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## *Retirement Expectations and Pension Reforms*

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# *Retirement Expectations and Pension Reforms*

**Tullio Jappelli[*], Mario Padula[**] and Renata Bottazzi[***]**

**Abstract**

We estimate the effect of pension reforms on households' expectations of retirement outcomes and wealth accumulation decisions exploiting a decade of 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 2000. 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. We find substantial offset between private wealth and perceived pension wealth. However, the Italian pension reforms had only limited impact on private accumulation, because people have not internalized the changes implied by the reform.

**Keywords**: Expectations, Pension reform

**JEL Classification**: H55, E21

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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. From a policy point of view, evaluating the impact of pension wealth on private wealth accumulation is crucial to understanding the consequences of the ongoing process of pension reform that is taking place in industrialized countries. 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 suitable methods 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 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, the expected ratio of pension benefits to pre-retirement earnings (the replacement rate), and the discount and mortality rates. 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. For example, Gale (1998) and Attanasio and Brugiavini (2002) respectively use U.S. and Italian microeconomic data and both studies find that pension wealth crowds out discretionary saving, but at 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 sets of issues which are, to a large extent, preliminary to the analysis of the effect of social security wealth on individual behavior. Specifically, it analyzes 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, a large representative survey carried out by the Bank of Italy, elicits retirement age and replacement rate expectations from 1989 to 2000. 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. In fact, during the period, the Italian government enacted three pension 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 benefits using a difference-in-difference approach, and to relate this change in perceptions to changes in private saving behavior.

The paper makes two contributions to the literature, one of method and one of economic substance. From the methodological point of view, current analysis of expectations are based on cross-sectional data or short panels which makes it virtually impossible to control for individual effects. Any comparison between planned and realized retirement age, for instance, is bound to be contaminated by unobserved heterogeneity. Our difference-in-difference framework allows us

[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.

to estimate the expectational impact of pension reforms even in the presence of individual heterogeneity.

From an economic point of view, we call attention to the fact that the effect of pension reforms on individual decisions depends on the extent to which people understand the changes implied by the reform. For instance, the life-cycle hypothesis, and many other theories of individual behavior based on intertemporal choice, posit that a reduction in expected pension benefits should increase private wealth during the working life. This offset is what Feldstein calls the substitution effect – pension wealth crowds out discretionary wealth. With life-span uncertainty pension availability reduces the wealth accumulated for precautionary purposes, further reinforcing the substitution effect.

There are several potential counter-effects to a complete crowding out of private wealth by social security wealth, however. Social security may induce early retirement, which increases the need for retirement saving. Since future benefits are non-marketable, individuals place a larger weight on private assets than on pension assets. In the absence of social security, some individuals rely on their children for old-age support; in this case the introduction of social security simply replaces a private pay-as-you-go system with a public one (Modigliani, 1988). Individuals may accumulate more assets to pass on to future generations to allow them to pay for the future social security contributions implied by the current system (Barro, 1974). If people perceive a risk that the system will not fulfill its promises they will consider pension wealth as a risky asset. Finally, some individuals may be short-sighted or liquidity constrained, and not conform to the life-cycle model. For all these reasons the offset between private and pension wealth may be considerably greater than minus one (in principle, it could even be positive).

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 the element 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, labor supply and saving decisions. Answering the first question is quite important in understanding the impact of variations in the distribution of pension wealth on saving decisions, and why people do not tend to offset even substantial 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 1989-2000 Survey of Household Income and Wealth, providing the ground for our difference-in-difference approach. Section 4 estimates the impact of pension reforms on the expected retirement age, replacement rates and pension wealth 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 40 percent. Although the estimated substitution coefficient is on the high side of current estimates, we find that the Italian pension reforms of the 1990s had limited impact on private wealth accumulation, because expectations adjust slowly, and therefore 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 (rather than contributions-based), indexation of pensions to real earnings, 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. After lengthy discussion and debate, in the second half of 1992 the Amato government presented a fiscal package raising social security contributions by 0.6 percent, stopping pension indexation for six months, and then approving a major reform of the social security system.[2]

The main features of the Amato reform were an increase in the retirement age and a gradual reduction in pension benefits. The minimum retirement age for old age pensions was raised from 60 to 65 years for men and from 55 to 60 for women. The reference period for computing pensionable earnings was gradually extended to the last 10 years for private and public employees, 15 years for the self-employed and to the entire working life for those entering the labor force after January 1, 1993.[3] Pension benefits were indexed to prices rather than to wages.

A few years later, Italy underwent a second major reform of the social security system, known as Dini reform (Law 335 of 8 August 1995). The reform identified three groups of workers: those who had already contributed to the system for at least 18 years at the end of 1995, those who had contributed for fewer years, and those who started working in or after 1996. One significant feature of the reform is that it maintained most of the generous provisions of the pre-1992 regime for relatively old workers, who in 1995 had at least 18 years of contributions.

Social security legislation was further refined in December of 1997. The Prodi reform (Law 449 of 27 December 1997) abolished seniority pensions for everyone who started working after

[2] Respectively, Law 333, passed on 11 July 1992 and Law 384, passed on 23 October 1992.

[3] Pension benefits were a proportion of pensionable earnings. Before the reform, pensionable earnings were computed as the average of the last 5 years of salary for private employees, 10 years for self-employed and the last year for public employees.

1995 and raised minimum years of contribution for pension eligibility for all categories of workers.

Each of the three reforms maintained significant differences between males and females, and different provisions 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.[4] In fact, we compare pension regimes, individual expectations, and saving decisions, *before the 1992 reform* and *after the 1997 reforms*, omitting the transitional years between the Amato and Prodi reforms (1992-1997). For this reason, we will denote the post-1997 regime as simply the "post-reform" period, rather than distinguishing between the three reforms. Our dataset allows us to observe workers in two regimes, one with generous provisions (before the Amato reform) and one – ten years later - with much lower benefits (after the Prodi reform), 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.

### 2.1. Changes in retirement age and replacement rates

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", 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.

[4] Brugiavini (1999) provides ample details on the specific features of the sequence of Italian pension reforms during the last decade.

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 introduces contributions-based pension benefits. Specifically, the pension is a proportion of 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.[5] 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.

### 2.2. The effect of the reform on pension wealth

Table 1 provides a qualitative assessment of the pension reform. To indicate the magnitudes involved, in Table 2 we compute typical replacement rates of private employees, public employees and self-employed before and after the reform. In each case we consider the

[5] In the new regime the average is computed on the basis of the previous 10 years, rather than 5, as in the old regime. Furthermore, the accrual rate is 2 percent even for categories that enjoyed slightly more generous treatment. The adjustment to the new rules is gradual even for older workers. For brevity, we discuss only the main provisions of the reform, but the Appendix and our computations take into account the gradual transition to the new regime.

case of a worker retiring at 60 years, after 35 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. In the table we distinguish between three categories of workers (private, public, self-employed), cohort (old, middle-age, young) and period (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.

In the pre-1992 regime the replacement rates were the same for old, middle-aged and young workers, because the earnings model applied to all without accounting for years of contributions. In that regime replacement rates did differ considerably across occupational groups, however: 67.3 percent for private employees, 82.5 percent for public employees and 64.1 percent for the self-employed. The higher rates for public employees reflect more generous pension award formulas (pensionable earnings were just the last salary) and accrual rates.

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 35 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 (-0.7 percent), while that of the old public employee falls by 11.6 percentage point. This effect is largely due to the reduced accrual rate of public employees.

In contrast, middle-aged and young workers from all three types of employer experience a dramatic reduction in replacement rates due to the reform. For private employees the change is –9.5 points for the middle-aged and –12.4 for the young; for public employees, –23.6 and –27.6 percent, respectively; and for the self-employed –22.6 and –30.8.

In summary, Table 2 indicates 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.

Italy therefore represents an ideal setting for evaluating the impact of social security on individual behavior, providing a quasi-experimental framework to analyze the impact of pension reforms on individual expectations and consequently on private wealth accumulation. 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.

### 2.3. Previous evidence

The literature provides some evidence on the effects of the 1992 Italian pension reform on household saving and consumption decisions, using data from the Survey of Household Income and Wealth, the same survey used in this paper. In an important recent study, Attanasio and Brugiavini (2002) exploit the variation of changes in pension wealth across demographic 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 30 to 40 cents. In an earlier study, Miniaci and Weber (1999) estimated the impact of the 1992 reform on household consumption, and concluded that the 1993 recession was partly due to the relatively large fall in consumption of the youngest cohorts who were most affected by the pension reform.

Estimating the impact of pension reforms on saving, consumption or labor supply requires suitable identification assumptions. The 1992 pension reform was part of larger fiscal package including stricter tax compliance measures for the self-employed, large increases in tax rates (total tax revenues increased by 5 percent in 1993), changes in employment legislation, an end to automatic wage indexation and the announcement of a large privatization program. Some of these changes mainly affected young cohorts and public employees, so they provide alternative potential explanations for the consumption fall of 1993 and for the increase in saving by the young in the years following the 1992 reform. Our estimates focus on the long-term effects of the reform, and should therefore be less subject to the potential confounding effect of the 1993 recession on people's expectations and behavior.

A second problem with previous studies of the effect of pension wealth on private accumulation is that the calculation of pension wealth requires estimating individual earnings

profiles and projecting individual productivity growth rates to retirement age. Furthermore, prior to the reform there were different social security funds for various categories of employees and self-employed workers (central and local public employees, craftsmen, tradesmen, farmers and professionals). Each category had different age eligibility requirements, accrual rates, contribution rates, and reference wages to compute benefits. In the absence of detailed employment statistics and contribution history, it is not easy to obtain precise measures of pension wealth prior to 1992, let alone impute expected pension wealth in periods of changing legislation and expectations.

A third problem is that previous empirical tests of the effect of pension reforms on individual choice assume that individuals exhibit a high degree of financial sophistication. That is, that individuals must be able to compute pension wealth, understand pension reforms, and accurately compute changes in pension wealth after the reform.

This paper addresses many of these problems. Since we use data on subjective expectations, we do not need to make assumptions about the way expectations are formed. By having a long sample, we can provide evidence on people's perceptions of pension reforms several years after the reforms have been implemented. And since we do not rely on imputations to construct pension wealth, we are able to directly assess how pension reforms affect people's expectations, which is an essential preliminary step when evaluating the potential impact of pension reforms on individual decisions. In the subsequent step that relates expectations to behavior, we use the variability of the pension reform across cohorts and employment groups to control the potential endogeneity of expected pension wealth with respect to saving decisions.

## 3. Expectations of retirement age, replacement rate and pension wealth

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 on average 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. 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. Disney and Tanner find that marital status and education have a significant effect in explaining systematic deviations of expectations from outcomes. 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 and its relation to planned and actual retirement age. 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 studies conducted so far, we use point expectations.[6] However, while the focus of most previous literature is on expected retirement age, we also consider expected replacement rates. 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 paper is that the relatively long sample period spans a set of intense pension reforms, which deeply changed the social security system.

The 1989-2000 Survey of Household Income and Wealth has repeated cross-sectional data on income, wealth and several demographic variables from representative samples of the Italian population (about 24,000 individuals and 13,000 income recipients interviewed in 1989, 1991,

[6] 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, Heinz and Manski (2002) use the Survey of Economic Expectations, which elicits the subjective probability distributions of eligibility for social security benefits and of the level of benefits; the paper reports a high degree of uncertainty about future benefits even for people only ten years from retirement.

1993, 1995, 1998 and 2000).[7] The survey also covers several important topics related to retirement and pensions. Specifically, it collects data on the ex-post retirement age and replacement rates of retirees and the subjective assessment of expected retirement age and replacement rates of those still working. The ex-post replacement rate and retirement age naturally reflect the social security rules that applied to the cohorts of retirees alive at the time of the interview. However, the expected replacement rate and expected retirement age determine expected social security benefits of the cohorts that have yet to retire. In Italy only about 5 percent of the workers are covered by occupational pension schemes, so for the overwhelming majority expected pension wealth coincides with expected social security wealth.

In the rest of the paper we focus on the cohorts of working population. All current 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 earnings will your pension be?*

The first question is posed in each survey year from 1989 to 2000; the second question only in 1989, 1991 and 2000. Since we are interested in studying workers' expectations about retirement income, we focus on the group aged 20 to 50 years in each survey year. This implies that we include in our sample individuals born between 1939 (who were 50 years old in 1989) and 1980 (20 years old in 2000). 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. 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 (1993 and 1995).

We define as the pre-reform period the pooled 1989-91 sample. For expected retirement age, the post-reform period is the pooled 1998-2000 sample, while it is just 2000 for expected replacement rates (the question is not asked in 1998). Finally, we consider only workers who are

[7] The main features of the SHIW are reported in the Appendix. Sample design, interviewing procedure and response rates are described in Brandolini and Cannari (1994) and D'Alessio and Faiella (2002).

employed or self-employed in the survey year, excluding the unemployed, retirees and other individuals not in the labor force. Obviously, we cannot attribute the unemployed to any specific employment group, while retirees are unaffected by the reforms we consider. Overall, we have valid responses on expected retirement age for 14,599 males and 8,767 females, and on expected replacement rate for 7,170 males and 4,214 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.[8]

As a preliminary step, we have checked the validity of the expected replacement rate by constructing a replacement rate based on the relevant legislation and the declared expected retirement age. We find a strong correlation between the expected replacement rate and the replacement rate computed on the basis of legislation. However, we also find that some groups, particularly private employees, tend to overestimate their pension benefits and that the degree of accuracy of expectations falls after the reform.[9] Furthermore, we find that expectation errors are higher for the better educated, and that males' expectations are relatively more accurate than females'. These findings are in line with previous research on expectation of retirement outcomes, which generally concludes that there is considerable heterogeneity in expectations, and that many workers lack precise knowledge about their public pensions.

[8] 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.

[9] 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.

## 4. The effect of the pension reform on expectations of retirement outcomes

In this section we use a difference-in-difference framework to study how expectations about retirement outcomes have been affected by the 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 saving decisions 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 saving by different cohorts or employment groups (if this had been the case, there would be an obvious problem of policy endogeneity). 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 and saving decisions. Cohorts are obviously fixed, and many compositional characteristics are determined at birth and so are exogenous with respect to pension reforms. As far as employment groups, we require that mobility across various employment groups (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.

### 4.1. Descriptive analysis

Table 3 reports the expected retirement age of males and females in the various employment groups considered. Males' average expected retirement age is 60 before the reform and 62 after; the corresponding figures for females are 57 and 60. Public employees expect to retire slightly earlier than private employees and the self-employed, both before and after the

reform. After the reform the expected retirement age increases for all employment groups.[10] Among the middle-aged, public employees raise expected retirement age more than other groups (2.2 years for males and 3.2 for females).

In Table 4 we provide descriptive statistics for the expected replacement rate of the same employment and cohort groups. On average, the rate is high for all groups, both before and after the reform, reflecting the generous provisions of the Italian social security system. The expected rate ranges from 65.2 to 82.5 percent before the reform, and from 56.2 to 81.5 percent afterwards. The replacement rate attains the highest value for public employees, before and after the reforms (over 80 percent for males, and between 75 and 80 percent for females). On the other hand, the self-employed report the lowest replacement rates.

The 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 (-7.4 percentage points) and self-employed (-10.6 percentage 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.

Qualitatively, the reduction in the expected replacement rate is consistent with the reform. However, the magnitude of adjustment is not as large as implied by the reform. This can be seen by comparing Tables 2 and 4. To take just one example, Table 2 shows that public employees with less than 18 years of contributions in 1995 should have reduced their expectation of the replacement rate by 23.6 percentage points in order to accurately account for the reforms; Table 4 shows that in practice the expectations of men in this group reduced by just 2.6 points on average. There are similar patterns for other groups.

Since the reform affects both the retirement age and the replacement rate, one might wonder how perceived pension wealth changed after the reform. A convenient proxy for the ratio of expected pension wealth at retirement to earnings is:

$$\frac{SSW}{y} = \sigma\left(\frac{1+g}{1+r}\right)^{N-t}\sum_{\tau=N}^{T} p(\tau \mid N)\left(\frac{1+g_N}{1+r}\right)^{N-\tau}$$

[10] No comparison is possible for young workers because this group is not observed before the reform.

where $\sigma$ is the expected replacement rate, $y$ earnings, $N$ expected retirement age, $T$ the maximum length of life, $p(\tau|N)$ the probability of surviving to age $\tau$, conditional on being alive at age $N$, $g$ is the growth rate of earnings, $r$ the real interest rate, and $g_N$ the growth rate of pension benefits during retirement. In the survey we observe $\sigma$ and $N$. Using survival probabilities from the mortality tables, and assuming that pensions are constant in real terms ($g_N$=0) and that the real interest rate is equal to 2 percent, we can compute the expected ratio of pension wealth to income for each individual in the sample.[11]

Group averages are reported in Table 5. Before the reform, the ratio ranges from 10.6 to 13.9 for males and from 13.0 to 16.8 for females. The higher ratio for females reflects the longer length of retirement, and the lower ratio for the self-employed the less generous pension award formula. After the reform, the ratio falls for each of the groups considered. The middle-aged feature the largest reductions; and among this cohort, the reduction is stronger for the self-employed (-2.3 points) than for any other employment groups.

The reduction in perceived pension wealth, however, is considerably less than implied by the reform. Consider, for instance, the self-employed. According to the numbers in Table 2 and using our proxy for expected pension wealth at retirement, before the reform a worker that retired at the age of 60 should have expected a ratio of pension wealth to income equal 10.6. After the reform, the ratio should have fallen to 6.8. If one further considers that for this group expected retirement age increases after the reform from 61.5 to 63.7 (see Table 3), the effective pension wealth-income ratio should have fallen to 6.2. In short, for the self-employed, the reform reduces the pension wealth-income ratio by 36 percent (41 percent considering the change in the expected retirement age). This should be compared with a reduction of 20 percent (or 2.3 percentage points) in the perceived ratio. Calculations for other groups indicate even larger differences between the reduction in pension wealth implied by the reform and people's perceptions.

Overall, the group comparison suggests that expectations move in the direction suggested by the reform, but that the magnitude of the expectations' revision is not as large as predicted by the reform. To control for other factors potentially affecting the expected replacement rate and retirement age, in the next section we turn to a regression framework.

[11] It is worth emphasizing that there is quite limited recourse to private pension funds and life insurance in Italy, so that social security benefits represent almost all of retired Italian households' annuitized wealth.

### 4.2. Regression analysis

We can identify the effect of the reform on the expected retirement age and replacement rate because there is one group of individuals (old private employees) that was unaffected by the reform, while other groups (the young and the middle-aged) were affected and should have revised their expectations downward. In the terminology of the literature on social experiments, the old represents the "control" group, while the middle-aged are the "treatment" group.

We therefore estimate the impact of the reform using a difference-in-difference framework. By studying the difference over time in the replacement rate of the middle-aged, we can obtain an estimate of the reform on expectations. By comparing this difference with the difference over time of the replacement rate of the old, we can control for common trends in expected retirement age and replacement rates, including the changing composition of the labor force and aggregate changes in expectations about the economy.

It is important to note 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 are sampled only after the reform is 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 retirement age, the replacement rate and the expected ratio of pension wealth to income. We assume that before the reform the variable of interest $Y$ (in turn, the expected retirement age; the expected replacement rate; and the expected ratio of pension wealth to income) is a linear function of socio-demographic variables $X$, employment status (private, public, self-employed), and years of contributions:

$$Y_i = X_i\beta + \alpha_0 + PUB_i\alpha_1 + SELF_i\alpha_2 + M_i\delta + \varepsilon_i$$

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 $\alpha$ coefficients capture the different rules applying to public employees (*PUB*) and self-employed (*SELF*) relative to private employees. After the reform *Y* potentially shifts for all groups, so we augment the previous equation with terms that interact cohort, the post-reform period and employment status:

$$Y_i = X_i\beta + \alpha_0 + PUB_i\alpha_1 + SELF_i\alpha_2 + M_i\delta + POST_i\phi + \\ POST_i * M_i * PUB_i\gamma_1 + POST_i * M_i * SELF\gamma_2 + POST_i * M_i * PRIV_i\gamma_3 + \varepsilon_i$$

where *POST* equals one for the post-reform period. The $\phi$ coefficient measures the effect of the reform for all groups, and the $\gamma$ coefficients the shift in *Y* due to the reform for each employment group, our main parameters of interest. To find how middle-aged workers are affected by the reform, we must therefore sum $\phi$ with the relevant $\gamma$ for each employment group. For instance, the effect of the reform on middle-aged private employees is $\phi+\gamma_3$.

For both males and females, we expect the reform to have reduced the replacement rate ($\gamma_1<0$, $\gamma_2<0$, $\gamma_3<0$), that this reduction is smallest for private employees ($\gamma_1<\gamma_3$ and $\gamma_2<\gamma_3$), and that the reduction for the self-employed roughly matches that for public employees, as indicated in Table 2 ($\gamma_1=\gamma_2$). For expected retirement age, we expect increases for all middle-aged groups, but particularly for public employees. As indicated in Table 1, this group experiences the strongest tightening of pension eligibility requirements.

For the pension wealth-income ratio we expect a pattern of results similar to that expected for the replacement rate, although here the predictions are less clear-cut because the replacement rate and retirement age interact in determining perceived pension wealth.

The model is estimated separately for males and females, omitting the transitional 1993-1997 period. Table 6 reports the results for the expected retirement age. In the first specification we drop the control vector *X*, and regress expected retirement age on a set of group dummies. The results confirm the descriptive analysis: after the reform expected retirement age increases for all middle-aged workers, but particularly for public employees. Furthermore, each of the coefficients

is statistically different from zero at the 1 percent level. To evaluate the results, note that one must add the coefficient of post-reform (0.64) to the group-specific coefficient; for instance, the overall effect of the reform for public employees is to raise retirement age by (0.64+1.43) years.

The second regression adds to the basic specification regional and educational dummies and annual earnings (in thousand Euro). We find that expected retirement age is considerably higher in the South (the coefficient is 1.66) and for workers with a college degree (2.6 years).[12] On the other hand, each thousand euro of income reduces expected retirement age by 0.04 years. Finally, the $\gamma$ coefficients record minimal changes with respect to the basic specification.

In the third specification we further add the interaction of employment dummies with the *M* dummy for the middle-aged and with the time dummy *POST* for the post-reform period. While a priori there is no strong justification for such dummies, they could proxy for group-specific trends during the sample period. The $\gamma$ coefficients are again qualitatively unaffected.

The three regressions for females in Table 6 confirm most of the patterns found for males. We find a stronger effect of the post-reform dummy (almost 2 years), and smaller group-specific effects. The largest increase in retirement age for the middle-aged is for public employees, with an overall effect of (1.88+1.03) years. As for males, the coefficients of the dummy for the South and for college education are positive, while income negatively affects retirement age.

In Table 7 we present regressions for the expected replacement rate. The coefficient estimates indicate that after the reform the replacement rate falls by 3.47 points, and that the decline is stronger for the middle-aged in all employment groups. As shown in Table 2, public employees and self-employed with less than 18 years of contributions as of 1995 should have revised downwards their expectations of the replacement rate by over 20 points, and private employees by over 10. According to our estimates, the impact of the reform is to reduce the expected replacement rate by about 4 points for public employees (3.47+0.37) and about 8 points for the self-employed (3.47+5.12) and private employees (3.47+4.15). The magnitude of these revisions therefore suggests considerable underestimation of the effects of the reform.

The specifications with additional controls and interaction terms produce no relevant change in the results. Workers in the South expect a higher replacement rate and the level of

[12] The positive effect of the dummy for the South is likely to arise from the fact that workers in the South enter the labor market later than in other parts of the country, and therefore qualify later for a pension.

income (again measured in thousand euro) is positively related to the expected replacement rate. The effect of the education dummies is positive but not statistically different from zero.

The regressions for females uncover further puzzles. There is an across-the-board reduction in the expected replacement rate (5.4 percentage points in the basic specification), but the group dummies interacted with the dummies for middle-aged and post-reform period signal no differential effect by employment groups. In fact, in all specifications the group dummies are not statistically different from zero, and in some cases they are of the wrong sign.

In Table 8 we summarize the previous evidence by regressing the ratio of expected pension wealth to income on the same set of variables as in Tables 6 and 7. For both males and females, the ratio decreases after the reform. For middle-aged males, the perceived reduction is stronger for self-employed (-1.33) than for private employees or public employees (-0.64 and –0.87, respectively), but considerably less than implied by the reform, confirming the descriptive patterns in Table 5. The evidence for females is similar: again, the middle-aged expect the largest reductions, but far less than suggested by the reform, mirroring the group averages in Table 5.

Adding further controls does not alter the pattern of the results. For both males and females, the expected pension wealth-income ratio is lower in Central and Southern Italy and for workers with higher education. Each thousand euro increase in earnings raises the expected pension wealth-income ratio by 0.05 for males and 0.1 for females, because higher income is associated with expectations of earlier retirement and higher replacement rates.

## 5. The offset between pension wealth and private 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. Our next step relates perceived pension wealth to private accumulation. Since the reform provides an exogenous source of variation in pension wealth

across socioeconomic 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 our basic specification we regress private wealth (scaled by disposable income) on the expected pension wealth-income ratio of the household and on dummies indicating public employee, self-employed, middle-aged, and post-reform period. We then extend the specification to include two area dummies, household labor income, and two education dummies, for high school and university degree. We define household pension wealth as the sum of pension wealth across household members, and scale the variable by the sum of individual earnings.

In the first column of Table 9, the OLS coefficient of pension wealth is –0.295, and statistically different from zero at the 1 percent level. Although the standard life-cycle model predicts complete offset between private and pension wealth, the response we find is in line with previous research. The regression coefficients also indicate that private wealth is higher for the self-employed and public-employees relative to private employees.

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.

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 quantile regressions, which are consistent and asymptotically normal in the presence of thick tailed error distributions, on trimmed least squares, discarding the top and bottom 1 percent of the private wealth-income ratio distribution, and on estimates based on least absolute deviations. The results are qualitatively unchanged.

A more important issue is that the coefficient on pension wealth is potentially biased because expected retirement age and the expected replacement rate may themselves be affected by private wealth accumulation decisions. This is likely to bias downward the OLS estimate of the offset coefficient of pension wealth (i.e., the OLS coefficient will show too little offset). For instance, thrift and hard work might be correlated tastes, and people with these traits might choose to save more and to retire with higher pension wealth. At the same time, low-wealth, liquidity constrained workers with steep earnings profiles may decide to postpone retirement if they want to increase their stock of private wealth. This reduces pension wealth, inducing a positive correlation between private and pension wealth. Finally, wealthy individuals may want to retire earlier, which given the rules for computing pension benefits increases their pension wealth in both the pre and post-reform regime.[13]

The second group of regressions in Table 9 report instrumental variable estimates, using as instruments employment dummies (public employees, private employees and self-employed) interacted with the dummies for middle-aged and the post-reform period – the same variables that we use to identify the effect of the reform on expectations. These can be used as instruments in our regressions since the rules for computing the pension wealth change for the middle-aged after the reform and depend on the employment group membership. Our identification assumption is 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, the instruments are also exogenous with respect to private wealth accumulation decisions. Attanasio and Brugiavini (2002) use similar employment-group instruments for pension wealth in their study of the impact of the 1992 pension reform on the household saving rate.[14]

The instruments pass the standard statistical tests. The null hypothesis that the over-identifying restrictions are valid is not rejected at the 1 percent significance level; the *F*-test that the instruments do not predict the wealth-income ratio is rejected, again at the 1 percent level. In these instrumental variable regressions the coefficient on pension wealth is –0.45 and is

[13] Imputing pension wealth on the basis of current and projected legislation and income growth does not solve the problem. If workers have imperfect knowledge about their pensions, or if the econometrician has less information than the individual, pension wealth is measured with error, and the coefficient of pension wealth underestimated.

statistically different from zero at the 5 percent level. The larger offset effect suggests that endogeneity may indeed be partly responsible for the small coefficients estimated by OLS.[15]

The results have interesting implications for evaluations of how pension reforms affect private and national saving. On this front, one may be puzzled by the observation that even after a decade of intense pension reform the Italian national saving rate has remained roughly constant, despite deep pension reforms.[16] The aggregate effect of the reform 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.

We know that the reform should have reduced the expected ratio of pension wealth to income for the middle-aged by about 4 points. This group, however, has perceived only half of this reduction, or 2.3 points (from 14.2 in 1989-91 to 11.9 in 2000). The instrumental variable estimates in Table 9 further suggest that such reduction in the expected pension wealth-income ratio has increased the private wealth-income ratio by about 1 point (2.3×0.45). The regression predicts no effect for the old, because for this group pension wealth has not changed as a consequence of the reform. On the other hand, our regressions do not predict the effect of the reform on those that retired before the reform, nor on those that entered the labor market after 1995. We speculate that for the former group there should be little or no 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.

In summary, we find 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,

[14] In particular, they use the interaction of four cohorts dummies with three employment group dummies to identify the effect of the 1992 reform.

[15] The results do not change if one trims the top and bottom 1% of the distribution of private wealth.

[16] 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

with offset rates in the order of 0.4. Second, 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.

## 6. Conclusions

In this paper we estimate the effect of pension reforms on households' expectations and wealth accumulation decisions. The Survey of Household Income and Wealth, a large representative sample of the Italian population, elicits expectations of retirement age and replacement rates from workers interviewed in the years between 1989 and 2000, a period of intense pension reforms. The reforms reduced the replacement rate and increased retirement age, thereby lowering pension wealth. Furthermore, the reforms had different impact on different cohorts and employment groups, providing exogenous variations in pension wealth to study the effect of pension reforms on expectations and household saving.

We find that pension reforms indeed affected expectations of retirement benefits. However, the revision in expectations is limited, and the vast majority of individuals have not yet adjusted their expectations to the new pension regime. For instance, while the perceived pension wealth-income ratio of the self-employed falls by 26 percentage points between 1989-91 and 2000, in reality the ratio will be about 40 points lower.

In the second part of our analysis we find substantial offset between private wealth and perceived pension wealth. Our procedure has several advantages. First, we can evaluate the relation between private accumulation and pension wealth, because pension reforms provide an exogenous source of variation in pension wealth. Second, we have survey expectations of retirement outcomes, and do not need to construct indicators of pension wealth imposing restrictions on the way people form expectations of post-retirement benefits. Finally, our sample spans 12 years of data, and we can assess the impact of the reform at relatively low frequency,

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saving, so the figures do not rule out that the reduction in pension wealth has increased national saving. But clearly the figures are suggestive of a limited aggregate saving impact of the reform.

omitting almost a decade of transitional data. The empirical estimates uncover substantial offset between private and pension wealth (in the order 40 percent or higher). However, our results also imply that the Italian pension reforms of the 1990s had only limited impact on current household saving rates, because people have not yet fully adjusted their expectations of future benefits to take account of the new pension regime.

The paper suggests that the effect of social security on private accumulation 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 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, 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 $\rho, N$ 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 $\alpha_{92}$ 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 who retire 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 $\alpha_{95}$ are the 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 makes a negligible contribution to the final pension with respect to the pre-reform regime.

*For the young*, benefits are computed according to a contribution model:

$$\gamma\tau \sum_0^{N-1} w_t (1+g)^{N-1-i}$$

where $\tau$ 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 the 5-year moving average, and then transformed in flow benefits using a

coefficient ($\gamma$), set by legislators, that depends on retirement age and life expectancy. Currently, $\gamma$ increases from 4.72 percent for somebody retiring at 57 to 6.136 percent for somebody retiring at 65.[17]

*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. Denote by $E$ and $C$ benefits computed with the earnings and contribution models, respectively. Then the pension for middle-aged is given by:

$$E\frac{\alpha_{95}}{N}+\left(1-\frac{\alpha_{95}}{N}\right)C$$

## 2. The 1989-2000 Survey of Household Income and Wealth

The primary purpose of the Bank of Italy Survey of Household Income and Wealth (SHIW) is to collect detailed data on demographics, and on households' consumption, income and balance sheets. The SHIW surveys a representative sample of the Italian resident population. Sampling is in two stages, first municipalities and then households. Municipalities are divided into 51 strata defined by 17 regions and 3 classes of population size (more than 40,000, 20,000 to 40,000, less than 20,000). Households are randomly selected from registry office records. From 1987 onward the survey is conducted every other year and covers about 8,000 households, defined as groups of individuals related by blood, marriage or adoption and sharing the same dwelling, see Brandolini and Cannari (1994) and D'Alessio and Faiella (2002) for more details on the survey. Data on expected retirement age were collected in 1989, 1991, 1993, 1995, 1998 and 2000. Data on expected replacement rates were collected in 1989, 1991, and 2000. The questionnaire, data and survey documentation can be downloaded from the Bank of Italy web site: http://www.bancaditalia.it/pubblicazioni/statistiche/ibf

[17] The coefficients are available at http://www.inps.it/Doc/TuttoINPS/nu/nu_tes069.htm.

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

| | | **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 | 65(60) | 15 | 35 | 20 | 35 |
| ***Post-1997 regime*** | **Old** | Progressively rising to 65(60) | 65 | 65(60) | Progressively rising to 20 | 40 before age 57<br>35 after age 57 | | 40 before age 58<br>35 after age 58 |
| | **Middle-aged** | Progressively rising to 65(60) | 65 | 65(60) | Progressively rising to 20 | 40 before age 57<br>35 after age 57 | | 40 before age 58<br>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**<br>*Earnings model* | 2% × years of contributions × average of the last 5 years of earnings | [2.2 - 2.5%] × years of contribution × last year of earnings | 2% × years of contributions × times average of the last 10 years of earnings |
| ***Post-1997 regime*** | **Old**<br>*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**<br>*Pro rata model* | Earnings model before 1995, contribution model after 1995. | | |
| | **Young**<br>*Contribution model* | Contributions rate (33% for employees and 20% for self-employed) is 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 | 67.3 | 66.6 | -0.7 |
| Middle-aged | 67.3 | 57.8 | -9.5 |
| Young | 67.3 | 54.9 | -12.4 |
| *Public employees* | | | |
| Old | 82.5 | 70.9 | -11.6 |
| Middle-aged | 82.5 | 58.9 | -23.6 |
| Young | 82.5 | 54.9 | -27.6 |
| *Self-employed* | | | |
| Old | 64.1 | 63.4 | -0.7 |
| Middle-aged | 64.1 | 41.5 | -22.6 |
| Young | 64.1 | 33.3 | -30.8 |

*Note*. The table report the replacement rate assuming that the growth rate of earnings is 2% per year and that the growth rater of aggregate GDP is 1.5%. The retirement age is 60, and each worker contributes for 35 year before retiring. In the post-reform regime the example considers an old worker who contributes 27 years before 1995 and 8 years after, and a middle-aged worker who contributes 10 years before 1995 and 25 years after.

**Table 3**
**Expected retirement age: descriptive statistics**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| | *Pre-reform* | *Post-reform* | *Difference* | *Pre-reform* | *Post-reform* | *Difference* |
| *Private employees* | | | | | | |
| Old | 59.7 | 60.2 | 0.5 | 56.8 | 58.6 | 1.8 |
| Middle-aged | 60.3 | 62.0 | 1.7 | 57.2 | 59.8 | 2.6 |
| Young | | 63.0 | | | 60.7 | |
| *Public employees* | | | | | | |
| Old | 59.6 | 60.3 | 0.7 | 57.6 | 59.7 | 2.1 |
| Middle-aged | 59.7 | 61.9 | 2.2 | 57.4 | 60.6 | 3.2 |
| Young | | 63.4 | | | 61.5 | |
| *Self-employed* | | | | | | |
| Old | 62.0 | 62.9 | 0.9 | 59.1 | 60.3 | 1.2 |
| Middle-aged | 61.5 | 63.7 | 2.2 | 58.6 | 61.1 | 2.5 |
| Young | | 63.8 | | | 62.2 | |

*Note*. Data are drawn from the 1989-2000 SHIW. The pre-reform period is 1989-91 and the post-reform period is 1998-2000.

**Table 4**
**Expected replacement rate: descriptive statistics**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| | *Pre-reform* | *Post-reform* | *Difference* | *Pre-reform* | *Post-reform* | *Difference* |
| *Private employees* | | | | | | |
| Old | 79.6 | 76.5 | -3.1 | 77.2 | 70.3 | -6.9 |
| Middle-aged | 79.4 | 72.0 | -7.4 | 76.9 | 70.9 | -6.0 |
| Young | | 69.7 | | | 67.7 | |
| *Public employees* | | | | | | |
| Old | 82.5 | 81.5 | -1.0 | 79.4 | 77.4 | -2.0 |
| Middle-aged | 81.8 | 79.2 | -2.6 | 80.3 | 76.0 | -4.3 |
| Young | | 78.6 | | | 71.9 | |
| *Self-employed* | | | | | | |
| Old | 69.1 | 62.3 | -6.8 | 65.2 | 56.9 | -8.3 |
| Middle-aged | 71.2 | 60.6 | -10.6 | 69.6 | 61.6 | -8.0 |
| Young | | 64.3 | | | 56.2 | |

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

**Table 5**
**Ratio of expected pension wealth to income: descriptive statistics**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| | *Pre-reforms* | *Post-reforms* | *Difference* | *Pre-reforms* | *Post-reforms* | *Difference* |
| *Private employees* | | | | | | |
| Old | 13.5 | 12.4 | -1.1 | 16.5 | 14.1 | -2.4 |
| Middle-aged | 13.1 | 11.1 | -2.0 | 16.3 | 13.8 | -2.5 |
| Young | | 10.4 | | | 12.8 | |
| *Public employees* | | | | | | |
| Old | 13.9 | 13.2 | -0.7 | 16.5 | 15.1 | -1.4 |
| Middle-aged | 13.9 | 12.2 | -1.7 | 16.8 | 14.5 | -2.3 |
| Young | | 11.5 | | | 13.3 | |
| *Self-employed* | | | | | | |
| Old | 10.6 | 9.4 | -1.2 | 13.0 | 11.2 | -1.8 |
| Middle-aged | 11.2 | 8.7 | -2.3 | 14.1 | 11.3 | -2.8 |
| Young | | 9.2 | | | 10.1 | |

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

**Table 6**
**The effect of the reform on the expected retirement age: regression results**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| Public employees | -0.256 | -0.752 | -0.682 | 0.710 | 0.051 | 0.194 |
| | (0.131) | (0.129)** | (0.192)** | (0.160)** | (0.164) | (0.251) |
| Self-employed | 1.950 | 1.218 | 1.627 | 1.818 | 1.346 | 1.999 |
| | (0.108)** | (0.150)** | (0.191)** | (0.168)** | (0.224)** | (0.299)** |
| Middle-aged | 0.247 | 0.020 | 0.351 | 0.127 | -0.065 | 0.245 |
| | (0.101)* | (0.101) | (0.124)** | (0.138) | (0.139) | (0.171) |
| Post-reforms | 0.640 | 0.766 | 0.624 | 1.887 | 2.089 | 2.145 |
| | (0.122)** | (0.119)** | (0.160)** | (0.177)** | (0.174)** | (0.251)** |
| Private employee, middle-aged, | 1.330 | 1.371 | 1.289 | 0.854 | 0.815 | 0.611 |
| after the reform | (0.178)** | (0.174)** | (0.207)** | (0.248)** | (0.243)** | (0.304)* |
| Public employee, middle-aged, | 1.430 | 1.218 | 1.187 | 1.032 | 1.032 | 1.103 |
| after the reform | (0.239)** | (0.234)** | (0.386)** | (0.269)** | (0.264)** | (0.421)** |
| Self-employed, middle-aged, | 1.029 | 0.940 | 1.373 | 0.406 | 0.162 | 1.349 |
| after the reform | (0.221)** | (0.216)** | (0.322)** | (0.338) | (0.333) | (0.525)* |
| Central Italy | | 0.923 | 0.919 | | 1.051 | 1.051 |
| | | (0.098)** | (0.098)** | | (0.127)** | (0.127)** |
| Southern Italy | | 1.665 | 1.678 | | 1.792 | 1.808 |
| | | (0.086)** | (0.086)** | | (0.125)** | (0.125)** |
| Labor income | | -0.039 | -0.036 | | -0.034 | -0.032 |
| | | (0.007)** | (0.007)** | | (0.013)** | (0.013)* |
| High school degree | | 1.016 | 1.011 | | 0.444 | 0.441 |
| | | (0.082)** | (0.082)** | | (0.118)** | (0.118)** |
| University school degree | | 2.609 | 2.616 | | 1.761 | 1.775 |
| | | (0.139)** | (0.138)** | | (0.171)** | (0.171)** |
| Public employee, middle-aged | | | -0.401 | | | -0.605 |
| | | | (0.314) | | | (0.371) |
| Public employee, after the | | | 0.270 | | | 0.178 |
| reform | | | (0.307) | | | (0.393) |
| Self-employed, middle-aged | | | -1.197 | | | -1.188 |
| | | | (0.237)** | | | (0.362)** |
| Self-employed, after the reform | | | 0.315 | | | -0.844 |
| | | | (0.291) | | | (0.483) |
| Constant | 59.819 | 59.162 | 59.011 | 56.905 | 56.374 | 56.195 |
| | (0.074)** | (0.142)** | (0.148)** | (0.112)** | (0.202)** | (0.213)** |
| Observations | 14599 | 14599 | 14599 | 8767 | 8767 | 8767 |
| R-squared | 0.07 | 0.11 | 0.11 | 0.09 | 0.12 | 0.12 |

*Note*. All explanatory variables are dummy variables, except for labor income (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 7**
**The effect of the reform on the expected replacement rate: regression results**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| Public employees | 3.385 | 3.194 | 2.874 | 3.746 | 2.453 | 0.978 |
| | (0.599)** | (0.603)** | (0.824)** | (0.703)** | (0.728)** | (1.037) |
| Self-employed | -10.499 | -6.825 | -6.526 | -10.601 | -4.572 | -5.609 |
| | (0.566)** | (0.775)** | (0.982)** | (0.879)** | (1.155)** | (1.510)** |
| Middle-aged | 0.174 | 0.712 | 0.529 | 0.594 | 1.023 | 0.198 |
| | (0.490) | (0.500) | (0.608) | (0.634) | (0.640) | (0.777) |
| Post-reforms | -3.473 | -3.253 | -2.810 | -5.409 | -4.565 | -5.764 |
| | (0.610)** | (0.610)** | (0.811)** | (0.845)** | (0.844)** | (1.197)** |
| Private employee, middle-aged, after the reform | -4.153 | -4.216 | -4.484 | -0.909 | -0.942 | 0.574 |
| | (0.889)** | (0.887)** | (1.050)** | (1.190) | (1.180) | (1.458) |
| Public employee, middle-aged, after the reform | -0.372 | -0.787 | -1.870 | 0.418 | 0.370 | -2.326 |
| | (1.169) | (1.167) | (1.873) | (1.295) | (1.286) | (1.937) |
| Self-employed, middle-aged, after the reform | -5.123 | -5.703 | -3.828 | 0.397 | -0.560 | 0.436 |
| | (1.109)** | (1.107)** | (1.728)* | (1.683) | (1.673) | (2.811) |
| Central Italy | | 0.808 | 0.729 | | 0.392 | 0.410 |
| | | (0.499) | (0.499) | | (0.624) | (0.623) |
| Southern Italy | | 1.230 | 1.178 | | 2.303 | 2.301 |
| | | (0.424)** | (0.424)** | | (0.594)** | (0.593)** |
| Labor income | | 0.225 | 0.223 | | 0.482 | 0.481 |
| | | (0.032)** | (0.032)** | | (0.061)** | (0.061)** |
| High school degree | | 0.675 | 0.698 | | 0.529 | 0.469 |
| | | (0.412) | (0.411) | | (0.572) | (0.572) |
| University school degree | | -0.250 | -0.275 | | -0.490 | -0.582 |
| | | (0.657) | (0.657) | | (0.813) | (0.813) |
| Public employee, middle-aged | | | -0.925 | | | 1.255 |
| | | | (1.432) | | | (1.595) |
| Public employee, after the reform | | | 2.074 | | | 4.458 |
| | | | (1.541) | | | (1.845)* |
| Self-employed, middle-aged | | | 1.456 | | | 4.068 |
| | | | (1.287) | | | (1.919)* |
| Self-employed, after the reform | | | -3.927 | | | -2.520 |
| | | | (1.526)* | | | (2.505) |
| Constant | 79.511 | 74.730 | 74.797 | 76.642 | 69.386 | 69.941 |
| | (0.340)** | (0.694)** | (0.719)** | (0.490)** | (0.969)** | (1.007)** |
| Observations | 7170 | 7170 | 7170 | 4214 | 4214 | 4214 |
| R-squared | 0.13 | 0.14 | 0.14 | 0.09 | 0.11 | 0.11 |

*Note*. All explanatory variables are dummy variables, except for labor income (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 8**
**The effect of the reform on expected pension wealth: regression results**

| | *Males* | | | *Females* | | |
|---|---|---|---|---|---|---|
| Public employees | 0.620 | 0.822 | 0.673 | 0.373 | 0.396 | 0.010 |
| | (0.118)** | (0.118)** | (0.161)** | (0.160)* | (0.166)* | (0.236) |
| Self-employed | -2.610 | -1.726 | -2.001 | -2.921 | -1.676 | -2.260 |
| | (0.112)** | (0.152)** | (0.193)** | (0.201)** | (0.263)** | (0.346)** |
| Middle-aged | -0.162 | 0.027 | -0.171 | 0.080 | 0.206 | -0.087 |
| | (0.097) | (0.098) | (0.119) | (0.144) | (0.146) | (0.177) |
| Post-reforms | -1.030 | -1.075 | -1.110 | -1.972 | -1.925 | -2.300 |
| | (0.120)** | (0.119)** | (0.158)** | (0.192)** | (0.192)** | (0.272)** |
| Private employee, middle-aged, | -0.636 | -0.604 | -0.860 | -0.347 | -0.337 | -0.935 |
| after the reform | (0.230)** | (0.228)** | (0.367)* | (0.294) | (0.292) | (0.440)* |
| Public employee, middle-aged , | -0.873 | -0.932 | -1.272 | -0.212 | -0.273 | -1.004 |
| after the reform | (0.218)** | (0.216)** | (0.338)** | (0.382) | (0.380) | (0.640) |
| Self-employed, middle-aged, | -1.337 | -1.448 | -1.554 | -0.187 | -0.320 | -0.852 |
| after the reform | (0.295)** | (0.294)** | (0.459)** | (0.465) | (0.463) | (0.779) |
| Central Italy | | -0.250 | -0.260 | | -0.313 | -0.315 |
| | | (0.098)* | (0.098)** | | (0.142)* | (0.142)* |
| Southern Italy | | -0.510 | -0.521 | | -0.335 | -0.340 |
| | | (0.083)** | (0.083)** | | (0.135)* | (0.135)* |
| Labor income | | 0.050 | 0.048 | | 0.098 | 0.097 |
| | | (0.006)** | (0.006)** | | (0.014)** | (0.014)** |
| High school degree | | -0.398 | -0.397 | | -0.094 | -0.110 |
| | | (0.081)** | (0.081)** | | (0.130) | (0.130) |
| University school degree | | -1.319 | -1.328 | | -0.842 | -0.866 |
| | | (0.129)** | (0.129)** | | (0.185)** | (0.185)** |
| Public employee, middle-aged | | | 0.189 | | | 0.559 |
| | | | (0.282) | | | (0.364) |
| Public employee, after the | | | 0.378 | | | 0.927 |
| reform | | | (0.301) | | | (0.419)* |
| Self-employed , middle-aged | | | 0.882 | | | 1.341 |
| | | | (0.252)** | | | (0.439)** |
| Self-employed, after the reform | | | -0.133 | | | 0.455 |
| | | | (0.298) | | | (0.570) |
| Constant | 13.426 | 13.024 | 13.128 | 16.333 | 15.297 | 15.496 |
| | (0.067)** | (0.136)** | (0.141)** | (0.111)** | (0.221)** | (0.229)** |
| Observations | 7128 | 7128 | 7128 | 4185 | 4185 | 4185 |
| R-squared | 0.19 | 0.21 | 0.21 | 0.16 | 0.17 | 0.17 |

*Note*. All explanatory variables are dummy variables, except for labor income (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 9**
**The effect of expected pension wealth on the private wealth-income ratio: regression results**

| | *OLS* | | | *IV* | | |
|---|---|---|---|---|---|---|
| Expected pension wealth / Y | -0.295 | -0.310 | -0.317 | -0.459 | -0.493 | -0.469 |
| | (0.018)** | (0.018)** | (0.018)** | (0.212)* | (0.203)* | (0.221)* |
| Public employees | 0.414 | 0.224 | 0.161 | 0.476 | 0.319 | 0.236 |
| | (0.110)** | (0.112)* | (0.162) | (0.137)** | (0.154)* | (0.195) |
| Self-employed | 1.500 | 1.475 | 1.338 | 0.964 | 1.036 | 0.886 |
| | (0.222)** | (0.222)** | (0.361)** | (0.726) | (0.535) | (0.747) |
| Middle-aged | -0.706 | -0.759 | -0.666 | -0.637 | -0.636 | -0.557 |
| | (0.102)** | (0.103)** | (0.123)** | (0.136)** | (0.172)** | (0.200)** |
| Post-reform | 0.299 | 0.422 | 0.228 | -0.313 | -0.135 | -0.258 |
| | (0.124)* | (0.125)** | (0.145) | (0.798) | (0.630) | (0.716) |
| Central Italy | | 0.297 | 0.306 | | 0.278 | 0.292 |
| | | (0.125)* | (0.125)* | | (0.128)* | (0.127)* |
| Southern Italy | | 0.013 | 0.027 | | 0.036 | 0.048 |
| | | (0.107) | (0.107) | | (0.111) | (0.112) |
| Labor income | | 0.033 | 0.034 | | 0.057 | 0.054 |
| | | (0.008)** | (0.008)** | | (0.028)* | (0.030) |
| High school degree | | 0.746 | 0.741 | | 0.657 | 0.666 |
| | | (0.105)** | (0.105)** | | (0.145)** | (0.151)** |
| University school degree | | 0.926 | 0.918 | | 0.616 | 0.658 |
| | | (0.162)** | (0.162)** | | (0.380) | (0.409) |
| Public employee, middle-aged | | | 0.071 | | | 0.070 |
| | | | (0.233) | | | (0.234) |
| Public employee, after the reform | | | 0.112 | | | 0.128 |
| | | | (0.236) | | | (0.238) |
| Self-employed, middle-aged | | | -1.736 | | | -1.807 |
| | | | (0.445)** | | | (0.460)** |
| Self-employed, after the reform | | | 2.265 | | | 2.524 |
| | | | (0.443)** | | | (0.582)** |
| Constant | 5.436 | 4.615 | 4.678 | 6.788 | 5.775 | 5.653 |
| | (0.160)** | (0.191)** | (0.193)** | (1.750)** | (1.300)** | (1.419)** |
| Observations | 5383 | 5383 | 5383 | 5383 | 5383 | 5383 |
| R-squared | 0.10 | 0.13 | 0.13 | | | |
| Test of over-identifying restrictions | | | | 0.508 | 0.3674 | 3.388 |
| | | | | (0.917) | (0.947) | (0.335) |
| Rank test | | | | 12.450 | 14.88 | 12.49 |
| | | | | (0.000) | (0.000) | (0.000) |

*Note*. The reference group is old private employees. The instruments used in the IV regressions are dummy variables for public employees, private employees, and self-employed interacted with a dummy for the middle-aged and the post-reform period. Two stars indicate significance at the 1% confidence level, one star at the 5% level.