. The implied magnitudes of change are substantial, because for some of the categories involved the replacement rate falls by over 20 percentage points. On the other hand, old private employees and old self-employed workers were basically unaffected by the reform. The Italian pension reforms therefore provide a quasi-experimental framework to analyze the impact of reforms on individual expectations. Since the reform affects some population groups (the middle-aged, the young, and public employees) more dramatically than others (old private employees and old self-employed), we can study the impact of the reform by comparing the changes in the behavior of different groups of individuals before and after the reform.

3. Expectations of retirement outcomes

A recent strand of literature has analyzed the role of expectations in determining retirement outcomes in the U.S. and Europe. In general, the literature finds that expectations are reasonably informative about retirement outcomes, but also uncovers substantial heterogeneity across the population and reveals that many workers lack knowledge about the details of their pension plans. The earliest paper is Bernheim (1990), who compares retirement expectations and realizations in the U.S. Retirement History Survey and finds that men and wealthier individuals make more accurate plans. Disney and Tanner (1999) analyze expectations of retirement age in the U.K. Retirement Survey, and find that marital status and education have a significant effect in explaining systematic deviations of expectations from outcomes. The focus of the paper is on the distribution of actual retirement age, conditional on a given expected retirement age, rather than on the overall distribution of expectations and realizations. Gustman and Steinmeier (2001) use data from the U.S. Health and Retirement Study to analyze the degree of information about social security and private pensions. They find only a weak relation between expected retirement benefits and benefits estimated on the basis of social security earnings records and employers' descriptions of pension plans.

In this paper, like most of the recent studies, we use point expectations.[4] However, while the focus of previous literature is mainly on expected retirement age, we focus on expected replacement rate, defined as the expected ratio of the first pension to the last salary. For any given expected retirement age, the replacement rate is a convenient summary measure of the generosity of the pension system and therefore a good proxy for expected pension wealth. Our data are repeated cross-sections, as opposed to the longitudinal data provided by the Health and Retirement Surveys in the U.S. or the U.K. The main advantage of the data used in the present study is that the sample spans a period set of intense pension reforms, which deeply changed the social security system.

The survey – the SHIW - is a large random sample of the Italian population drawn by the Bank of Italy every two years. Sample design, interviewing procedure, response rates and a comparison between sample and population means are reported in the Appendix. The survey covers several important topics related to retirement and pensions and collects data on the subjective assessment of expected retirement age and replacement rate. All workers (public employees, private employees, self-employed) are asked the following questions:

- *When do you expect to retire?*
- *Think about when you will retire, and consider only the public pension (that is, exclude private pensions, if you have one). At the time of retirement, what fraction of labor income will your public pension be?*

In Italy only about 5 percent of the workers are covered by occupational pension schemes, so for the overwhelming majority the social security replacement rate coincides with the overall replacement rate. The first question is posed in each survey year from 1989 to 2002; the second question only in 1989, 1991, 2000 and 2002. Since we are interested in studying workers' expectations about retirement income, we focus on the group aged 20 to 50 years. This implies that we include in our sample individuals born between 1939 (who were 50 years old in 1989) and 1982 (20 years old in 2002). The composition of the sample of older workers is likely to reflect self-selection into higher expected retirement ages, and so these workers are dropped from the analysis.

[4] Some studies focus on the subjective probability distribution of retirement outcomes, rather than on point expectations of retirement age and benefits. Hurd and McGarry (1995) analyze the subjective probability distribution of the chance of working full-time past age 62 and of living to age 75 in the U.S. Health and Retirement Study. Dominitz, Manski and Heinz (2002) use the Survey of Economic Expectations, which elicits the subjective probability distributions of

A small number of individuals younger than 20 are also excluded (less than 1 percent of the sample). We focus on how expectations change after the reform and therefore drop workers that are interviewed in the transitional years.

We define as the pre-reform period the pooled 1989-91 sample, while the post-reform period is the pooled 2000-02 sample. Finally, we consider only workers who are employed or self-employed in the survey year, excluding the unemployed, retirees and other individuals not in the labor force. Overall, we have valid responses on expected replacement rate for 9,766 males and 5,955 females.

As explained in Section 2, the pension reform has different effects depending on whether workers had contributed for more or less than 18 years at the end of 1995, and different again for those who started working after 1995. The SHIW records the age at which individuals started working. This allows us to compute the years of contribution at the end of 1995 for each worker and to define our groups accordingly.[5]

As a preliminary step, we compare the replacement rate that people expect with the rate that they should expect, given the relevant pension legislation at the time of the interview and the declared expected retirement age (henceforth "statutory replacement rate"). Pooling all observations, we find that for 75 percent of the sample the expected replacement rate is higher than the statutory rate. Expectation errors are higher for private employees, for the better educated and for females (for brevity, these regressions are not reported). These findings are in line with previous research, which generally concludes that there is considerable heterogeneity in expectations, and that many workers lack precise knowledge about their public pensions.[6] What is most interesting, however, is to compare the replacement rate of specific employment groups and cohorts before and after the reform.

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eligibility for social security benefits and of the level of benefits. They report a high degree of uncertainty about future benefits even for people only ten years from retirement.

[5] Our imputation procedure assumes no unemployment spells during the working life and is therefore subject to a certain amount of measurement error. As a sensitivity check, we assume that each individual starts working and contributing at age 20 (or 22) and define years of contribution as current age less 20 (or 22). These alternative definitions do not affect any of our results.

4. The effect of the pension reform on expectations

We use a difference-in-difference framework to study how the expected replacement rate has been affected by the three pension reforms. As with other studies that use a quasi-experimental framework, our tests rely on the assumptions that the pension reform is exogenous with respect to individual decisions – in particular, with respect to retirement age – and changes in sample composition. As far as the first assumption is concerned, we believe that the possible endogeneity of the reform can be safely ruled out. The reform was not implemented in order to offset different paths of retirement ages by different cohorts or employment groups. Rather, the 1992 reform was part of a major deficit-reduction package, prompted by a severe political crisis coupled with the dramatic devaluation of the lira; and it was followed shortly by the deepest recession of the post-war era. The 1995 and 1997 reforms were prompted by the huge projected deficits of the social security system and the attempt to meet the Maastricht criteria.

The second assumption posits that shifts in sample composition are exogenous with respect to pension expectations. Cohorts and gender are obviously determined at birth. As far as employment groups are concerned, we require that mobility across various sectors (for instance, from public to private employment or self-employment) are independent of pension expectations, i.e. that workers did not switch jobs as a result of the pension reform itself. Since the SHIW has a rotating panel component, we can check the validity of this assumption by computing the transition rates across the three employment groups between each pair of adjacent survey years from 1989 to 2002; the Appendix reports the transition rates for 1989-91 and 2000-02. We find that, in each period, the probability of not changing sector is about 90 percent for each of the three groups. Furthermore, we do not reject the hypothesis that the degree of sector mobility is the same before and after the reform for each of the estimated transition matrices.[7] Although we cannot test directly the hypothesis that workers did not change sector as a consequence of the reform, we take this as

[6] Other surveys confirm that predictions of pension-related variables are not accurate. Boeri, Börsch-Supan and Tabellini (2001) analyze the results of a recent European survey on 1,000 households showing that only two thirds of individuals give the correct answer when asked about the social security contribution rate.

[7] As an example, consider the Shorrocks mobility index in 1989-91 (12.5 percent) and 2000-02 (13 percent). The statistical test does not reject the hypothesis that mobility is the same in the two periods (the associated statistic is 0.12 and is normally distributed with mean zero and variance equal to one). The same test can be performed for each of the transition matrices (1991-93, 1993-95, 1995-98, 1998-2000), and in all cases we do not reject the hypothesis that mobility is constant.

indirect evidence that the pension reform has not changed the overall pattern of workers' mobility across sectors.

4.1. Descriptive analysis

Table 3 reports the expected replacement rate of males and females in the various employment groups and cohorts considered. On average, the rate is high for all groups, for both males and females, reflecting the generous provisions of the Italian social security system. The expected rate ranges from 65.3 to 81.8 percent before the reform, and from 57.3 to 79.9 percent afterwards, and attains the highest value for public employees (between 74 and 82 percent for males, and between 69 and 74 percent for females). On the other hand, the self-employed report the lowest replacement rates.

The expected replacement rates decrease after the reform, for both males and females, and for all employment groups. For males, the reduction of the middle-aged is stronger than for the old, particularly for private employees (-8.4 percentage points) and self-employed (-12.2 points). Replacement rates also fall for females, but the difference between the old and the middle-aged is not as large as that for males.[8]

Qualitatively, the reduction in the expected replacement rate is consistent with several features of the reform. However, for most groups the magnitude of adjustment is not as large as implied by the reform. This can be seen by comparing the expected replacement rates with the statutory rates after the reform. For this purpose, we cannot use the example of Table 2, where we keep retirement age and years of contributions fixed. The reason is that the pension accrual formula relates the replacement rate to years of contributions, and therefore workers could offset part of the reduction in pension benefits by raising retirement age after the reform. As a result, the statutory rates after the reform would reflect not only differences in pension rules across groups and pension regimes, but also the increase in retirement age.

To compute the statutory replacement rate, we therefore need information on retirement age after the reform. We indeed find that expected retirement age increases after the reform (about 2 years for males and 3 years for females), which in turn entails higher replacement rates. It follows

[8] In Table 3, no comparison is possible for young workers because this group is not observed before the reform.

that the reduction in the statutory rates in Table 3 is lower than in Table 2, although the pattern is similar: the largest reductions in the statutory rates are for middle-aged public employees and self-employed.

We now compare the expected and the statutory rates in Table 3, focusing on the middle-aged, the group that is most affected by the reform. For males, the two groups that face the largest reductions in the statutory rates (public employees and self-employed) are also those whose expected replacement rates after the reform are furthest away from the statutory rates. For example, although self-employed have revised their expectations down by 12.2 percentage points after the reform, they should have further reduced them by 9.8 percentage points to reach the statutory level of 49.2. Similarly, the post-reform expected replacement rate is above the statutory one by 7.4 and 4 percentage points for, respectively, public employees and private employees. For females, the difference between post-reform expected and statutory replacement rates is similar for private and public employees (7.9 and 7.4 percentage points, respectively) and larger for the self-employed (13.7). Overall, the comparison indicates that expectations move in the direction suggested by the reform, but that the magnitude of the revision in expectations is not as large as implied by the reform.

4.2. Regression estimates

The drawback of looking at differences in the expected replacement rate over time is that this depends not only on the pension reforms, but also on other economy-wide phenomena. To control for other factors potentially affecting the expected replacement rate, we turn to a difference-in-difference framework. We can identify the effect of the reform on the expected replacement rate because there is one group of individuals (old private employees) that was unaffected by the reform, while other groups (public employees, self-employed, the young and the middle-aged) were affected and should have revised their expectations downward. Therefore to disentangle the effect of the reforms on expectations from other effects, such as common trends in determinants of labor supply and business cycle effects, we compare the difference over time in the replacement rate of the middle-aged with the same difference for the old.

It is important to notice that our approach does not require panel data. What we need to observe is a representative sample of the various groups in each of the two periods and therefore rely on repeated cross-sectional data. The young cannot be used to evaluate the effect of the reform because they entered the labor market after 1995. Since they were sampled only after the reform was in place, they are dropped from the analysis.

We pool all data from pre- and post-reform periods and specify a reduced form for the expected replacement rate σ. We assume that before the reform σ is a linear function of socio-demographic variables X, employment status (private, public, self-employed) and depends on whether the years of contributions of 1995 are more or less than 18:

$$\sigma_i = X_i\beta + \alpha_0 + PUB_i\alpha_1 + SELF_i\alpha_2 + M_i\delta_1 + M_i * PUB_i\delta_2 + M_i * SELF_i\delta_3 + \varepsilon_i \tag{1}$$

The reference group in the regression equation is the group of old, private employees; the dummy variable M equals 1 for the middle-aged (less than 18 years of contributions as of 1995). The α coefficients capture the different rules applying to public employees (*PUB*) and self-employed (*SELF*) relative to private employees, whereas the δ coefficients measure the potential differences between middle-aged and old of the three employment groups.

After the reform σ potentially shifts for all groups, so we augment the previous equation with terms that interact the cohort (*M*), the post-reform period (*POST*, where *POST* equals one for the post-reform period) and the employment status (*SELF*, *PUB*):

$$\begin{aligned}\sigma_i = {} & X_i\beta + \alpha_0 + PUB_i\alpha_1 + SELF_i\alpha_2 + M_i\delta_1 + M_i * PUB_i\delta_2 + M_i * SELF_i\delta_3 + \\ & + POST_i\phi_1 + POST_i * PUB_i\phi_2 + POST_i * SELF_i\phi_3 + \\ & + POST_i * M_i * PUB_i\gamma_1 + POST_i * M_i * SELF_i\gamma_2 + POST_i * M_i * PRIV_i\gamma_3 + \varepsilon_i\end{aligned} \tag{2}$$

The ϕ coefficients capture the change in σ after the reform for the three employment groups: ϕ_1 measure the change for old private employees and ϕ_2 and ϕ_3 the additional effects for public employees and self-employed. The γ coefficients measure the change in σ for the middle aged due to the reform, and are our main parameters of interest. We expect the reform to reduce the replacement rate ($\gamma_1<0$, $\gamma_2<0$, $\gamma_3<0$), and that this reduction is smallest for private employees and largest for the self-employed, as shown in Table 3 ($\gamma_3>\gamma_1>\gamma_2$).

The model is estimated separately for males and females, omitting the transitional 1993-1997 period. Table 4 reports the results. In the first specification we drop the control vector X, and regress σ on a set of group dummies. The results confirm the descriptive analysis. The coefficient estimates indicate that after the reform there is a reduction in the replacement rate of private employees by 4.2 percentage points (the estimated γ_3). The coefficients γ_1 and γ_2 for public employees and self-employed are both negative, but only γ_2 differs statistically from zero.

To benchmark the estimated γ's, recall from Table 3 that σ should change by -4.4 percentage points for middle-aged private employees, -14.7 for public employees, and -20.4 for self-employed. Subtracting from these numbers the corresponding differences for the old, the appropriate benchmark for the difference-in-difference estimates is -4.7 for private employees, -8.5 for public employees, and -18.9 for the self-employed. According to the estimates in the first regression of Table 4, the difference-in-difference estimates are -4.2 for private employees, -2.0 for public employees and -4.3 for the self-employed. The coefficient for private employees is close to the benchmark, but the other two coefficients imply considerable underestimation of the effect of the reform.

The second regression adds to the basic specification regional and educational dummies and annual earnings (in thousand Euro). Working in the South and the level of income are positively related to σ. The effect of the education dummies is positive for high school, negative for university degree but never statistically different from zero. The γ's are qualitatively unchanged, confirming partial adjustment of the expected replacement rate in the new pension regime.

The regressions for females uncover an across-the-board reduction in σ after the reform by 6.1 percentage points, but the employment dummies interacted with M and $POST$ signal no differential effect by employment groups or cohort after the reform. The corresponding coefficients are not statistically different from zero, while Table 3 implies a large reduction in σ for each employment group.

In summary, the regressions of Table 4 suggest that most groups have revised their expectations in the direction and magnitude implied by the reform. But the revision to the new pension rules has been far from complete. Two interpretations of the results are possible: an anticipation effect, or lack of information. If the reform had been anticipated, people would have adjusted downward the expected replacement rate even before the reform. This explanation clashes

with the fact that, on average, the 1989-91 expected replacement rates were quite close to – or even overestimated – the statutory rates. Furthermore, the anticipation effect should be stronger in the years immediately before the reform; however, dropping 1991 and defining the pre-reform period as just 1989 does not change the results with respect to estimates in Table 4. Therefore, the most likely explanation for our findings is that, as of 2002, many workers did not fully understand the implications of the new pension regime and had not yet updated their pension expectations accordingly.

5. The offset between pension wealth and private wealth accumulation

So far our analysis suggests that people reacted to the pension reform by raising expectations of retirement age and reducing perceived replacement rates and pension wealth. However, the magnitude of the expectation revision is considerably lower than the actual magnitudes implied by the reform. This is an important first step in evaluating the effect of pension reforms on individual behavior. The next important step relates perceived pension wealth to private accumulation. Since the reform provides an exogenous source of variation in pension wealth across socio-economic and demographic groups, we are in a good position to assess the extent to which the revision in retirement age and replacement rate leads to changes in private wealth. In this section we therefore estimate the offset between pension wealth and private wealth using the reform as an instrument for pension wealth.

Our empirical specification relates private wealth to pension wealth, and to a set of observable variables potentially correlated with private wealth. More specifically, we estimate the following equation:

$$WY_{it} = \alpha + SSWY_{it}\delta + X_{it}\gamma + \theta_t + \varepsilon_{it} \tag{3}$$

where WY_{it} is private wealth of household i at time t, scaled by household disposable income, $SSWY_{it}$ is the ratio of expected pension wealth at retirement to earnings (evaluated at time t), X_{it} is a

vector that includes age of the household head,[9] disposable income, employment group dummies, education dummies, and region dummies;[10] θ_t represents time effects. Age, income, education and employment sector are proxies for lifetime earnings, while year dummies capture macroeconomic effects. Sensitivity analysis is performed to check, among other aspects, for the inclusion of an additional vector of demographic characteristics such as family size and number of family workers.

Total net worth is defined as financial assets plus real assets (real estates and businesses) minus financial debt. As for the ratio of expected pension wealth at retirement to earnings (evaluated at time t), in order to keep its computation as simple and as tailored as possible to elicited expectations on the replacement rate and the retirement age, we use the following proxy for each worker's pension wealth:

$$SSWY_t = \left[P(N_t \mid t) \left(\frac{1+g_u}{1+r} \right)^{N_t - t} \sigma_t \right] \sum_{\tau=N_t}^{T} P(\tau \mid N_t) \left(\frac{1+g_N}{1+r} \right)^{\tau - N_t} \tag{4}$$

where σ_t is the expected replacement rate and N_t the expected retirement age elicited at time t,[11] T the maximum length of life, $p(\tau|N)$ the probability of surviving to age τ, conditional on being alive at age N, g_u the growth rate of earnings for group u, r the real interest rate, and g_N the growth rate of pension benefits during retirement – assumed to be the same for all groups.

In the survey we observe σ_t and N_t for each individual. Survival probabilities are taken from the Italian life tables, by age and gender, for the years 1990 and 2000, so that the change in life expectancy over time, and in particular before and after the reform, is accounted for.[12] The growth rate of earnings (g_u) is estimated from our data at 0.015 for individuals with university degree and at 0.008 for individuals with less than university degree.[13] We assume that after retirement pensions are constant in real terms (g_N=0) and that the real interest rate is equal to 2 percent.

Armed with this information, we can compute the expected ratio of pension wealth for each individual in the sample. In households with more than one member, we define the household

[9] We define the head of the household as the partner with higher earnings.
[10] In the regressions, the reference group is private employees with less than 13 years of education and living in Northern Italy.
[11] t=1989, 1991, 2000, 2002, the survey years in which the expected replacement rate is elicited.
[12] Data source: *Italian Statistical Annex* (Rome: ISTAT, 1990 and 2000).

expected pension wealth-to-income ratio at retirement as the weighted sum of both partners' expected pension wealth-to-income ratio, where each partner is given her relative weight in terms of her income in relation to the income of the couple.

The individual expected pension wealth-to-income ratio is adjusted by the factor suggested by Gale (1998). This factor allows to adjust expected pension wealth for the number of years people have contributed to their pension plan as well as for when in their life cycle they have experienced some shock that should have made them revise their consumption and savings plans (the reforms, in our case). Omitting to adjust for this factor would produce an underestimate of the offset between pension wealth and private wealth, i.e. the estimates for the pension wealth coefficient would be biased towards zero. The adjustment depends on the utility function that is chosen for the underlying life-cycle model and on the values for the discount rate, the interest rate and the time preference rate (see Appendix for further details on the "Adjustment factor for pension wealth"). We use the adjustment developed in Gale (1998) for a CRRA utility function and set the discount rate and the interest rate equal to 2 percent. Sensitivity analysis is then performed on these values.

5.1. Regression estimates

Table 5 presents the results obtained from, respectively, OLS (col. 1-2) and median regressions (col. 3-4). OLS estimates are inefficient if the disturbance term is heteroskedastic. Standard errors are therefore corrected using the White's (1980) heteroskedasticity-consistent covariance matrix estimator. To further characterize the distribution of the wealth-income ratio, we rely on estimates based on least absolute deviations, which are consistent and asymptotically normal in the presence of thick tailed error distributions.[14]

In columns (1) and (3) we report the results of a specification that includes only the pension wealth to income ratio, time dummies and age, whereas in columns (2) and (4) we report the results of the full specification as in equation (3). The offset between private wealth and pension wealth is, respectively, 40 percent and 47 percent, and statistically different from zero at the 1 percent level,

[13] The growth rates were obtained from a median regression of log-earnings on sex and employment dummies and full interaction of age with a college dummy. Data source: SHIW, years 1989-2002, individuals with age 20-60.

[14] We also perform trimmed least squares, discarding the top and bottom 1 percent of the private wealth-income ratio distribution. The results are qualitatively unchanged.

for the OLS and LAD baseline specifications. The full specification gives an offset of, respectively, 17 percent and 25 percent, again significant at the 1 percent level.[15]

The estimates indicate that the wealth-income ratio increases with age during the working span (recall that individuals over 50 are excluded), in agreement with the life-cycle model. The extended specifications further signal that private wealth increases with labor income. The latter should not affect the wealth-income ratio if preferences are homothetic. The regression coefficient, on the other hand, can hardly be interpreted as evidence in favor or against homothetic preferences since other variables (education or residence in the South) may also proxy for lifetime earnings. Residence in the South reduces wealth accumulation; education has an opposite effect. These variables are obviously related to household resources. But they may also capture other effects. For instance, there is evidence that the better educated are more likely to report financial assets (Brandolini and Cannari, 1994); households with higher education may have easier access to capital markets and to better investment opportunities; thrift may be correlated with schooling.

The results in Table 5, however, understate the offset between pension wealth and private wealth if pension wealth and private wealth are positively correlated. This might be the case if thrift and hard work are correlated tastes, and people with these traits choose to save more and to retire with higher pension wealth. Since the pension reforms provide us with an exogenous source of variation for pension wealth, we can perform instrumental variable estimation and remove this source of bias from our estimated offset.

In particular, in (4) there are two potential sources of endogeneity: the subjective replacement rate and the subjective retirement age. In a first IV regression we use as instrument the "statutory pension wealth", computed by replacing only the expected replacement rate with the statutory rate (derived from legislation before and after the reform as explained in the Appendix). In a second IV regression statutory pension wealth is computed in relation to the statutory replacement rate and to the sample median expected retirement age, by gender, before and after the reform.[16]

The validity of these instruments rests on the fact that the rules for computing pension wealth change exogenously for the middle-aged after the reform, depending on employment group

[15] Without the adjustment factor for pension wealth, the offset would be, respectively, 13 percent and 17 percent for OLS and LAD regressions (tables not reported in the paper and available upon request).

[16] Median retirement age is set at 60 for males and at 55 for females before the reform and at 65 and 60, respectively, after the reform.

membership. It also depends on the assumption that the middle-aged did not switch jobs after the reform to offset the impact of the pension reform on their retirement wealth. Under this reasonable assumption, which is corroborated by the evidence on employment transition matrices discussed in Section 4 and reported in the Appendix, the instruments are also exogenous with respect to private wealth accumulation decisions.[17]

Results reported in Table 6 indicate that the offset between private wealth and pension wealth is considerably higher than the one resulting from OLS regressions, confirming the idea that the previous estimates are biased toward zero. The estimation with all the controls gives an offset of 31 percent and 52 percent, respectively, depending on the definition of statutory pension wealth used.[18] We check the sensitivity of the results against the inclusion of family size and number of income recipients or a dummy for whether the number of family workers is greater than one among the vector of observable characteristics as in equation (3). We also introduce a quadratic term in age and show that the results are not sensitive to any of these changes in specification.

Another set of sensitivity checks relates the interest rates, the discount factor and the coefficient of relative risk-aversion that the computation of the Gale adjustment factor involves. In particular, we check the sensitivity of the results to changes of $x = [(r-\delta)/\rho] - r$, where r, δ and ρ are, respectively, the interest rates, the discount factor and the coefficient of relative risk-aversion. We have assumed earlier that x=-0.02, which is consistent, for instance, with $r = \delta = 0.02$. Setting x=-0.04 or x=-0.06 gives smaller offsets, as expected. For instance, the offset in the full specification is, respectively, 13 percent and 12 percent for the OLS estimates; the first set of IV estimates gives, respectively, an offset of 25 percent and 23 percent for the two values of x, whereas the second set of IV estimates gives an offset of 42 percent and 35 percent.

Previous literature provides some evidence on the effect of the 1992 Italian pension reform on household saving. Using SHIW data for the years 1989-95, Attanasio and Brugiavini (2003) exploit the changes in pension wealth across cohorts and employment groups due to the 1992 reform to estimate the crowding out effect of pension wealth on the household saving rate. They find that a reduction in pension wealth of 1 euro prompts an increase in private saving of between

[17] Attanasio and Brugiavini (2003) use similar employment-group instruments for pension wealth in their study of the impact of the 1992 Italian pension reform on the household saving rate.

[18] We also run a regression of private wealth on statutory pension wealth (the instrument). The estimated offset in the baseline specification is -0.669 (with a standard error of 0.051) and -0.459 (with a standard error of 0.052).

30 to 40 cents. Although these point estimates are not far from ours, we must bear in mind that there are at least three crucial differences between these two studies: we look at the combined impact of three pension reforms (1992, 1995 and 1997), focus on private wealth, rather than on saving, and rely on a different estimate of pension wealth, based on the expected retirement age and expected replacement rate, rather than computed from legislation.

5.2. Implications

The estimated coefficient for the offset between pension wealth and private wealth means that, on average, there is far from full crowding out of private accumulation in our sample of Italian households. Combining this information with our findings that people have revised their expectations on replacement rate and retirement age less than they should have following the reforms, makes the question of whether people are saving enough for their retirement of central interest.

To provide a sense of the magnitudes involved, let us look at the following case: a female aged 40 in the year 2000 (and belonging to the so-called middle-aged group with respect to the reform), single, public employee, with 13 years of education (i.e. non-university graduate), after the reform expects to retire at age 60 with a replacement rate of 75 percent. Using equation (4), and applying the survival probabilities for a female of her age in 2000, her pension wealth-to-income ratio at retirement would be 10.351. Setting her statutory retirement age at 60 and statutory replacement rate at 68 percent,[19] would give a statutory pension wealth-to-income ratio of 9.386, which would mean that her expectations overstate her pension wealth by 26,050 euro (at the annual median disposable income of 27,000 euro). Using the most optimistic estimates of -0.525 for the offset between pension wealth and private wealth, this would mean that this single household would adjust private wealth by 13,677 euro upon an unexpected change in pension wealth of 26,050 euro.

The results have also interesting implications for evaluations of how pension reforms affect private and national saving. On this front, one may be puzzled by the observation that over the past

[19] This would still be 2.6 percent points higher than the statutory replacement rate for a female in her employment and cohort group, as indicated in Table 3.

decade the Italian national saving rate has remained roughly constant, despite deep pension reforms reducing considerably pension wealth.[20]

The aggregate effect of the reform on national saving depends on the reaction of the old, the middle-aged, the young and those already retired, weighted by the respective shares of these groups in total population. The comparison between the statutory and the expected pension wealth reveals that the middle-aged have perceived only two thirds of the reduction in statutory pension wealth; furthermore, from the IV estimates in Table 6 only 50% of the reduction in perceived pension wealth has been offset by an increase in private wealth. The effect for the old is small, because for this group the change in actual and perceived pension wealth has been far more limited.[21] On the other hand, our regressions cannot predict the effect of the reform on those that retired before the reform, nor on those that entered the labor market after 1995 (which are not included in the estimation). We speculate that for the former group there should be little effect, because the reform has mainly affected working cohorts and future generations, rather than the retired. As for the young, the effect might be more substantial, but as of today their weight in the total working population is still limited, and therefore an impact on the aggregate wealth and saving might not be visible. Overall, this might explain why the Italian saving rate has not increased despite the decade of pension reforms.

In summary, we find robust evidence that expected pension wealth is a substitute for private wealth. However, we also find that the pension reforms of the last decade did not have a large impact on the household private wealth and, consequently, on national saving. Two factors account for this result. First, the substitution between the two forms of wealth is only imperfect, with offset rates in the order of 0.5. Second, some households do not yet seem to have fully internalized the implications of the reform into their expectations of social security pensions or their retirement plans.

[20] In 1981-1990 the average gross national saving rate was 22.3 percent, while in 1991-2000 it was 21 percent (20.4 percent in 2000-01). Clearly pension reform is just one of the main determinants of national saving, so the figures do not rule out that the reduction in pension wealth has increased national saving, with offsetting effects from other sources. But the figures are suggestive of a limited aggregate saving impact of the reform.

[21] Recall from Section 2 that pension reforms reduced pension of the elderly, particularly of public employees, through changes in the pension award formula and indexation of benefits to cost of living rather than wages.

6. Conclusions

The Survey of Household Income and Wealth, a large representative sample of the Italian population, elicits expectations of replacement rates from workers interviewed in the years between 1989 and 2002, a period of intense pension reforms. The reforms reduced the replacement rate and increased retirement age, and had different impact on different cohorts and employment groups, providing exogenous variations in replacement rates to study the effect of pension reforms on expectations.

We find that pension reforms indeed affected expectations of retirement benefits. However, the revision in expectations is limited, and many individuals have not yet updated completely their expectations. For instance, while the perceived replacement rate of the self-employed falls by about 10 percentage points between 1989-91 and 2000-02, in reality the rate falls by about 20 points. Moreover, we find that the offset between pension wealth and private wealth is only partial, in the order of 50 percent. This suggests that the effect of pension reform on individual behavior depends critically on the extent of the knowledge and information that individuals have about the social security system and changes to it, and has three important policy implications.

First, the descriptive and econometric analysis implies that current workers lack crucial information to fully understand the implications of the new pension regime, thus making a clear case for investing public resources in the dissemination of information about pension rights, especially during periods of intense reform. Campaigns to increase financial literacy and the understanding of pension rules, and to provide individuals with regular statements of their expected retirement income, are important steps in this direction. Second, the paper suggests that if one wants to use observations of past pension reforms to make predictions about likely responses to new reforms, then one needs to estimate how responses in the past were limited by inaccurate updating of expectations, and how the new reform will affect expectations. Finally, given the dramatic reduction in replacement rates implied by the pension reform, combined with an incomplete offset between pension wealth and private wealth, it is likely that some individuals, especially the younger cohorts most affected by the reform, might not be saving enough for their old age. This might have a long-term impact on the well being of future retirees in the coming decades, when the generations affected by the pension reform will start to retire.

Appendix

1. The pension award formula before and after the reform.

In the *pre-reform* regime social security benefits were computed according to an earnings-based formula:

$$\rho N \overline{w}_R$$

where ρ, N and $\overline{w}_R$ are, respectively, the accrual rate, the years of contributions and the average of the last R years of salary. The accrual rate is 2 percent for private employees and self-employed, and ranges from 2.2 to 2.5 percent for public employees, depending on the years of contribution; R is 5 for private employees, 1 for public employees, and 10 for the self-employed.

In the *post-reform* regime pensions are computed distinguishing between three cases: *earnings model for the old* (more than 18 years of contributions in 1995), *contribution model for the young* (started working after 1995), and *pro-rata model for the middle-aged* (less than 18 years of contributions as of 1995). In each case, different rules apply to public employees, private employees and self-employed. *For the old*, benefits are the sum of two components. The first component is $\rho\alpha_{92}\overline{w}_R$, where α_{92} is the number of years of contributions at the end of 1992. The second component reflects a gradual increase of R to 10 for private and public employees and to 15 for the self-employed. Namely, for years of contributions between 1992 and 1995, R is increased by 1; for years of contributions between 1995 and the year of retirement, R is increased by the minimum of 5 and 2/3 of the years of contributions between 1995 and the year of retirement. For instance, for those retiring in 2000 R is increased by 3; for those retiring in 2005 it is increased by 5. The second component is therefore:

$$\rho(\alpha_{95} - \alpha_{92})\overline{w}_{R'} + \rho(N - \alpha_{95})\overline{w}_{R''}$$

where α_{95} is years of contribution at end of 1995, $R' = R + 1$ and $R'' = R + \min[5, \text{int}((2/3) * (N - \alpha_{95}))]$. Therefore, the pension for the old is:

$$\rho\left[\alpha_{92}\left(1 - \frac{R}{R'}\right) + \alpha_{95}\left(\frac{R}{R'} - \frac{R}{R''}\right) + N\frac{R}{R''}\right]\overline{w}_R$$

In practice, for realistic earnings growth rates, the second component has a small impact on the final pension with respect to the pre-reform regime. *For the young*, benefits are computed according to a contribution model:

$$\gamma\tau\sum_{0}^{N-1} w_t (1+g)^{N-1-t}$$

where τ is the contribution rate (0.33 for private and public employees and 0.20 for self-employed) and g a 5-year moving average of the GDP growth rate. Contributions are therefore proportional to earnings, capitalized on the basis of a 5-year moving average, and then transformed in flow benefits using a coefficient (γ), set by legislators, that depends on retirement age and life expectancy. Currently, γ increases from 4.720 percent for somebody retiring at 57 to 6.136 percent for somebody retiring at 65. *For the middle-aged*, benefits are computed using the earnings model for years of contributions before 1995, and the contribution model for years of contributions after 1995. The pension is then equal to:

$$\rho\alpha_{92}\overline{w}_R + \rho(\alpha_{95} - \alpha_{92})\overline{w}_N + \gamma\tau\sum_{\alpha_{95}}^{N-1} w_t (1+g)^{N-1-t}$$

2. The adjustment factor for pension wealth

As in Gale (1998), we adjust pension wealth multiplying each individual's expected pension wealth by a factor that takes into account people's position in the life cycle and years of service in the pension as well as the position in people's life cycle when a change in pension benefits takes place (the reforms, in our case). The underlying idea for the simplest theoretical model is that people plan their consumption at the beginning of their working career, and consumption is a function of total lifetime resources, that is earnings and pension benefits. Since decisions are based on total lifetime resources, the true offset between pension wealth and private wealth is 100 percent (coefficient of -1). However, as pointed out by Gale (1998, pp. 708-710) an estimate of the coefficient of pension wealth in a regression of private wealth on earnings to date, lifetime earnings and pension benefits, would not produce the true offset. The pension wealth coefficient would instead be between –1 and 0, and a function of the years of service in the pension and of the expected life horizon. In particular, in the case of a CRRA utility function, the coefficient would be as follows:

$$Q = \frac{\exp(xS-1)}{\exp(xT-1)} = \frac{\exp(xS-1)}{\exp(x(le+S)-1)}$$

where $x = \frac{r-\delta}{\rho} - r$, and r =interest rate, δ =time preference rate, ρ =coefficient of relative risk aversion, S =years of service in the pension, T =life span, and le =life expectancy.

Therefore, one would need to adjust pension wealth by this factor in order to recover the true offset in the regression. Intuitively, this factor adjusts pension wealth to account for the fact that a change in pension wealth that takes place at the beginning of one's career translates into a change in the consumption plan (and therefore in non-pension wealth) over the life span. At time S, the reduction in non-pension wealth is captured by Q, and Q increases with S to reflect the fact that the later in life we observe individual's decisions, the more of the initial plan has already taken place.

A further aspect to be taken into account is given by the time at which the change in pension benefit is realized. For a generic time t^*, Gale's adjustment factor is:

$$Q^* = \frac{\exp[x(S-t^*)-1]}{\exp[x(le+S-t^*)-1]}$$

This accounts for the fact that individuals had to revise their plans at time t^* and the remaining horizon over which they can realize their plans is shorter.

In our setting, we assume that $r = \delta = 0.02$ and apply different adjustment factors according to which group the individual belongs to. In particular, the so-called "Old" group is not affected by the reform, and therefore we apply a version of Q, corrected for the fact that individuals start contributing to the pension system at different ages (we observe this in the data), i.e.:

$$G = \frac{\exp[-r(age-agew)-1]}{\exp[-r(le+age-agew)-1]}$$

where *age* = age at which observed and *agew* = age at which started working.[22] The adjustment factor for the group affected by the reform ("Middle-aged") instead needs to take into account of the year in which the reform took place and is therefore a version of Q^*. We assume that the year of the reform is 1995 and adjust pension wealth of individuals belonging to this group, and observed after the reform, by the following factor:

$$G = \frac{\exp[-r(age - ageref) - 1]}{\exp[-r(le + age - ageref) - 1]}$$

where *ageref* = age at which the individual faced the reform.

3. The Survey of Household Income and Wealth

The SHIW is a representative sample of the Italian resident population. Sampling is in two stages, first municipalities and then households. Municipalities are divided into strata defined by regions and classes of population size (less than 20,000, 20,000 to 40,000, more than 40,000). Households are then randomly selected from registry office records, see Biancotti et at. (2004) for details. From 1987 onward the survey is conducted every other year and covers about 24,000 individuals and 8,000 households, defined as groups of individuals related by blood, marriage or adoption and sharing the same dwelling. Interviews are conducted by a specialized agency with professional interviewers, and are preceded by extensive trainings and meetings with Bank of Italy representatives. Interviews take place in person, by visiting the residence of the household. Because of its sample design and its collection of detailed wealth statistics, the SHIW is similar to the Survey of Consumer Finances (SCF), which is representative of the U.S. population. The English version of the questionnaire, data and survey documentation can be downloaded from the Bank of Italy web site: http://www.bancaditalia.it/statistiche/ibf/statistiche/ibf/pubblicazioni/boll_stat/en_shiw00.pdf.

Table A1 compares the population and sample means of selected demographic variables (age, gender and region) in 1989, 1991, 2000 and 2002. The population means are obtained from the *Italian Statistical Annex* (Rome: ISTAT, 1989, 1991, 2000 and 2002). Sample statistics are computed using the SHIW population weights, defined as the inverse of the probability of inclusion in the sample. Overall, the comparison indicates that the sample reflects fairly well the demographic characteristics of the Italian population and is stable over time.

4. Employment transition matrix

The rotating panel component of the SHIW allows us to compute sector transition matrices in 1989-91, 1991-93, 1993-95, 1995-98, 1998-2000, and 2000-02. Table A2 reports two such transition matrices and shows that mobility across sector is stable over time. All elements on the main diagonal are close to 90 percent. The Shorrocks mobility index is 12.5 percent in 1989-91 and 13 percent in 2000-02. The hypothesis that the mobility index did not change after the reform cannot be rejected at the 1 percent level (the statistic associated to the difference test is 0.12 and is distributed as a standard normal). Comparison with mobility matrices for other years confirms this result. We interpret the stability of the employment transition matrix as indirect evidence that the pension reform did not change the pattern of mobility across the three sectors.

[22] We use the Italian life tables by age and gender to recover *le* (life expectancy).

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Table 1
Retirement age and pension award formula after the Italian pension

		Retirement age						
		Old age pensions				*Seniority pensions*		
		Minimum retirement age			*Minimum years of contributions*	*Minimum years of contributions*		
		Private sector	Public sector	Self-employed		Private sector	Public sector	Self-employed
Pre-1992 regime	**All workers**	60(55)	65(60)	65(60)	15	35	20	35
Post-1997 regime	**Old**	Progressively rising to 65(60)	65(60)	65(60)	Progressively rising to 20	40 before age 57 35 after age 57		40 before age 58; 35 after age 58
	Middle-aged	Progressively rising to 65(60)	65(60)	65(60)	Progressively rising to 20	40 before age 57 35 after age 57		40 before age 58; 35 after age 58
	Young	Subject to incentives: 57-65			5	Abolished		

		Pension award formula		
		Private sector	*Public sector*	*Self-employed*
Pre-1992 regime	**All workers** *Earnings model*	2% × years of contributions × average of the last 5 years of earnings	2.33% × years of contribution × last year of earnings	2% × years of contributions × times average of the last 10 years of earnings
Post-1997 regime	**Old** *Earnings model*	Gradually to 2% × years of contribution × average of last 10 years of earnings	Gradually to 2% × years of contribution × average of last 10 years of earnings	Gradually to 2% × years of contribution × average of last 15 years of earnings
	Middle-aged *Pro rata model*	Earnings model before 1995, contribution model after 1995.		
	Young *Contribution model*	Contributions (33% of gross wage for employees and 20% for self-employed) are capitalized on the basis of 5-years moving average of GDP growth. The capitalized sum is then multiplied by a coefficient that varies by retirement age, taking into account life expectancy.		

Note. Old, middle-aged and young refer, respectively, to workers with more than 18 years of contributions in 1995, less than 18 years of contributions in 1995, and who start working after 1995. In the top panel female retirement age is reported in brackets when different from males.

Table 2
The statutory replacement rate before and after the pension reform

	Pre-reform	*Post-reform*	*Difference*
Private employees			
Old	71.1	70.1	-1.0
Middle-aged	71.1	64.0	-7.1
Young	71.1	61.7	-9.4
Public employees			
Old	86.2	81.2	-5.0
Middle-aged	86.2	66.9	-19.3
Young	86.2	61.7	-24.5
Self-employed			
Old	67.8	66.9	-0.9
Middle-aged	67.8	45.2	-22.6
Young	67.8	37.4	-30.4

Note. In the post-reform period, for middle-aged and young the replacement rate is based on the assumptions that the growth rate of earnings is 2 percent per year and the growth rate of aggregate GDP is 1.5 percent. In all cases the retirement age is 62, and each worker contributes for 37 year before retiring. In the post-reform regime the example considers an old worker who contributes 27 years before 1995 and 10 years after, and a middle-aged worker who contributes 10 years before 1995 and 27 years after.

Table 3
Expected and statutory replacement rate: descriptive statistics

	Males					
		Expected			*Statutory*	
	Pre-reform	*Post-reform*	*Difference*	*Pre-reform*	*Post-reform*	*Difference*
Private employees						
Old	79.2	74.9	-4.3	71.2	71.5	0.3
Middle-aged	79.2	70.8	-8.4	71.2	66.8	-4.4
Young		67.9			67	
Public employees						
Old	81.8	79.9	-1.9	86.2	80	-6.2
Middle-aged	80.6	76.6	-4	83.9	69.2	-14.7
Young		73.9			66.2	
Self-employed						
Old	69.0	61.2	-7.8	71.5	69.9	-1.5
Middle-aged	71.2	59.0	-12.2	69.6	49.2	-20.4
Young		61.8			41.1	
	Females					
		Expected			*Statutory*	
	Pre-reform	*Post-reform*	*Difference*	*Pre-reform*	*Post-reform*	*Difference*
Private employees						
Old	77.2	71.1	-6.1	67.3	71.5	4.2
Middle-aged	76.9	70.0	-6.9	67.3	62.1	-5.2
Young		67.2			61.2	
Public employees						
Old	78.3	74.0	-4.3	79.2	79.5	0.3
Middle-aged	78.3	72.8	-5.5	76.9	65.4	-11.5
Young		69.1			55.3	
Self-employed						
Old	65.3	57.3	-8	67.8	69.9	2.1
Middle-aged	69.7	58.9	-10.8	62.3	45.2	-17.1
Young		57.4			35.5	

Note. Data are drawn from the 1989-2002 SHIW. The pre-reform period is 1989-91, the post-reform period is 2000-02.

Table 4
The effect of the reform on the expected replacement rate: regression results

	Males		Females	
Private employee, middle-aged, after the reform	-4.202	-4.552	-0.718	-0.796
	(0.960)**	(0.957)**	(1.427)	(1.411)
Public employee, middle-aged, after the reform	-2.046	-2.585	-1.182	-1.476
	(1.357)	(1.353)	(1.336)	(1.324)
Self-employed, middle-aged, after the reform	-4.291	-4.298	-3.118	-2.868
	(1.511)**	(1.504)**	(2.375)	(2.350)
Public employee	2.689	2.501	1.077	-0.483
	(0.696)**	(0.699)**	(0.960)	(0.974)
Self-employed	-10.046	-5.956	-12.020	-6.733
	(0.839)**	(0.965)**	(1.405)**	(1.508)**
Middle-aged	0.109	0.916	-0.421	-0.251
	(0.684)	(0.689)	(1.027)	(1.022)
Public employee, middle-aged	-1.357	-1.603	0.414	0.695
	(1.148)	(1.144)	(1.385)	(1.371)
Self-employed, middle-aged	1.968	1.096	4.959	4.267
	(1.341)	(1.339)	(2.074)*	(2.053)*
Post-reform	-4.289	-3.961	-6.110	-5.735
	(0.716)**	(0.715)**	(1.136)**	(1.124)**
Public employee, after the reform	2.325	2.453	1.797	2.317
	(1.226)	(1.221)*	(1.532)	(1.518)
Self-employed, after the reform	-3.632	-3.874	-1.735	-2.188
	(1.317)**	(1.313)**	(2.110)	(2.089)
Central Italy		0.724		0.362
		(0.431)		(0.526)
Southern Italy		1.249		2.569
		(0.370)**		(0.517)**
Earnings		0.235		0.413
		(0.027)**		(0.045)**
High school degree		0.622		1.587
		(0.356)		(0.486)**
University school degree		-0.429		0.775
		(0.586)		(0.708)
Constant	79.182	74.249	77.215	70.683
	(0.425)**	(0.673)**	(0.737)**	(0.956)**
Observations	9766	9766	5955	5955
R-squared	0.16	0.17	0.11	0.13

Note. All explanatory variables are dummy variables, except earnings (expressed in thousand euro). Young workers, who started working after 1995, are excluded. Standard errors robust to unknown form of heteroskedasticity are reported in parentheses. Two stars indicate statistical significance at the 1% confidence level, one star at the 5% level.

Table 5
The offset between private wealth and pension wealth:
OLS and LAD estimates

	Ordinary Least Squares		*Least Absolute Deviations*	
SSW/Disposable income	-0.403	-0.167	-0.474	-0.254
	(0.043)**	(0.044)**	(0.035)**	(0.032)**
Year 1991	0.641	0.754	0.596	0.580
	(0.187)**	(0.182)**	(0.150)**	(0.132)**
Year 2000	1.384	1.464	0.804	0.851
	(0.183)**	(0.180)**	(0.147)**	(0.131)**
Year 2002	1.700	1.784	0.752	0.909
	(0.190)**	(0.187)**	(0.152)**	(0.135)**
Age	0.134	0.101	0.161	0.114
	(0.011)**	(0.011)**	(0.009)**	(0.008)**
High school degree		1.018		0.643
		(0.133)**		(0.097)**
University degree		0.855		0.454
		(0.206)**		(0.150)**
Disposable Income		0.012		0.034
		(0.003)**		(0.002)**
Self-employed		3.574		1.974
		(0.159)**		(0.115)**
Public employee		0.279		0.345
		(0.154)		(0.112)**
Central Italy		0.092		0.319
		(0.160)		(0.116)**
Southern Italy		-0.279		-0.065
		(0.141)*		(0.102)
Constant	-0.990	-1.869	-2.543	-3.202
	(0.410)*	(0.409)**	(0.328)**	(0.297)**
Observations	9462	9462	9462	9462
R-squared	0.04	0.10		

Note. Standard errors robust to unknown form of heteroskedasticity are reported in parentheses. Two stars indicate statistical significance at the 1% confidence level, one star at the 5% level.

Table 6
The offset between private wealth and pension wealth: instrumental variable estimation

	Instrument: Statutory replacement rate at the expected retirement age		*Instrument: Statutory replacement rate at the median retirement age*	
SSW/Disposable income	-0.542	-0.309	-0.761	-0.525
	(0.049)**	(0.050)**	(0.058)**	(0.059)**
Year 1991	0.630	0.740	0.614	0.718
	(0.187)**	(0.182)**	(0.188)**	(0.183)**
Year 2000	1.216	1.288	0.953	1.020
	(0.186)**	(0.183)**	(0.190)**	(0.188)**
Year 2002	1.512	1.587	1.218	1.288
	(0.193)**	(0.190)**	(0.197)**	(0.195)**
Age	0.153	0.121	0.182	0.152
	(0.012)**	(0.012)**	(0.012)**	(0.013)**
High school degree		1.016		1.013
		(0.133)**		(0.134)**
University degree		0.826		0.782
		(0.206)**		(0.207)**
Disposable Income		0.010		0.007
		(0.003)**		(0.003)*
Self-employed		3.489		3.360
		(0.160)**		(0.161)**
Public employee		0.292		0.312
		(0.154)		(0.155)*
Central Italy		0.060		0.011
		(0.161)		(0.161)
Southern Italy		-0.322		-0.388
		(0.141)*		(0.142)**
Constant	-1.328	-2.156	-1.856	-2.594
	(0.414)**	(0.413)**	(0.422)**	(0.419)**
Observations	9462	9462	9462	9462
R-squared	0.04	0.10	0.03	0.09

Note. In the first two regressions the statutory pension wealth-to-income ratio is constructed using the statutory replacement rate and the expected retirement age. In the other regressions the statutory pension wealth-to-income ratio is constructed using the statutory replacement rate and median retirement age before and after the reform (60 for males and 55 for females before the reform and 65 and 60, respectively, after the reform). Standard errors robust to unknown form of heteroskedasticity are reported in parentheses. Two stars indicate statistical significance at the 1% confidence level, one star at the 5% level.

Table A1
Population and sample means of selected variables

	1989		*1991*		*2000*		*2002*	
	Population	*Sample*	*Population*	*Sample*	*Population*	*Sample*	*Population*	*Sample*
Males	48.6	48.7	48.6	48.9	48.5	48.6	48.6	48.5
Females	51.4	51.3	51.4	51.1	51.5	51.4	51.4	51.5
Age <24	32.7	32.9	32.0	31.6	26.2	26.3	25.8	25.7
Age 25-44	28.6	28.8	29.2	28.7	30.8	30.7	30.9	29.1
Age 45-64	24.1	26.1	24.0	25.9	25.0	25.0	25.1	27.1
Age >65	14.5	12.3	14.8	13.8	18.0	18.0	18.2	18.1
North	44.3	46.5	44.8	44.3	44.6	44.6	44.7	44.7
Center	19.1	18.9	19.1	19.0	19.2	19.2	19.3	19.3
South	36.6	34.7	36.1	36.5	36.2	36.2	36.0	36.1

Note. Sample statistics are computed using SHIW population weights, defined as the inverse of the probability of ample inclusion. Sources: *Survey of Households Income and Wealth*, Bank of Italy, and *Italian Statistical Annex* (Rome: ISTAT, 1989, 1991, 2000 and 2002).

Table A2
Transition matrix among employment groups

		1991	
1989	*Private sector*	*Public sector*	*Self employed*
Private sector	0.89	0.09	0.02
Public sector	0.07	0.92	0.01
Self employed	0.05	0.02	0.93
		2002	
2000	*Private sector*	*Public sector*	*Self-employed*
Private sector	0.88	0.08	0.03
Public sector	0.08	0.91	0.01
Self employed	0.00	0.03	0.97

Note: The upper left cell in each panel reports the probability of working in the private sector in years t and t+1. The other cells have similar interpretation. The generic cell i, j gives the probability of working in sector i in year t and in sector j in year $t+1$.