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EARLY RETIREMENT AND THE AGING POPULATION TREND: AN ANALYSIS ON WELFARE AND LABOUR MARKET

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INTRODUCTION

The Italian pension system has been reformed 23 times in 18 legislations. The most discussed reform is the one made in 2011 during the Sovereign debt crisis, when the new Goverment led by Mario Monti presented the "Save Italy" decree to raise 30 billion euros to hurl the country out of its crisis. The Monti Fornero reform, named after the labour minister Elsa Fornero, accelerated the transition phase from a Defined Benefit (DC) to a Defined Contribution (DC) system already started in the past and tightened the loose eligibility requirements for retirement that had incentived early retirement. It was done as an attempt to lower the extremely high Italian pension expenditures and to face the ageing population trend that characterizes all OECD Countries. It is still the current pension system in 2019, however in 2018 the "Yellow-Green" Government proposed a new and temporary reform called *Quota 100* which aims to stimulate the youth labour market by encouraging early retirement.

The objective of this paper is to analyse the impact of the ageing population trend and early retirement on the welfare and the labour market, in a framework where the OECD Countries keep getting older, by looking at the extensive literature available and by the employment of econometric and macroeconomic models. In the first chapter we will review the several Italian pension systems from 1969 to 2018, the changes in the eligibility requirements and the reasons why each reform was adopted. In the second chapter we will consider the consequences of this aging trend, the effects of early retirement incentives on the general employment rate and the link between old-age employment and youth unemployment rate. The study on early retirement employs the analysis of an implicit tax rate and the Option Value model proposed by Stock and Wise in 1988, while for the latter the examination will be performed by looking at the impact that policy-induced early retirement (or a postponement in the retirement age) had on the young of several national labour markets. Concerning this last aspect, we will see that not only it does not have any negative statistically significant effects on the counterparts, but sometimes a decrease in the labour force participation (LFP) of senior-workers causes a decrease in the level of youth employment, thus spreaking of "the lump of labour fallacy", i.e. the erroneous theory that the maximum number of jobs in an economy is fixed. These results however hold only in the long run and at the aggregate level. In the third chapter we will have an in-depth view of *Quota 100* as a form of early retirement, about its sustainability and the effects on the labour market and the macroeconomical environment. While this reform could be actually sustainable in the long run, the high level of uncertainty contributes to higher costs despite the new lower expenditures under the "Yellow-Red" Government. Moreover, the impacts on GDP are too low to offset the rise in public debt which was needed to finance several policies. Employment is going to slightly increase on average, but the main reason is attributed to the higher deficit and not to the reform per se. Finally, studies adopting more recent datasets suggest that the lump of labour theory seems to hold to some extent in the Italian labour market after the 2008 and 2011 crises, mainly because of the way the Fornero-Monti reform was designed.

We conclude the paper with some general considerations on the empirical evidence thus analyzed and on the reform, summarizing its pros and cons. Although the final judgement on its effects is negative, *Quota 100* may be the starting point to overcome some of the most critical aspects of the Fornero reform, that is its lack of flexibility which might heavily affect future young workers.

CHAPTER 1. OVERVIEW OF THE ITALIAN PUBLIC PENSION SYSTEM FROM 1969 TO 2018

The Italian pension systems has included different institutions to administer public pension programs according to the various economic sectors. In recent years there has been a partial unification and currently there is only one institution (INPS) paying out benefits to retirees. Funding is on a pay-as-you go (PAYG) basis.

As of 2015, the old-age pension expenditure in Italy stood at 11.8% of GDP, ranking second-highest in the EU28 after Greece. If we consider that in the interval 1989-2013 the percentage of old people in the Italian population passed from 14,49% to 20,92%, the negative forecasts on the ageing population trend and low fertility rate, we realize that as time passes Italy (and the other OECD countries) will have to spend more and more on old-age pensions as showed in figure 1.2, which is clearly unsustainable. Several attempts have been made to take into account this trend, unfortunately with scarce results. In this chapter we will look at the different pension systems in Italy in the last 50 years. We will summarize the period from 1969 to 1992 as there were no individual substantial changes in each reform.

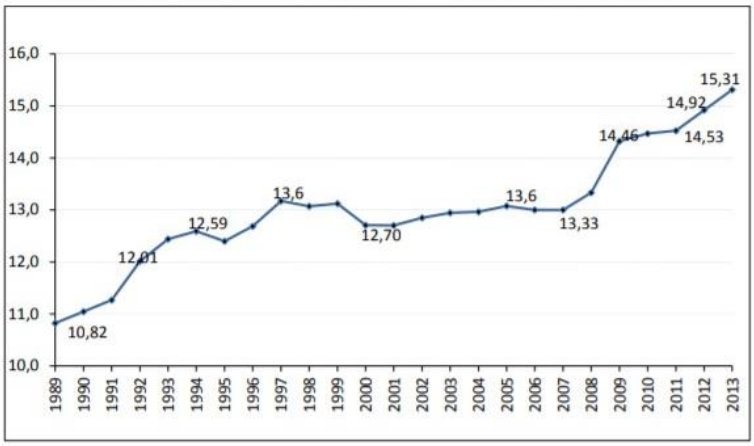

Figure 1.1 Pension expenditure as percentage of GDP (1989-2013).

Source: [9]

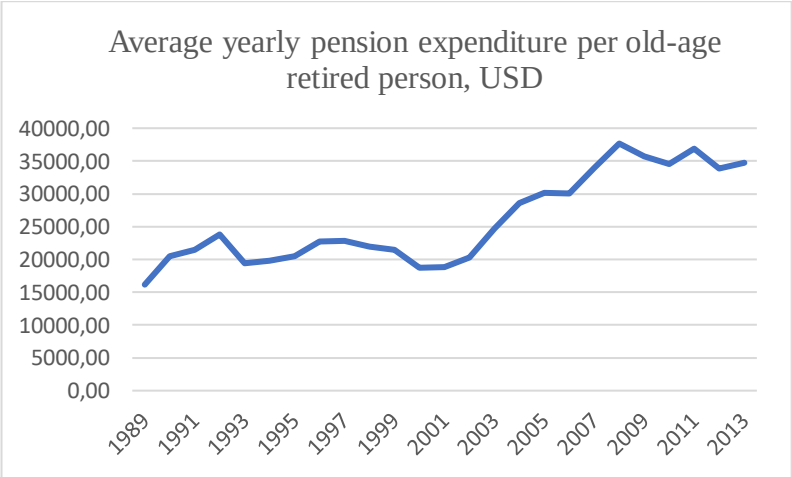

Figure 1.2 The computations were made assuming that on average 75% of the old receive a pension.

Source: Data from World Bank, [9], OECD

Before 1992

Until 1992 the PAYG system was funded through a payroll tax where the employer contributed aroud two thirds (plus 7.41% to the severance pay fund) while the employee for the remaining part. This was done to guarantee pensioners a standard of living as close as possible with that of active workers. Men could retire if they were 60 years old and women if they were 55 years old, with a minimum seniority of 15 years, however if public employees had a seniority of 20 and 15 years for males and females respectively, starting from 1973 it was possible for them to retire early with no actuarial penalty. For private employees the seniority requirement was set at 35 years.

In 1969 it was introduced an indexation mechanism which became effective after two years, so that pensions were aligned with the statutory minimum wage. Benefits were computed as follows: for private employees a 2% rate of return was applied to the last 5 years average salary; for public employees the rate of return was applied to the last monthly salary; for self-employed workers the rate of return was applied to the average earnings of the last 10 years.

The Amato Reform

In 1992 the Amato Government changed radically the pension system also due to the exchange rate crisis and the need to cut the deficit according to the Maastricht Treaty. In one of his papers, Daniele Franco (2002) identifies three main drivers of the reform: expenditure trends, labour market, and equity considerations. First, pension expenditure went from 5% of GDP in 1960 to 14.9% in 1992 with a projection made by the *Ministero del Tesoro* of 25% by the year 2030. In spite of the aforementioned population ageing trend and declining birth rate, demographic factors were not the main cause of the rising expenditures, although they certainly had an impact[1]: the eligibility conditions, the pension formula, the indexation mechanism, and an interest rate that was higher than the rate of growth of the social security wage base, thus ususstainable. Second, as we will further discuss in the next chapter, the lack of an actuarial correlation between pension benefits and the age of retirement caused a huge decline in the employment rate of older men and women since there was an implicit tax on continuing to work. Third, the previous system was particularly beneficial to workers whose salary grew considerably in the last years of employment. Furthermore, “low pensions were raised to the guaranteed minimum level while high-income workers were attributed lower accrual factors. Public-sector employees and the self-employed had very advantageous rules” [1]: according to Peracchi and Rossi (1998), the rates of return on the contributions paid by the self-employed were two to three times higher than those on the contributions paid by private-sector employees. There were clearly equity problems.

The reform progressively increased the eligibility requirements for old age pensions, which went from 55 to 60 years for women and from 60 to 65 years for private employees; the total payroll tax passed from

[1] The demographic element explained the 20% of the increase in the GDP ratio of total pension expenditure.

24.5% to 27.17% of gross earnings; the pension formula was unified across private, public, and self-employed, taking now into account the average of *whole working life* earnings for those workers with fewer than 15 years of contribution in 1992 while older worker's reference period consisted in the last 10 years o accrued contribution. Each earning was adjusted for inflation, which became the new indexing mechanism, and further revalued by 1% per year. The minimum number of years of contributions for old age pensions was raised from 15 to 20 years. For public sector employees the minimum number of years of contributions for seniority pensions was gradually raised to 35 years.

Although this new pension system reduced net pension liabilities by one fourth, it failed to produce enough savings. Lastly, "the exclusion of individuals with at least 15 years of contributions from changes in the pension formula implied a long transition period and an uneven distribution of the reform burden" [1].

The Dini Reform

In 1995 the Italian pension system was completely overhauled, as a response to the severe projections released by INPS and the Ministry of Treasury on expenditure prospects. This reform had a wider scope than the 1992's: its objective consisted in stabilizing the percentage of pension expenditure on GDP, in addressing distortions in the labor market, and in making the system more fair by tightening the eligibility conditions for seniority pensions, which were risen every year from 1996 to 2008 and reached either 40 years of paid contributions independently of age or alternatively 57 years of age and 35 years of paid contributions, to gradually abolish them.

Italy went from a DB to a DC system[2], meaning that now the pension formula was based on the accrued contribution payments -not the average salary anymore- which were capitalised at the GDP growth rate and "transformed into a lifetime annuity according to *actuarial fairness* (taking into account the expected age of death)" [2]. Workers were separated in three groups depending on their number of years of contribution at the end of 1995. Despite the new rules on eligibility requirements were introduced for all workers, those with at least 18 years of contributions experienced no changes in terms of benefit calculations, meaning that the DB formula still applied. For newly hired workers the benefit computation method changed completely from DB to DC while for those who were working before 1996 but with less than 18 years of contributions at the beginning of 1996 a mixed system was applied. This difference in treatment raises an equity problem.

Despite these two reforms, the ratio of public pension expenditure to GDP reached 16 percent in 1999 and according to the Ministry of Treasury it was likely to rise even further. This was a crucial aspect because

[2] Pizzuti argues that by simply adjusting the old DB system most of the potential benefits and distributive effects could have been still achieved. Applying the same pension formula to all categories and computing pensions on the basis of lifetime earnings would have infact accomplished the equalization of yields on contributions and the strengthening of the link between contributions and benefits. See [15]

the Stability and Growth Pact requires close-to-balance budgets. Since revenue increases are problematic, the only option are cuts in public expenditures.

How contribution-based schemes work[3]

In a DC system, pensions may be seen as saving accounts where money are deposited during the working period and withdrawn once the former is over. Two different rates of return should be applied: one for workers (long-term government bond) and one for retired people (short-term government bond). Plus, a *deposit-exhaustion constraint* must be satisfied, i.e. the money withdrawn must equal the money deposited including the interest accrued, meaning basically that the account balance must be zero after the last annual benefit has been withdrawn. Assuming discrete time, the formula is

$$a\sum_{i=1}^{n}(w_i)\prod_{j=i+1}^{n+1}(1+\pi_j^L)=p\left(1+\sum_{i=n+2}^{n+m}\prod_{j=n+2}^{i}\frac{1+\sigma_j}{1+\pi_j^R}\right) \tag{1.1}$$

where the left-hand side is the future value of contributions deposited up to retirement, and the right-hand side is the present value of all pension benefits. N represents the duration of working life, a is the contribution rate, w_i is the wage earned in i-th year, p the first annual benefit, π_j^L and π_j^R are the values taken by the rate of returns applied to the account balances of workers and pensioners respectively in j-th year, σ_j the value taken in j-th year by the indexation rate, and m the life expectancy at retirement. If we define h as the inverse of the term in brackets on the right-hand side[4], then we can rewrite 1.1 as

$$p=\left[a\sum_{i=1}^{n}(w_i)\prod_{j=i+1}^{n+1}(1+\pi_j^L)\right]h \tag{1.2}$$

The term in square brackets is also called *notional capital* and can be easily computed, however further assumptions must be made on h since $\boldsymbol{\sigma_j}$ is unknown. In Italy the indexation rate is chosen by the policy maker and the following relationship between the former and π_j^R holds $\forall j$:

$$\pi_j^R=\left(1+\sigma_j\right)(1+\delta)-1 \tag{1.3}$$

[3] This section references the work of Gronchi and Nisticò. See [7].

[4] In reference to the Italian pension system, h is called *conversion rate*.

where δ is the amount by which π^R will deviate from σ in each year and is called *deviation rate*. Since the deviation rate is set by the policy maker, we have all the instruments to compute the conversion rate: substituting (1.3) in the definition of *h* gives

$$h(\delta, m) = \left[\sum_{i=1}^{m} (1+\delta)^{1-i}\right]^{-1} \tag{1.4}$$

that is, the conversion rate is increasing in the deviation rate and decreasing with respect to life expectancy.

The Maroni and Prodi Reforms

The change in the design of the pension system did not significantly affect the long-term expenditure trends of the Amato reform: it was estimated by Rostagno (1996) that the reform increased the liabilities of the private-sector employees' pension scheme by 4% to 9% of GDP depending on the rate of growth of the former. Moreover, the implementation of the reform was extremely gradual, which along other factors reduced its microeconomic benefits.

In 2004 the Welfare minister Roberto Maroni introduced new incentives for those who had delayed their seniority pensions, who would benefit from an extra bonus close to one third of their wage. At the same time, the eligibility requirements for seniority pensions became tighter, passing from a minimum age of 57 to 60 years for public and private employees, and from 58 to 61 years for the self-employed[5]. For the cohort that was still under the DB system, the minimum retirement age was raised to 65 years for men and 60 years for women. Finally, incentives to continue working after retirement were provided, making possible to combine income from pension benefits and wages.

The *scalone* was supposed to be effective starting 2008, however in 2007 the new Government led by Romano Prodi postponed it to 2011[6]. Eligibility requirements to seniority pensions were further tightened by making them conditional to achieving a given threshold, the so-called *quota*, equal to the sum of age and years of contributions. In 2009 the *quota* was set at 95 with at least 59 years of age, starting from 2013 at 97 with at least 61 years of age.

The Monti Fornero Reform

In 2011 the Monti Government changed drastically the pension system with the "Save Italy" decree. As mentioned in the introduction, this reform accelerated the transition phase from the defined benefit to the

[5] This three-years shift is called *scalone*. Women were still eligible at 57, however their retirement benefits would have been severely cut.

[6] Since in 2011 seniority pensions were abolished, nobody has retired under the requirements of this reform.

defined contribution system. Due to the precarious situation Italy was in at that period, it was essential to cut one of the most expensive elements in the Country (despite that, in 2016 Italy spended 15% of the GDP in public pensions versus the OECD average of 8.2% [3]). The Labour minister Elsa Fornero abolished seniority pensions starting in 2012 and further increased minimum retirement age from 60 to 66 years for both males and females (in the public sector) and from 60 to 62 for females in the private sector. Moreover, seven additional months were added for males to these new thresholds in the time period from 2013 to 2016, while in the same time interval the minimum retirement age for females employed in the private sector increased by three years and seven month. By 2050 there will not be any difference between men and women, both in the public and private sector, as everyone will meet the eligibility requirements for old-age pensions at 69 years and 9 months[7]. Early retirement pensions were changed too: by 2050, the years of accrued contribution will be 46 for males and 45 for females, irrespectively of the working sector. We mentioned that workers who by 1995 had at least 18 years of contribution payments were still under the DB system; after the Monti Fornero reform, they too shifted to a DC system. Finally, those who by 31/12/2011 had already met the age and contribution payments requirements, still followed the previous retirement rules.

With the new eligibility requirements, the employment rate for people aged 55 -64 experienced a sharp increase, passing from 37.8% in 2011 to 48.2% in 2015 [4], however at the same time the youth unemployment rate went from 29.2% to 40.3% [5]. One of the main criticism of the Fornero reform is the massive toll put on the youth, who in Italy already struggle to get a job. The relationship between old-age and young-age workers will be further analysed in the second chapter.

	Requirements ante reforms			Requirements post reform Fornero	
year	age limit men	age limit women	mobile window	age limit men	age limit women
2011	65	60	12 months		
2012	65	60	12 months	66	62
2013	65 e 3 months	60 e 3 months	12 months	66 e 3 months	62 e 3 months
2014	65 e 3 months	60 e 4 months	12 months	66 e 3 months	62 e 9 months
2015	65 e 3 months	60 e 6 months	12 months	66 e 3 months	62 e 9 months
2016	65 e 7 months	61 e 1 months	12 months	66 e 7 months	65 e 7 months
2017	65 e 7 months	61 e 5 months	12 months	66 e 7 months	65 e 7 months
2018	65 e 7 months	61 e 10 months	12 months	66 e 7 months	
2019	66	62 e 9 months	12 months	67	
2020	66	63 e 3 months	12 months	67	

Table 1.1 Requirements before and after the 2011 reform. Source: [10]

[7] "Moreover, for those individuals whose retirement benefits are computed with the defined benefit method, the law sets a penalty if they retire before the age of 62. The 2011 reform links the adjustment of the age requirement for an old-age pension to the increase in life expectancy according to an *actuarially fair* principle." See [8].

Quota 100

In 2018 the "Yellow-Green" Government proposed a new reform of the pension system, with the aim to lower the youth unemployment rate. This reform, later confirmed by the new "Yellow-Red" Government, is addressed to: those who, between 2019 and 2021, will be at least 62 years old with no less than 38 years of accrued payment contribution; those who, between 2019 and 2026, will have a pension contribution of at least 42 years and 10 months for men and 41 years and 10 months for women; women who by 31/12/2018 will be at least 58 years old with no less than 35 years of accrued payment contribution if employees, otherwise they must be 59 years if self-employed (*Opzione donna*)[8]; those who, between 2019 and 2026, will have a pension contribution of at least 41 years, i.e. the so-called *lavoratori precoci*, who will be able to retire after three months once the conditions are met[9]. After 2026, Italy will go back to the 2011 system.

It is crucial to remember that *Quota 100* does not substitute the Fornero reform, meaning that old-age requirements will not change, as this is just an incentive to retire early by relaxing eligibility requirements so that younger workers will get employed easier. Several aspects have been criticised, such as the correlation between old-age employment rate and youth unemployment rate, the effectiveness of these incentives to cause early-retirement, and the sustainability of the reform, a critical aspect if we consider that Italy's GDP growth rate is close to zero and its population keeps ageing.

[8] Once these conditions are met, the former will retire after 12 months while the latter after 18 months.

[9] The Yellow-Green Government has also confirmed the extention of the social *APE*, a State-funded loan addressed to limited working categories with the old-age pension as collateral. If the worker is 63 years old with at least 20 years of contribution payments, they are able to request a monthly cheque between 75% and 90% of their future pension until the date of retirement.

CHAPTER 2. ECONOMICAL IMPLICATIONS OF AN AGING POPULATION AND EARLY RETIREMENT

Starting from the Sixties the industrialized world has experienced a continuous drop in both the population growth rate and in the mortality rate, resulting in an older population as time passes. This fact has inevitably caught the interest of policy makers and economists as it will affect several aspects such as the rate of savings, the structure of demand, the distribution of wealth between the old and the young, and the labour market. Concerning this last aspect, since contemporaneous pension systems tend to be actuarially based, older people retire later and this is thought to be one of the main causes of the lower youth employment rate. As a way to stimulate the labour offer for the young, some Governments have incentived early retirement, however the correlation between the two is still object of discussion.

Consequences of the ageing population trend

We start this section by defining the *dependency ratio*, i.e. the ratio between non-working to employed people. As shown in a paper from Hagemann and Nicoletti (1989), this ratio has grown quite considerably, with overall actual results higher than the projections[10]. We also mentioned that in many Countries pension benefits are financed through a PAYG scheme, that is through contemporaneous payroll taxes, so that social insurance depends on labour income instead of capital income. In spite of the increasing participation of older workers to the labour force to face the ageing population trend, the percentage of people older than 65 keeps increasing. Combining these aspects, it is obvious that PAYG schemes will become unsustainable as future workers will have to pay more taxes to maintain benefits constant[11].

According to Razin *et al* (2002) however, this does not seem the case. They use a median voter model with overlapping generations with young workers and old dependants (the former outnumbering the latter), the only tax being proportional to labour income, and a periodical rebalance of the budget constraint. Tax revenues are entirely spent on benefit payments, equal for both the old and the young. The authors then distinguish among the young between skilled and unskilled workers according to a cut-off level equal to

$$e^* = 1 - q - \frac{\gamma}{(1-\tau)w} \tag{2.1}$$

where $q < 1$ are the efficiency units of labour per unit of labour time, γ is the not-tax-deductible cost of education, and w is the wage rate equal to the marginal productivity of labour of a linear production function

[10] Data: World Bank. The employed variables are highly volatile.
[11] One of the biggest disadvantages of PAYG schemes is that if the payroll taxation is not perceived as some way of future savings, it could also reduce labour supply and create other distortions.

with labour and capital as inputs. If for the i-th young $e_i > e^*$, then they will invest in education. In equilibrium, the gain from higher benefits for the median voter must be equal to the loss caused by an increase in taxation, but since taxes are paid only by the young, the old will always vote for raising benefits and taxes, while the young will base their vote on their level of education/income: the higher the wage, the lower the magnitude of the extra incentives. In short, to find the median voter we have to look at both the percentage of young and old in the economy and at the average level of education. Collecting data from 12 European countries and the US over the period 1965-1992, an OLS regression then is performed on the dependency ratio with the labour tax rate and the log of benefits per capita as the independent variables, controlling for government employment as a fraction of total employment, trade openness to account for the sensitivity to external shocks, real GDP growth rate for the business cycle, and unemployment. They find that an increase in the dependency ratio is associated with a reduction in benefits and taxation, i.e population ageing has actually reduced per capita expenditures, in constrast with the expectations on the median voter. This apparent puzzle is then further analyzed by Bryant (2003) by considering a disaggregated dependency ratio thus composed to account also for young dependants

$$\begin{aligned} &Dependency\ ratio \\ &= proportion\ of\ total\ population\ aged\ 0-14\ +\ labour\ force\ participation\ rate, ages\ 15-64 \\ &+ proportion\ of\ population\ aged\ over\ 65 \end{aligned} \tag{2.2}$$

where the labour force participation for workers older than 65 is assumed to be 0 for simplicity. Using the same independent variables and data for 13 OECD countries over the period 1960-1996, the author finds statistically significant results at the 5% level. Specifically, the OLS regression shows that, *coeteris paribus*, an increase in the proportion of population aged 0-14 lowers taxation and benefits per capita while the opposite happens for an increase in the proportion of population aged 65+: overall, the more young people, the lower the level of taxes (assuming that benefit payments are not treated as if they were directed to the parents); conversely, more older people imply higher taxes. This difference can be explained by the negative correlation between benefit levels and youth dependency as they are not able to vote, hence they do not add up to those favourable to higher taxation.

To quantify the impact of ageing in pension expenditure, we start by a simple budget identity: at each time t the revenues from contributions plus the interests on the pension fund's assets must be equal to its expenditures and its variation in assets, that is

$$Rev_t + I_t F_{t-1} = Exp_t[1 - S_t] + F_t - F_{t-1} \tag{2.3}$$

where I_t is the nominal average rate of return and S_t is a general government subsidy. To express Rev_t as the amount of taxes paid by workers, we substitute it with the identity $Rev_t \equiv \tau_t y_t N_t^c$ (the product of average

contribution rate, average taxable income, and number of contributors). We do the same for $F_t \equiv \varphi_t y_t N_t^c$ (the product of unit of taxable income, average taxable income, and number of contributors) and $Exp_t \equiv b_t N_t^b$ (the product of the average pension benefit and the number of beneficiaries). The growth rate of the aggregate taxable income $y_t N_t^c$ is equal to the product of inflation, growth of real taxable wages, and number of contributors, i.e.

$$\frac{y_t N_t^c}{y_{t-1} N_{t-1}^c} = (1 + \pi_t)(1 + g_t)(1 + n_t) \tag{2.4}$$

Finally, if we let $\beta_t = \frac{b_t}{y_t}$ be the average replacement rate and substitute these equations in (2.3), we obtain two results depending on the variables we want to isolate:

$$\begin{aligned} \tau_t &= \varphi_t - \varphi_{t-1} + \frac{g_t + n_t - i_t}{1 + g_t + n_t} \varphi_{t-1} + \beta_t (1 - S_t) DEP_t \\ \varphi_t - \varphi_{t-1} &= \tau_t - \beta_t (1 - S_t) DEP_t - \frac{g_t + n_t - i_t}{1 + g_t + n_t} \varphi_{t-1} \end{aligned} \tag{2.5}$$

where i_t is the real average interest rate, $\frac{g_t + n_t - i_t}{1 + g_t + n_t} \varphi_{t-1}$ the growth in the fund per unit of taxable income, and $DEP_t \sim \frac{N_t^b}{N_t^c}$ the dependency ratio. The first equation quantifies the average contribution rate of an economy, while the second one the dynamic of the pension fund's surplus. We observe that τ depends positively, among the other variables, on the dependency ratio and the replacement rate.

Another major issue is intergenerational equity, that is the extent of the burden caused by current period fertility decisions that should be shifted to future generations. The degree of burden-sharing may be determined either in conjunction with the increases in dependency ratios or by a "constitutional rule" that reflects society' s equity norm as proposed by Petersen (1988). Independently of the adopted solution, the core aspect should be the minimization of the welfare losses to transitional generations, which could be done "either explicitly via an arbitrary reduction in future income replacement rates, or implicitly, such as by replacing a proportion of net rather than gross earnings"[11].

Other channels that have been affected by this trend in recent years are of course the labour market, income, and consumption. First, the composition of the labour force has radically changed since many countries have tightened the eligibility requirements for retiring. An older working population may lead to a less dynamic labour force, thus reducing the degree of adaptability to new technologies and jobs. Second, other things being equal, in an ageing population it is possible to increase the amount of capital per worker due to the fact that to maintain a constant capital-labour ratio fewer additions to the capital stock are needed

to be allocated to new workers. *Coeteris paribus*, a greater capital stock per worker raises productivity and therefore per capita income. Third, it is safe to assume that a change in age distribution might lead to a change in the structure of commodities' preferences, which implies that consumption and saving habits could change as well. As an example, food and medical care will increase while hard goods and education will decrease.

One further aspect we need to consider is the impact of demographic shocks on the rate of return applied to savings. Keyfitz (1985) used historical and projection data for the United States to show that just a small decrease in birth rates could lead to a negative rate of return for the next generations.

The causal relationship between incentives and early retirement

Although with a considerable cross-country variation, many OECD members experienced a drop in the effective retirement age and a subsequent reduction in the LFP of senior workers after the first oil shock that stopped only in the early Nineties when Governments started tightening the eligibility requirements to face the ageing population trend and the rise in pension expenditures. The structure of a social security system directly influences the decision between chosing to retire and remaining in the labour market: in many cases an additional year of working reduced the level of utility, i.e. past a certain age keep working is not an optimal solution. In a paper from 2000, Börsch-Supan takes as example the German public pension system due to its universality and notices how with the 1972 rules the lack of actuarial fairness creates a sort of implicit tax that reaches its minimum exactly when people have the opportunity to retire early [7]. To estimate this tax, he considered a worker who is S years old and plans to retire at age R, then he defined their Social Security Wealth as the present discounted value of benefits minus applicable contributions.

In formulae

$$SSW_S(R) = \sum_{t=R}^{\infty} YRET_t(R) \cdot \alpha_t \cdot \delta^{t-S} - \sum_{t=S}^{R-1} c_t \cdot YLAB_t \cdot \alpha_t \cdot \delta^{t-S} \qquad (2.6)$$

where $YLAB_t$ is labour income at age t, $YRET_t(R)$ is pension income at age t for retirement at age R, c_t the contribution rate to pensions at age t, αt the probability of surviving at least at age t conditional to surviving until age S, and δ is the intertemporal discount factor equal to 1/(1+r).

From this definition, we define the accrual rate of social security wealth from t-1 to t as

$$ACCR_S(t) = \frac{[SSW_S(t) - SSW_S(t-1)]}{SSW_S(t-1)} \qquad (2.7)$$

If the accrual rate is negative, it means that working one more year actually reduces the worker's benefits and could be perceived as a tax to continued work at time t. The implicit tax rate is equal to, assuming $ACCR_S(t) < 0$

$$TAXR_S(t) = -\frac{ACCR_S(t)}{YLAB_t^{NET}} \tag{2.8}$$

where $YLAB_t^{NET}$ is the net wage at age t that the worker would earn if they delayed retirement.

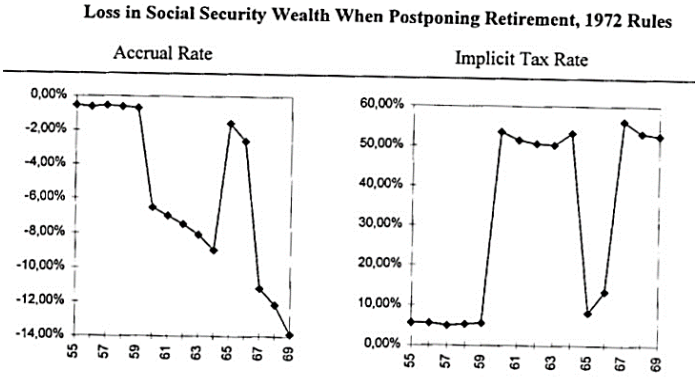

Figure 2.1 Source: [12]

We notice from figure 2.1 that whenever there is a kink in the accrual rate, the implicit tax rate drops. The first -and highest- kink occurs at 60 years, implying a strong incentive to retire early. The other two kinks coincide with the bonus for delaying retirement at 65 and 66 years.

The relationship between the implicit tax rate and the average age of retirement has been studied by Blöndal and Scarpetta (1997) using data from OECD countries over the period 1971-1995. In particular, they wanted to quantify how a variation in the accrual rate affects the ratio between male workers aged 55-64 and the total population. Let us consider the following equation

$$MPR_{it} = \mu_0 + \mu_i + \beta_1 WA(or\ SSWA)_{it} + \beta_2 EAGE_{it} + \beta_3 UR_{it} + \beta_4 RPOP_{it} + \beta_5 UDENS_{it} + \varepsilon_{it} \tag{2.9}$$

where μ_i is a State-specific effect, WA_{it} the expected change in pension wealth for State i at time t, $EAGE_{it}$ is the required age to get old-pension benefits, UR_{it} and $RPOP_{it}$ refer to the male unemployment rate and the share of the prime-aged population in the total working-age population and are controls for the labour market and demographic variables respectively, and $UDENS_{it}$ is the union density rate, that is the share of workers who are member of trade unions[12]. The presence of positively autocorrelated residuals (see the adjusted Durbin-Watson test in Table 2.1) and heteroskedasticity makes OLS not the best estimators, so Feasible GLS are adopted. Specifically, a three-step method is employed: first, the coefficients are estimated via OLS to obtain consistent results for the autocorrelated terms, then the original data are transformed using the estimates found in step one to get rid of the Country-specific autocorrelation using the Prais-Winsten transformation, to finally employ FGLS.

[12] Trade unions could influence the perception of early retirement "as a socially acceptable way to accommodate downsizing and economic restructuring of firms" [29].

FGLS, population 55-64

	With controls for serial correlation of residuals and heteroskedasticity													
	Model 1				Model 2				Model 3				Model 4		Model 5	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
UR	**−1.460**	**0.102*****	**−1.355**	**0.090*****	**−0.747**	**0.078*****	**−0.605**	0.071***	**−0.915**	0.078***	**−0.765**	0.071***	**−0.764**	0.072***	**−0.754**	0.071***
RPOP			**−0.903**	**0.097*****			**−0.805**	0.091***			**−1.024**	0.091***				
UDENS	**0.317**	0.045***	**0.264**	**0.040*****	**0.107**	0.040***	**0.129**	0.039***	**0.094**	0.044**	**0.139**	0.043***	**0.131**	0.046***	**0.141**	0.043***
U repl	**−0.328**	0.034***	**−0.285**	**0.030*****	**−0.188**	0.030***	**−0.149**	0.029***								
Off. age.ret.	**0.028**	0.004***	**0.029**	**0.003*****	**0.018**	0.003***	**0.015**	0.003***	**0.011**	0.003***	**0.015**	0.002***	**0.012**	0.002***	**0.014**	0.002***
Pens. wealth accr.	**0.010**	0.007	**−0.002**	**0.006**	**0.026**	0.004***	**0.018**	0.004***								
Soc. s. wealth accr.									**0.017**	0.002***	**0.015**	0.002***	**0.014**	0.002***	**0.015**	0.002***
RPOP (decentralised)													**−0.782**	0.119***		
RPOP (sectoral)													**−1.656**	0.294***		
RPOP (centralised)													**−1.023**	0.133***		
RPOP (small)															**−0.906**	**0.092*****
RPOP (intermediate)															**−0.722**	**0.437***
RPOP (large)															**−1.367**	**0.217*****
Log Likelihood		809.0		848.0		1 187.5		1 209.9		1 184.0		1 206.9		1 215.6		1 215.2
χ^2_1		2 536.3		3 220.4		1 501.6		1 517.2		1 616.2		1 926.6		1 929.6		2 105.3
Test of country dummies (χ^2_{13})		868.8		731.8		409.9		143.5		544.8		180.4		122.3		135.3
Adj Durbin-Watson test		0.2		0.3												
Wald tests (χ^2_1):																
RPOP (decentr.) = RPOP(sect.)														7.8***		
RPOP (sect.) = RPOP(centr.)														3.7*		
RPOP (small) = RPOP (intermediate)																0.2
RPOP (small) = RPOP(large)																4.0**

Table 2.1 Old-age male participation rate, pension, and social-security wealth accrual (1971-1995). Model 1 uses OLS, while the three-steps approach is applied to Model 2 through Model 5. The various Models control for different variables, even within the same category. Source: [25]

Focusing on the result for the social security wealth accrual, we observe how a decrease in the implicit tax of 10% causes a significant increase in the senior-worker participation rate of almost 2%. On top of that, all models tell us that a one year decrease in the age of entitlement implies an average decrease in the participation rate of 1,5%. There will be a more in-depth analysis on this topic in the next section.

This empirical evidence is consistent with the study made by Duval (2003) about the effects of an increase in the implicit tax on the labour force participation of older workers. A panel estimation is performed using data from 1967 to 1999 for 22 OECD Countries starting from equation

$$\frac{\Delta PRM_{it}}{PRM} = \beta_1 TAX_{it} + \beta_2 STANDARD\_AGE_{it} + \beta_3 UR_{it} + a_i + \gamma_t + \varepsilon_{it} \qquad (2.10)$$

where the dependent variable is the difference in male LBP rates between two consecutive age groups for Country i at time t, $STANDARD\_AGE_{it}$ is the ordinary retirement age, UR_{it} is the prime-age workers unemployment rate, a_i and γ_t are Country-specific and common year-specific controls respectively.

	Model A			Model B			Model C		
Dependent variable:	(Pr55-59 - Pr50-54) / Pr50-54, in per cent	(Pr60-64 - Pr55-59) / (Pr55-59), in per cent	(Pr65-69 - Pr60-64) / Pr60-64, in per cent	(Pr55-59 - Pr50-54) / Pr50-54, in per cent	(Pr60-64 - Pr55-59) / (Pr55-59), in per cent	(Pr65-69 - Pr60-64) / Pr60-64, in per cent	(Pr55-59 - Pr50-54) / Pr50-54, in per cent	(Pr60-64 - Pr55-59) / (Pr55-59), in per cent	(Pr65-69 - Pr60-64) / Pr60-64, in per cent
implict tax on continued work	-0.06	-0.06	-0.13	-0.11	-0.17	-0.15	-0.09	-0.12	-0.1
	(4.23)**	(3.54)**	(5.43)**	(7.15)**	(4.88)**	(4.88)**	(8.98)**	(5.16)**	(5.65)**
unemployment rate	-0.16	-0.77	-0.34	-0.12	-0.9	-0.53	-0.15	-1.07	-0.29
	(2.97)**	(7.85)**	(3.32)**	(1.88)	(5.95)**	(3.98)**	(3.25)**	(10.28)**	(3.01)**
standard retirement age		-0.14	2.41		1.63	1.17		1.27	1.27
		(0.39)	(6.08)**		(3.29)**	(3.70)**		(3.40)**	(6.22)**
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country specific time trends	Yes	Yes	Yes	No	No	No	No	No	No
Time fixed effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	431	431	431	484	471	471	484	471	471
R-squared	0.93	0.95	0.87	0.92	0.89	0.8			

Table 2.2 Panel data estimates of the LFP of older workers. Source: [26]

Model A uses Country-specific time trends instead of common time fixed effects but this variable is correlated with the magnitude of implicit taxes[13]. Models B and C are the same with the only difference that the latter uses FGLS to account for heteroskedasticity. In all three models, the coefficiets for the implicit tax rate are negative and statisically significant at the 5% level.

The Option Value model

A more sophisticated utility-based model to study this effect was proposed by Stock and Wise in 1988. While the model considers the trade-off of working one more year versus the benefits of retiring, meaning that the option value of continuing to work is compared with the value of retiring now, the key aspect consists in reevaluating this decision every time the worker has new informations regarding their future income. Briefly, suppose the worker is at time t and will receive wage income Y_s in year s as long as they do not retire. If that were not the case case, they would receive pension benefit $B_s(r)$, where r is the first full year of the individual's retirement[14]. The indirect utility functions are assumed to be

$$\begin{aligned} U_w(Y_s) &= Y_s^\gamma + \omega_s \\ U_r(B_s) &= [k \cdot B_s(r)]^\gamma + \xi_s \end{aligned} \tag{2.11}$$

where ω_s and ξ_s are random walks, and k some parameter. The value of working from age t to age r-1 is

$$V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} \cdot U_w(Y_s) + \sum_{s=r}^{S} \beta^{s-t} \cdot U_r(B_s) \tag{2.12}$$

[13] An auxiliary regression made to test this relationship yields statistically significant coefficients at the 5% level.
[14] Pension benefits are a function of the worker's age, their past contribution payments, and earnings.

where S is the year of certain death and $\beta \in [0,1]$ the intertemporal discount rate. Letting $E_t[\cdot]$ be the worker's expectation conditional to the informations available at time t, then the expected gain at age t from delaying retirement to age r is

$$G_t(r) = E_t[V_t(r)] - E_t[V_t(t)] \tag{2.13}$$

Finally, let r* be the argmax of $E_t[V_t(r)]$. The worker will retire at age t if

$$G_t(r*) = E_t[V_t(r*)] - E_t[V_t(t)] < 0 \tag{2.14}$$

Substituting (2.12) in (2.13) and assuming that being alive in future years is independent of both the worker's earnings and ω_s and ξ_s gives

$$G_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} \cdot \pi(s|t) \cdot E_t[Y_s^{\gamma}] + \sum_{s=r}^{S} \beta^{s-t} \cdot \pi(s|t) \cdot E_t\,[k \cdot B_s(r)]^{\gamma} - \sum_{s=r}^{S} \beta^{s-t} \cdot \pi(s|t) \cdot E_t\,[k \cdot B_s(t)]^{\gamma} + \sum_{s=t}^{r-1} [\beta^{s-t} \cdot \pi(s|t)](\omega_t - \xi_t) \tag{2.15}$$

where $\pi(s|t)$ is the probability of the person being alive in year s given that they were alive in year t. Using a lighter notation, (2.15) can be rewritten as

$$G_t(r) = g_t(r) + K_t(r) \cdot \nu_t \tag{2.16}$$

The first term on the right-hand side contains the starting three sums while the second one the discounted random walk processes. ν_t is assumed to be normally distributed with mean 0 and standard deviation σ_ν[15].

Using this equation, it is possible to estimate the *probability of retirement*. Letting r^+ be the argmax of $g_t(r)/K_t(r)$, then the probability is estimated as such

$$\pi(retire\ in\ year\ t) = \pi\left(\frac{g_t(r^+)}{K_t(r^+)} < -\nu_t\right) \tag{2.17}$$

In his estimations on the German pension system, Börsch-Supan obtained consistent and statistically significant results using this model, concluding that around 30% of the total early retirement is actually related to policies, suggesting the existence of a causal relationship between incentives and early retirement.

The Italian case

We now want to apply the Option Value model to Italy, however we need first to modify (2.13) as it does not take into account several retirement programs that are relevant in our country: old-age pensions,

[15] The further r, the greater the volatility, meaning that the potential retirement age becomes more and more uncertain.

early-retirement pensions, and disability insurance. As proposed by Belloni and his coauthors, we should consider a *weighted* OV such as

$$OV_{Weight} = OV_{DI} \cdot w_{DI} + OV_{Early} \cdot w_{Early} + OV_{Old} \cdot w_{Old} \tag{2.18}$$

where the weights are estimated "by the relationship between individual attributes and the possibility that a plan was already chosen in the past" [8]. Applying the model to the cohort 1945-1949, we find that for both men and women there is a significant incentive to retire at younger ages through DI or early retirement than considering the old age pathway. The cohort 1940-1944 confirms this result for men but has some differences for women.

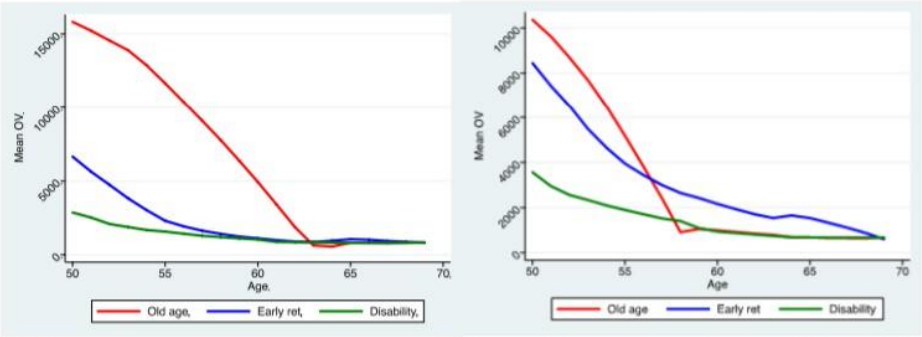

Figure 2.2

Cohort 1945-1949

Source: [8]

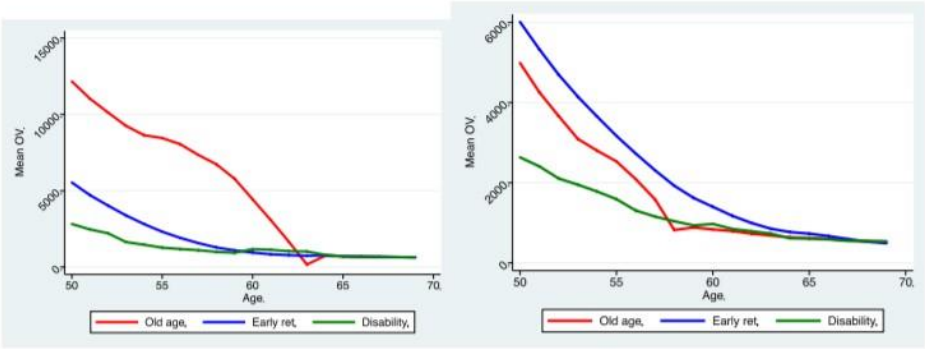

Figure 2.3

Cohort 1940-1944

Source: [8]

One last aspect we should consider is how different social security regimes influenced the exit rates into retirement and the implied employment rates. The regimes are: pre-1992, Amato, Dini-Prodi[16], and an actuarial adjustment that features early retirement at 60 years old, normal retirement at 65, pensionable earnings equal to the last five years of contributions with 60% replaced by benefits when retiring at 65 years with 40 years of contribution, a yearly reduction of 6% for early claiming and a yearly 6% increase for later claiming. Using the pre-1992 regime as reference, all the others imply a reduction of retirement rates and hence an increase of employment rates over the 50–60 age range, especially under the Dini-Prodi regime and the actuarial adjustment. Specifically, for both men and women there is an increase in the median retirement age of 2 years under the Dini-Prodi regime and of 3 years under the actuarial adjustment. After age 60, however, only the actuarial adjustment appears to be able to generate a sizeable increase in employment rates

[16] The so-called Prodi I Government (1996-1998).

relative to the pre-1992 regime. We can conclude that mostly under the older regimes, Italian workers have retired as soon as they could. This phenomenon contributed to the massive rise of public expenditure in social pensions.

Does rising the eligibility requirements directly affect the youth labour market?

Looking now at a recent case of policy-induced form of early retirement, the objective of *Quota 100* is to (temporarily) overcome the Fornero reform to make eligibility conditions more flexible thus creating more jobs for the young, in contrast with the stricter pension regimes recently adopted by several OECD countries to face the ageing population trend. Although we have just seen that the first step may actually work, the validity of the second claim has yet to be verified.

Let us first analyze the increase in female workers at the end of the XXth and its effects on the male rate of employment. Gruber, Milligan, and Wise (2009) show that in spite of the considerable increase in female employment rates from 1983 to 2003, the male employment rate declined by a negligible percentage. This could be explained by a growing economy that needs more and more employees: while in some cases men are fired, the overall male participation does not drop.

The lump of labour fallacy

We now apply the same reasoning to the old and the young. In the previous section we stated that, on average, when workers have the opportunity to retire early, they typically do that because working just one more year could be seen as an implicit tax. Then, since the tax is linked to the number of older people out of the labour force and its increase should stimulate the youth labour market, it should be positively correlated with the youth employment rate, i.e. the higher the former, the higher the latter, however the empirical correlation is actually negative as shown in the graph

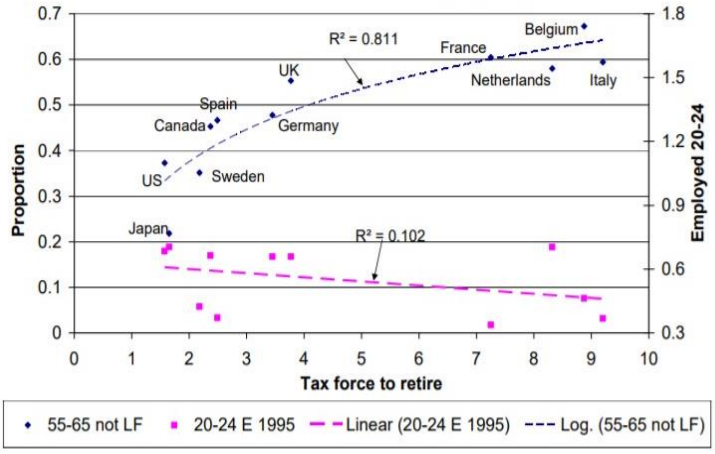

Figure 2.4 Tax force to retire, men 55-65 out of the labour force, Youth 20-24 employed (1995) Source: [15]

Going back to the German pension system, with the introduction of the actuarially unfair possibility of early

retirement in 1972, workers between 55 and 64 experienced an increase in the unemployment rate of 17%, which is why in 1992 a fair reform was introduced to correct this trend, resulting in an increase of 23% between 1997 and 2006. The effects on the unemployment rate of the young were: in the interval 1972-1976 a reduction of 7% in the employment rate of older people was associated with a reduction of 2% in the employment of younger people and with an increase of 1.7% in the unemployment rate of the same category; in the interval 1997-2006 an increase of 15% in the employment rate of older people was associated with no change in employment rate of the young and a slight reduction in the unemployment rate of the same category[17].

Let us consider the heterogeneous American labour market over the period 1977-2011, thus including the effects of the Great Recession in the analysis. Munnell and Wu (2012) study the effects of delayed retirement on the level of employment and unemployment of the young, even in conditions of strong crisis. Using data from Current Population Survey (CPS), they examine the equation

$$Y_{st} = \beta_0 + \beta_1 Olderemp_{st} + X_{st}\beta_2 + \gamma_t + \delta Rec + \Psi_s + \varepsilon_{st} \tag{2.19}$$

where Y_{st} can be either the youth unemployment or employment rate for State s at time t, $Olderemp_{st}$ is self-explanatory, X_{st} is a vector of explanatory variables referring to the differences between the American States like the per-capita level of Gross State Product (GSP), its growth rate, the demographic composition, and so on. γ_t is a set of controls for changes in the whole American economy, Rec in an indicator for the Great Recession, and Ψ_s is a vector that controls for significant State-specific characteristics. Though the OLS estimator for β_1 is negative and statistically insignificant for the unemployment rate but positive and statistically significant -at the 10% level- for the employment rate, even after rearranging (2.19) to make all the variables in X_{st} interact with Rec, the authors suspect that the results are biased due to omitted variables[18]. A solution consists in running a TSLS estimation: using the mortality rate as an IV[19] from data over the period 1979-2008, the two equations are

$$\begin{aligned} Olderemp_{st} &= \alpha_0 + \alpha_1 MT_{st} + X_{st}\beta_2 + \gamma_t + \delta Rec + \Psi_s + \varepsilon_{st} \\ Y_{st} &= \beta_0 + \beta_1 \widehat{Olderemp}_{st} + X_{st}\beta_2 + \gamma_t + \delta Rec + \Psi_s + \varepsilon_{st} \end{aligned} \tag{2.20}$$

where MT_{st} is the log of men aged 55-64 for State s at time t, $\widehat{Olderemp}_{st}$ are the fitted value of the first

[17] Consistent results have been obtained for other countries and with a cross-country analysis.
[18] Take as example an investment that raises both youth and elderly employment.
[19] The State-year mortality rate satisfies the two requirements needed to be employed as a instrumental variable in this framework: according to Haider and Stephens (2007); Smith (2006); Hurd and Rohwedder (2003), (2008); McGarry (2004); and Stevens *et al.* (2011) it is correlated with employment for older people and it does not directly impact the employment of the younger.

regression, and X_{st} is defined as in (2.18) with the exeption of including also the log of the mortality rates of young and prime-aged workers as further controls.

Panel A:	Youth, both sexes			
Outcome variable	OLS	IV	First stage	F-statistic
Unemployment	-0.008	0.085	-0.085 ***	16.76
	(0.026)	(0.199)	(0.021)	
Employment	0.063 *	-0.231	-0.080 ***	14.76
	(0.032)	(0.300)	(0.021)	
Hours worked	0.056	-0.328	-0.086 ***	17.45
	(0.038)	(0.355)	(0.021)	
Wage rate	-0.031	0.822	-0.086 ***	17.28
	(0.074)	(0.605)	(0.021)	

Table 2.3 Effects of an increase in elderly employment rate. The high value of the F-statistic implies that the instruments are not weak. Source: [24]

The coefficients of the IVs have opposite signs with respect to those obtained via least squares but none of them is statisically different from zero, implying no correlation. The same procedure is then applied to the Chinese labour market using surveys of China's Census Bureau (CCB) for 84 provinces from 1990, 2000, and 2005, using the share of older people who are approaching the retirement age among the oldest part of the labour force due to a lack of data. The results are aligned with the American ones.

We move our focus on the Japanese population, one of the oldest among the industrialized economies. To reduce pension expenditure, the government implemented in 2001 the Pension Reform Act, progressively increasing the retirement age from 60 to 65 years for a part of the pension benefit, and a revision of the Elderly Employment Stabilization Law (EESL) in 2006 to face the gap "between the the pension eligibility age and mandatory retirement age, which was still 60 in most firms"[14] created by the former, allowing essentially for people older than 60 to get reemployed. Collecting data from the Employment Trend Survey (ETS) and the Establishment Enterprise Census (EEC), Kondo (2016) measures the effects of the EESL on the level of employment on different categories of Japanese workers, using as measurement the ratio of full-time male employees aged 55-59 with 2003 as the base year[20] and controlling for other variables. She considers the following equation for $t = 2003, \dots, 2008$

$$Y_{ijt} = \alpha + \sum_{\tau \neq 2003}^{2008} \beta_\tau X_{ij2003\,x\,\tau}\, d(\tau = t) + \nu_{jt} + \upsilon_i + \varepsilon_{ijt} \qquad (2.21)$$

where the different interpretations of Y_{ijt} are reported in Table 2.4. $X_{ij2003\,x\,\tau}$ is the ratio already defined for year 2003 for the i-th company in the j-th industry, d is a year dummy that is equal to 1 if τ = t and 0 otherwise,

[20] 2003 was the year before the announcement of the revision.

ν_{jt} is a time-varying industry effect, υ_i is a constant firm effect, and ε_{ijt} is the error[21].

	(1) Total # of employees	(2) Full-time employees	(3) Younger than 50	(4) 50–59 years old	(5) 60 or older	(6) Full-time younger than 25	(7) Female part-time 35–54 years old	(8) Part-time 60 or older
Ratio of age 55–59 in 2003 × 2002	0.065	0.034	0.133**	0.027	−0.333	0.044	−0.045	−0.091
	[0.059]	[0.053]	[0.059]	[0.112]	[0.255]	[0.153]	[0.213]	[0.172]
Ratio of age 55–59 in 2003 × 2004	0.013	0.052	0.04	−0.159	0.339	0.614***	−0.091	0.278
	[0.045]	[0.047]	[0.044]	[0.104]	[0.299]	[0.206]	[0.199]	[0.255]
Ratio of age 55–59 in 2003 × 2005	−0.083	−0.014	−0.005	−0.555***	0.817**	0.919***	−0.094	0.372
	[0.070]	[0.071]	[0.082]	[0.177]	[0.338]	[0.286]	[0.226]	[0.319]
Ratio of age 55–59 in 2003 × 2006	−0.189**	−0.091	−0.062	−0.912***	1.180***	1.259***	−0.26	0.751**
	[0.083]	[0.084]	[0.102]	[0.239]	[0.420]	[0.329]	[0.249]	[0.367]
Ratio of age 55–59 in 2003 × 2007	−0.166	0.114	0.149	−1.642***	0.953	2.173***	−0.860*	0.459
	[0.161]	[0.236]	[0.209]	[0.481]	[0.695]	[0.622]	[0.485]	[0.513]
Ratio of age 55–59 in 2003 × 2008	−0.347***	−0.193	−0.059	−1.883***	0.743	1.515***	−0.487	0.597
	[0.102]	[0.125]	[0.137]	[0.449]	[0.693]	[0.463]	[0.304]	[0.624]
Observations	6745	6745	6745	6745	6745	6745	6745	6745
R-squared	0.03	0.019	0.024	0.091	0.266	0.064	0.046	0.09
Number of establishments	1024	1024	1024	1024	1024	1024	1024	1024

Table 2.4 Estimates of β_τ for different Y_{ijt} (log results). Source: [14]

If we look at coloumn (6), we observe that almost every estimate is statistically significant at the 1% level, meaning that with the EESL companies started to hire also more young workers. The negative values in coloumn (4) and the positive values in coloumn (5) are simply a consequence of ageing: they refer to people who in that period passed from their fifties to their sixties. Repeating this model with 2007 as the base year until 2011 does not change the results.

This and the previous studies show that the so-called "lump of labour theory", i.e. the idea that there is a fixed amount of work in a Country, does not hold[22]. Another piece of evidence comes from the study made by Boldrin *et al.* (1999) when analyzing the degree of correlation between the exit rates from the labour force of the 1931-1940 cohort and the variation in unemployment rates from 1991 to 1996 of the young born in 1965-1975. Collecting data from 260 European regions where early retirement policies had been particularly frequent over different periods, they found that for both men and women the correlation is not statistically significant even after controlling for cohort effects, that is differences in the characteristics of the two cohorts such as propensity to save, or the employment of different lags.

The Belgian youth labour market

The method adopted by Boldrin and his coauthors has been revisited by Jousten *et al.* (2010) who focused on youth unemployment in Belgium in the private sector, considerebly high among unskilled people for both young men and women. Assuming a zero-sum game in the labour market, they ran two OLS regressions based on data from the European Labour Force Survey over the time interval 1983-2004: the first one puts directly in relationship the employment of the young and the elderly participation rate; the second

[21] There is some degree of autocorrelation in the residuals due to the nature of the equation. Despite this, the results are still consistent.

[22] The lump of labour could work in a "boxed economy", which is unrealistic.

one considers the incentives of retiring and how they influence the youth employment rate. The first equation is defined as such

$$A_t = \theta + \beta B_t + \delta X_t + \varepsilon_t \tag{2.22}$$

where θ is the intercept, A_t can be either the unemployment rate or the employment rate for youth 0 to 24[23] or prime age workers 25 to 54, B_t is the labour force participation rate of the old, and X_t is a matrix of covariates referring to GDP. Further variations on (2.22) are then studied, substituting the levels with three-year lags, five-year lags, and five-year lags on the logarithms.

	Youth 20 to 24			Prime age 25 to 54	
Specification	UR	ER	SCH	UR	ER
		No controls			
Levels	0.539**	0.067	0.081	0.056	0.094
	(0.217)	(0.219)	(0.278)	(0.124)	(0.262)
3-year lag	0.328	0.589**	–0.627*	0.337**	–0.589**
	(0.278)	(0.235)	(0.297)	(0.116)	(0.248)
5-year difference	0.591	0.292	–0.092	0.116	–0.089
	(0.357)	(0.208)	(0.171)	(0.136)	(0.089)
5-year log difference	0.883	0.152	–0.075	0.296	–0.039
	(0.549)	(0.111)	(0.132)	(0.448)	(0.032)
		With controls			
Levels	0.619***	0.185	–0.118	0.151**	–0.116**
	(0.180)	(0.157)	(0.129)	(0.068)	(0.054)
3-year lag	0.534**	0.372*	–0.259	0.273***	–0.262***
	(0.221)	(0.211)	(0.173)	(0.076)	(0.048)
5-year difference	0.683***	0.351**	–0.099	0.198***	–0.166**
	(0.139)	(0.125)	(0.153)	(0.038)	(0.056)
5-year log difference	0.093	0.408***	–0.330*	0.092	0.408***
	(0.294)	(0.108)	(0.169)	(0.294)	(0.107)

Table 2.5 Effects of elderly labour outcomes on the young. Source: [17]

Looking at the results for the young and controlling for other effects, an increase in B_t causes a statistically significant increase in both the employment and unemployment rate[24], while the effects on the five-year difference between log-unemployment rates are close to zero. The authors suggest to concentrate just on the employment rate to quantify the degree of activity of young workers, as unemployment in Belgium depends more on elements such as mismatching, high reservation wages, and lack of professional training, so the creation of new jobs would not be much effective. The second equation is

$$C_t = \vartheta + \gamma \overline{W} + \upsilon_t \tag{2.23}$$

where $\overline{W}$ is the weighted sum of the cohort-specific social security wealths W and is used as variable to explain the drop in the participation rate of the old. The different expanations of C_t are reported in table 2.6, which confirms the results of equation (2.22): albeit statistically significant, the unemployment rate is not a

[23] In that case the dependent variable considered could also be the percent of young people still in education.
[24] The unemployment rate is not equal 1-employment rate, but the to the ratio between the unemployed and the labour force. The employment rate is the ratio between the unemployed part of the total labour force and the population.

good measurement for youth working activity for what has just been said, while the coefficient for the employment rate is not statistically different.

Using $\overline{W}$ as an explanatory variable	In level			In 5-years difference		
	Coefficient	Standard error	R^2	Coefficient	Standard error	R^2
LFP of old	–0.820***	0.101	0.823	–0.806***	0.132	0.819
Unemployment of young	–0.487**	0.226	0.493	–0.799***	0.078	0.978
Employment of young	–0.148	0.183	0.547	–0.125	0.169	0.688
School of young	–0.069	0.135	0.849	–0.237*	0.108	0.735
Unemployment of prime age	–0.059	0.084	0.720	–0.179***	0.051	0.929
Employment of prime age	0.040	0.061	0.963	0.081	0.066	0.698

Table 2.6 Coefficients are expressed in thousands of people. Source: [17]

To sum up, while the youth employment rate seems to be affected by the retirement decisions of the elderly, the unemployment rate would not be sensitive to the creation of new jobs, thus rejecting the lump of labour theory.

Early retirement in Norway and female unemployment in Portugal

If in the long run and at the aggregate level we do not observe a correlation between youth unemployment rate and old employment rate, in the short run and at the micro level the results seem to be different. Vestad (2013) shows that generous early retirement policies do infact in the short term stimulate the youth labour market, by taking as example the Norwegian early retirement scheme introduced in 1989 and its effects from 1994 to 2004 on the level of occupation among the young, although the magnitude of these effects was not the same between employment and unemployment.

We define the potential entrants as those who are under 30 years old and do not belong to the active labour force at time t, whereas if they become employed at time t+1 in any labour market region (LMR), they are classified as entrant at time t+1. To see the effects of early retirement on the youth employment rate, we run the following OLS regression

$$P_{ijt}^0 = \alpha^0 + F_j^0 + \lambda_t^0 + X_{it}'\beta^0 + \delta_{OLS} fracpens_{jt} + \varepsilon_{ijt}^0 \qquad (2.24)$$

where P_{ijt}^0 is a dummy denoting the participation in the active labour force at time t+1 for potential entrants at time t, F_j^0 unobserved effects in the j-th LMR that are constant over time, λ_t^0 time-dependent fixed effects, X_{it}' a row vector of time-dependent LMR level characteristic like: fraction of male workers, fraction of low education, fraction of high education, dummies for age, and so on. $fracpens_{jt}$ is the percentage of workers who at time t will receive early retirement benefits at time t+1. It is safe to assume though that in (2.24) there

are omitted variables such that their covariance with both $fracpens_{jt}$ and ε^0_{ijt} is different from zero: sudden changes in the economy will inevitabily have some consequences on the <u>total</u> level of employment, thus making δ_{OLS} a biased estimator. To avoid that, we consider a two stage least squares estimation

$$fracpens_{jt} = \alpha^1 + F_j^1 + \lambda_t^1 + X_{it}'\beta^1 + \gamma fracERage_{jt} + \varepsilon_{ijt}^1$$

$$P_{ijt} = \alpha + F_j + \lambda_t + X_{it}'\beta + \delta_{TSLS}\widehat{fracpens}_{jt} + \varepsilon_{ijt} \tag{2.25}$$

where $fracERage_{jt}$ is the percentage of workers that at time t+1 will be eligibile for early retirement and it is used as an instrumental variable for $fracpens_{jt}$, whose fitted value are going to be used in the second stage of the regression. The author directly addresses the validity of $fracERage_{jt}$ as an IV, for example by considering a transfer of young potential entrants from declining LMRs to more favourable ones which will have consequences on the percentage of workers eligible for early retirement in that region. Declining LMRs are also less appealing to potential entrants, thus lowering P_{ijt}. Controlling for different demographic factors that could influence both the instrument and P_{ijt} like the fraction of immigrants and guest workers in various LMRs, the overall results are almost the same. Other aspects might be the drop in unemployment rates for the entire Norwegian economy from 1994 to 2004 which coincided with a loosening of the eligibility requirements for early retirement in 1997 and 1998. Concerning the first one, other variables such as F_j, λ_t, and X_{it}' already account for this phenomenon, making δ_{TSLS} unbiased and robust, where for the second one the coefficients of different regressions using data only from specific periods, i.e. just before 1997, just after 1998, and in those years, do not present significant differences.

	All		**Men**		**Women**	
	OLS	IV	OLS	IV	OLS	IV
First stage						
fracERage		0.271***		0.270***		0.273***
		(0.024)		(0.024)		(0.024)
F-statistic		126.0		123.6		127.9
Second stage						
fracpens	0.379	2.990**	0.306	3.551**	0.506	2.820**
	(0.256)	(1.162)	(0.421)	(1.464)	(0.314)	(1.259)
N	5,393,241		2,407,898		2,985,343	
R^2	0.033		0.024		0.026	

Table 2.7 Coefficients for equations (2.24) and (2.25). Source: [22]

Looking at the results in the table for the second stage, we immediately notice the negative omitted variable bias in (2.23): the TSLS coefficients are statistically significant at the 5% level while we do not have enough informations to reject the null hypothesis for the OLS. We can conclude that an increase in the number of retirees leads to an increase in the probability of employment for both men and women, at least in the short

run. We now focus on the effets on the unemployment rate by repeating the TSLS regression, this time using either a dummy for potential entrants at time t that resulted unemployed at time t+1 or the months of registered unemployment.

	All		Men		Women	
	OLS	IV	OLS	IV	OLS	IV
P(unemployment year $t+1$)						
fracpens	0.750	-4.525**	0.415	-6.079***	1.066	-3.244*
	(0.769)	(1.945)	(0.972)	(2.498)	(0.763)	(1.843)
R^2	0.026		0.029		0.017	
Months of unemployment year $t+1$						
fracpens	1.393	-22.86***	-0.101	-28.40**	2.695*	-18.46**
	(1.183)	(8.809)	(1.930)	(11.52)	(1.460)	(7.470)
R^2	0.025		0.027		0.018	
N	5,393,241		2,407,898		2,985,343	

Table 2.8 Coefficients for equations (2.24) and (2.25) with unemployment as the dependent variable. Source: [22]

As expected, the relationship is negative and statistically significant, however if we control for the demographic composition of LMRs, the coefficients become smaller and not statistically significant anymore.

The idea that the lump of labour theory holds in a weak form, at least in the short term and not in the aggregate, is further confirmed by the analysis of Martins *et al*. (2009) in relationship with the effects of a law in 1993 that increased the retirement age of women, leaving eligibility requirements for men unchanged. They first checked whether the law had a substantial effect on the female labour force by running a logit regression addressed to the ideal target, i.e. women in their mid sixties over the period 1992-2000. The odds ratio associated with this regression showed that it was 31,3% more likely for an older woman to get a job[25]. After doing that, starting from the equation

$$Y_t^Q = \alpha + \beta ATT_t^Q + \varepsilon_t \tag{2.26}$$

where Y_t^Q is a dummy whose value is equal to 1 if refers to female hirings and 0 otherwise, ATT_t^Q is the worker flow at time t=1995/1995-97/1995-99, and Q is a superscript identifying age, they ran a probit regression controlling for the firms directly affected by the reform, using 1992 as the base year.

[25] In a probit or logit regression the coefficients have to be interpreted as the variation in the probability of Y happening given a unitarian variation of X.

	Year	*ATT*	*t(ATT)*	*Treated*	*Control*	
Younger men						
	1995	-0.12	-1.83	21.1	5870	59051
	1995-97	-0.09	-1.33	21.8	4937	48172
	1995-99	-0.29	-2.83	22.0	4409	43025
Younger women						
	1995	-0.24	-2.88	21.1	5870	59051
	1995-97	-0.26	-2.76	21.8	4937	48172
	1995-99	-0.45	-3.23	22.0	4409	43025
Older men						
	1995	0.00	0.00	21.1	5870	59051
	1995-97	-0.12	-1.48	21.8	4937	48172
	1995-99	-0.17	-1.16	22.0	4409	43025
Older women						
	1995	-0.16	-1.99	21.1	5870	59051
	1995-97	-0.21	-1.62	21.8	4937	48172
	1995-99	-0.36	-2.88	22.0	4409	43025

Table 2.9 Effects on hires for different demographic categories. Source: [23]

The results show that if on the one hand the effect upon hirings on men younger than 25 was just -0,29 with a t-ratio of -2.83, on the other hand the same effect upon women younger than 25 was -0,45 with a t-ratio of -3,23, implying a stronger level of statistical significance.

CHAPTER 3. A MORE IN-DEPTH VIEW ON QUOTA 100 AND THE ITALIAN LABOUR MARKET

According to the Ministers Di Maio and Salvini in 2018 and in the first half of 2019, *Quota 100* was supposed to help the young in finding a job with the retirement of hundrends of thousands of older workers. At first it was said that there would have been a 1:3 ratio, meaning that for each retiree 3 young people would have been employed, to later change this statement into a 1:2 ratio. Moreover, it was said by the Minister Salvini that in the public administration a 1:1 ratio had been achieved.

There is however a huge discrepancy between what was promised and what actually happened. In the first ten months of 2019, 132.000 people decided to retire via *Quota 100*, two thirds of the number announced by the former Ministry of the Interior[26]. On top of that, it was registered in the same period a drop in employment of 10% among those with less than 30 years, who are the target of the reform. Sticking to the public sector, it seems that especially in the North *Quota 100* has caused a lack of employees as there have been no new public examinations to replace those who retired. Instead, older rankings were used, implying that almost no recently graduated person has been hired. Finally, the Parliamentary Budget Office (P.B.O.) has estimated that in 2020 those who will be able to benefit from this option will be 246.000 people, 19% less than the original prediction. This difference is likely explained by the significant reduction in gross pension that those eligible for *Quota 100* might face compared to the existing system: from 5% if retiring one year earlier to 30% if retiring 4 years earlier.

Lastly, although the 2019 Draft Budgetary Plan was approved by the European Commission, policies such as the *Reddito di Cittadinanza* and *Quota 100* were financed via deficit, a questionable decision considering the Italian 130+% debt to GDP ratio and a GDP growth rate close to zero.

Costs and Sustainability

According to the P.B.O. 2019 report, early retirement was originally going to cost about:

- 4 billion euros in 2019
- 8,3 billion euros in 2020
- 8,7 billion euros in 2021
- 8,2 billion euros in 2022
- 7 billion euros in 2023

[26] Furthermore, the people in the public administration who retired were 36.000 versus the 58.000 claimed.

These costs had to be added to those for the *Pensione di Cittadinanza*, a form of social security aimed at helping older people that live in poverty conditions who are according to Eurostat in 2016 around 22% of the total over 65 populations, well above the 18,2% European average.

In the Senate deposition of the former INPS president of 4th February 2019, Boeri highlighted how future generations will have to bear the burden of these policies. The amount of these costs depends on whether *Quota 100* and the actuarial adjustment will be confirmed or not after 2021 and 2026 respectively: assuming a discount rate of 4%, in the first case there is going to be an increase in the implied debt of 92,5 billion euros, while in the second case the implied debt will grow "only" by 37,6 billion euros[27].

However, newer estimations suggest that the expediture for *Quota 100* will be lower than what was initially stated: with the 2020 Budget Law it seems that there is going to be a cut of 5 billion euros, due to the scarce number of workers who opted for retiring earlier. In spite of that, the total pension expenditure is actually going to rise, passing from 231,3 to 233,1 billion euros.

There might be the possibility of a "discontinuity effect" near the end of 2021, i.e. a sort of run on the bank's deposits to benefit from the option. This could be the case for two reasons: first there is the issue of those who will be 62 years old in 2022 with 38 years of pension contributions who are going to face a 5 year *scalone*, and second if the law that allows people who have met the eligibility requirements in 2019-2021 for *Quota 100* to claim the pension after 2021 (so that the loss in value is reduced) will be changed. All this uncertainty may lead to higher costs.

The model

The focus of this paragraph is to see if *Quota 100* may be sustainable in the medium-long run considering all these costs and the uncertainty level. In his recent report on the Italian social state, Pizzuti (2019) considers three different levels of participation which are then confronted with the trend scenario (T): 85% (P1) which is the original government expectation, 70% (P2), and 50% (P3). Under some assumptions on future life expectancy, employment rates, birth rate, and productivity[28], the pension expenditure to GDP ratio is expected to rise, on average, by 0,34 GDP percentage points in 2020 to then drop significantly below the trend scenario in 2024-2025 due to the effects of the whole Budget Law on the denominator, however if the growth-oriented policies will not be effective, pension expenditure is going to increase up to some point more than 15,7% of the GDP in 2030. One further aspect that contributes to a lower expenditure level is the reduction of pension benefits relative to wages and labour productivity "dovuta alla riduzione dei periodi di contribuzione implicita all'anticipo del periodo di pensionamento"[27], offset by an increase in pension

[27] 5,1% and 2,1% of the 2019 nominal Italian GDP level.

[28] Realtive to their 2019 values, in 2050 people will live on average 3 years longer, employment will rise by 6 percentage points, the birth rate will be almost the same, and the growth rate of productivity will rise by1,5 percentage points. The unemployment rate is expected to rise in the short run to later drop at 6,2% (10% in 2019).

income[29].

The model employed was developed by Beqiraj and Tancioni in 2014, hence the name BeTa. It is a dynamic-stochastic model which, in this specific case, assumes an open economy with a centralized monetary policy and focus on fiscal policy and sovereign risk[30]. The domestic country is Italy while the foreign country is the rest of the Eurozone. The equations of the model are obtained by constrained optimization of rational agents such as households, producers of intermediate goods, wholesalers and retailers, and Central Banks, while the parametrization is based both on a Bayesian approach, i.e. by the maximization of the posterior expectation[31] of a utility function, and the usage of dogmatic priors (i.e. a prior that assigns a prior probability[32] of 0 to some parameters) for those parameters that do not satisfy the identification conditions. We report only the equations that describe the agents' behaviour.

Households

We distinguish two types of households: Ricardian and non-Ricardian[33]. The former maximise their intertemporal utility under a budget constraint and are assumed to be homogeneous with respect to consumption and asset holding, the latter consume their entire net income at each period t. The representatative Ricardian household maximises the following utility function, positive in consumption and negative in work:

$$\max_{C_t^r, B_t^r, B_t^{*r}, K_t^{p,r}, I_t^r, u_t^k} E_0 \sum_{t=0}^{\infty} \beta^t \left[\xi_t^c \frac{\left(C_t^r - h\tilde{C}_{t-1}\right)^{1-\sigma_c}}{1-\sigma_c} - \chi_t \int_0^1 n_t(i)\ di \right] \tag{3.1}$$

where C_t^r represents a composite consumption index, $h\tilde{C}_{t-1}$ external habits[34], σ_c is a parameter that identifies the consumption curvature and $n_t(i)\ \epsilon\ [0,1]$ the fraction of the employed household members. ξ_t^c is a preference shock that follows the i.i.d process $\xi_t^c = exp\{\varepsilon_{\xi^c,t}\}$ and χ_t is the stochastic scaling factor of labour disutility which follows the i.i.d. process $\chi_t = \chi\mu^{(1-\sigma_c)t}\xi_t^n$, where μ represents the trend growth of labor-augmenting productivity in the long-period and $\xi_t^n = exp\{\varepsilon_{\xi^n,t}\}$. The budget constraint is given by the purchase of consuption and investment goods cosidering after tax labour and capital incomes, after tax unemployment benefits, dividends and government transfers.

In formulae

[29] Assuming a growth in productivity and GDP.

[30] This version is also known as BeTa MK VI.

[31] In Bayesian statistics, the posterior probability is the probability of the parameters given the data, the exact opposite of the likelihood function.

[32] A prior is the probability that expresses someone's beliefs, for example on a parameter, before any data is collected.

[33] A Ricardian household internalizes in its budget constraint that an increase in public expenditure implies an increase in taxation, meaning that the present values of the two have to be equal.

[34] If a consumer presents external habits it means their utility depends also on the cumulated average of past consumptions in the whole economy.

$$(1+\tau_t^c)C_t^r + I_t^r + \frac{B_t^r}{P_t R_t^e} + \frac{e_t B_t^{*r}}{P_t R_t^{e*}\Phi\left(\frac{A_t}{Y_t}, \frac{e_t}{e_{t-1}}, R_t^{e*} - R_t^e, \tilde{\varphi}_t\right)}$$
$$= TR_t^r + \frac{B_{t-1}^r}{P_t} + \frac{e_t B_{t-1}^{*r}}{P_t} \tag{3.2}$$
$$+ (1-\tau_t^n)\int_0^1 \left[\frac{w_t(i)}{P_t} n_t(i) + b_t^u(1-n_t(i))\right] di + \left\{(1-\tau_t^k)\left[\frac{R_t^k}{P_t} u_t^k - a(u_t^k)\right] + \delta\tau_t^k\right\} K_{t-1}^{p,r} + \frac{\Pi_t^p \mu^t}{P_t}$$

where I_t^r denotes private investment, P_t is the average of the prices of domestic and imported goods weighted for the import share parameter and the elasticity of substitution between imported and exported goods, $A_t = \frac{e_t B_{t+1}^*}{P_t}$ the aggregate net foreign asset position of the domestic economy, $\tilde{\varphi}_t$ a time-varying shock to the risk premium following an AR(1) process, e_t the nominal effective exchange rate[35], B_t^{*r} and B_t^r the foreign and the domestic bond holdings respectively, P_t the consumption price index, $R_t^e = R_t q_{b,t}$ and $R_t = R_t^* q_{b,t}^*$ the domestic and foreign interest rates on government bonds (R_t and R_t^* identify the policy rates set by the Central Banks, $q_{b,t}$ and $q_{b,t}^*$ the spreads on said bonds. The former follows an AR(1) process), $\frac{R_t^k}{P_t}$ the real return on capital $K_t^{p,r}$ and u_t^k its utilization rate with an adjustment cost identified by a strictly increasing and convex function $a(u_t^k)$, δ the private capital depreciation rate, $\frac{w_t(i)}{P_t}$ and $\frac{\Pi_t^p \mu^t}{P_t}$ real wage and real dividends respectively, TR_t^r government transfers, b_t^u unemployment benefits, τ_t^c, τ_t^n, and τ_t^k the tax rates on consumption, labour income, and capital respectively. Φ_t is the risk premium on foreign bonds in the modified version of the UIP equation, that is $E_t\left[\frac{e_{t+1}}{e_t}\right] = \frac{R_t^e}{\Phi_t R_t^{e*}}$; $K_t^{p,r}$ is equal to

$$K_t^{p,r} = (1-\delta)K_{t-1}^{p,r} + q_{i,t}\left[1 - S\left(\frac{I_t^r}{I_{t-1}^r}\right)\right] I_t^r \tag{3.3}$$

where $S\left(\frac{I_t^r}{I_{t-1}^r}\right)$ is a cost function that represents the private investment adjustment and the investment specific shock $q_{i,t}$ follows the i.i.d. process $q_{i,t} = exp\{\varepsilon_{q_{i,t}}\}$. The first order condition with respect to consumption at time t yields the Euler equation

$$C_t^r - hC_{t-1}^r = \left[\beta R_t^e \frac{P_t}{P_{t+1}} \frac{(1+\tau_t^c)}{(1+\tau_{t+1}^c)} \frac{\xi_{t+1}^c}{\xi_t^c}\right]^{-\frac{1}{\sigma_c}} \left(C_{t+1}^r - hC_t^r\right) \tag{3.4}$$

The intermediate goods sector

Production is associated with a Cobb-Douglas function with labour, private capital, and public investments as inputs. Public investments are not completely exogenous but follow a maximisation process of the difference between production and private capital, i.e. by maximising expenditure efficiency. In other

[35] The NEER is an "unadjusted weighted average rate at which one country's currency exchanges for a basket of multiple foreign currencies" [40]. Since in the model both the domestic and foreign country adopt the euro, the exchange rate will be the ratio between foreign and domestic prices.

words, assuming perfect competition, for each firm i the optimal choice of capital $K_t(i)$ is

$$\max_{K_t(i)} P_t^i(i)Y_t(i) - R_t^k(i)K_t(i) \qquad \text{s.t.}$$
$$Y_t^i(i) = \xi_t^a \left[\frac{K_{t-1}^g}{\int_0^1 Y_t^i(j)\,dj}\right]^{\frac{\xi}{1-\xi}} [K_t(i)]^{\alpha}[\mu^t n_t(i)]^{1-\alpha} \tag{3.5}$$

where K_{t-1}^g denotes the public capital with output elasticity ξ, α the output elasticity of private capital, $P_t^i(i)$ the intermediate sector price index, and the AR (1) process $\xi_t^a = \xi_{t-1}^{a^\rho} e^{\varepsilon_{\xi^a,t}}$ the dynamic of total factor productivity. Differentiating with respect to private capital gives

$$R_t^k(i) = \alpha P_t^i(i)\frac{Y_t(i)}{K_t(i)} \tag{3.6}$$

When deciding the optimal level of wages $w_t^*(i)$ firing is assumed to be exogenous, hence the firm is not able to choose an optimal firing strategy distinguishing between incumbents and newly hired workers. Instead, it simply maximises the surplus of the worker with respect to wage, that is the difference between being employed with salary $w_t(i)$ and being unemployed, accounting for the influence of trade unions and the aggregate job value to the firm at wage $w_t(i)$[36]. Assuming no wage and hiring subsidies, the real wage is equal to the marginal product of labour as seen in basic models, however with the introduction of the former we need to consider also the present and future wage subsidies for the newly hired, while the introduction of the latter actually reduces real wages due to "the anticipation of the loss opportunity of a future reduction in the hiring cost"[28].

Wholesalers and retailers

In this context, firms producers of the final goods are assumed to be in a monopolistic competition framework, meaning that the products and services offered are somewhat similar but not perfect substitutes, allowing companies to apply a time-varying markup to the final product identified by the i.i.d stochastic process $\lambda_{p,t} = exp\{\varepsilon_{p,t}\}$. Precisely, considering an open economy, the domestic intermediate homogeneous good Y_t^i is bought by domestic wholesalers at price P_t^i, then by using a linear technology the good is transformed into the domestic final product $Y_t^d(i)$, which is sold to domestic retailers to produce the composite final good Y_t^d. The same thing happens in the import (export) sector, where wholesalers buy at price P_t^* (P_t^d) the foreign (domestic) intermediate homogeneous good Y_t^* (Y_t^x) which is later transformed in the final good $Y_t^m(i)$ ($Y_t^x(i)$) and then sold to import (export) retailer to produce the composite final good Y_t^m (Y_t^x). The

[36] The aggregate job value is the weighted average of the job value of the incumbent and newly hired workers.

following assumption on the aggregator G is made

$$\int_0^1 G\left(\frac{Y_t^k(i)}{Y_t^k}; \lambda_{p,t}^k\right) di = 1 \tag{3.7}$$

where k is an index for the three sectors d, m, and x to have a variable demand elasticity in each sector. If wholesalers reoptimize prices, then they will choose a level $\tilde{P}_k^t(i)$ such that the conditional expected value at time t of the discounted stochastic profits will be maximised, that is

$$\max_{\tilde{P}_k^t(i)} E_t \sum_{j=0}^{\infty} \left(\beta \xi_p^k\right)^j \frac{\Lambda_{t+j} P_t}{\Lambda_t P_{t+j}} \left[\tilde{P}_t^k(i) - MC_{t+j}^k\right] Y_{t+j}^k(i) \qquad s.t.$$

$$Y_t^k(i) = Y_t^k G'^{-1}\left[\frac{P_t^k(i)}{P_t^k} \varkappa_{p,t}^k\right] \tag{3.8}$$

$$\varkappa_{p,t}^k \equiv \int_0^1 G'\left(\frac{Y_t^k(i)}{Y_t^k}; \lambda_{p,t}^k\right) \frac{Y_t^k(i)}{Y_t^k} di$$

where the first equation in the constraint refers to the demand of domestic retailers for the heterogeneous goods, MC are the marginal costs of the k-th sector equal to P_t^i, $e_t P_t^*$, and $\frac{P_t^d}{e_t}$ for k=d, m, x, respectively, and $\left(\beta \xi_p^k\right)^j \frac{\Lambda_{t+j} P_t}{\Lambda_t P_{t+j}}$ is the discounted stochastic factor. ξ_p^k is the probability of the i-th firm adjusting its price in any one period.

Central Banks and Fiscal Authorities

The Central Bank follows a Taylor rule in setting the nominal interest rate according to the difference between the level of inflation in the Eurozone and its target value which is below, yet close, to 2%. To compute the level of inflation, we simply consider a weighted average of the domestic inflations where the weights account for the relative influence of each domestic economy in the currency area. As of January 2020, the value is around 1,4% according to Eurostat.

The fiscal authority takes public expenditure and tax rates as partially endogenous, with the exception of public investments that are chosen optimally. It is in charge of the government financial need which is founded in two ways: a fraction through taxation on consumption, labour income, capital, and profits; the remaining part by issuing new public debt.

Final considerations

In equilibrium, market clearing requires that the following equations for the net foreign assets evolution and aggregate resources are satisfied:

$$\frac{e_t B^*_{t+1}}{\Phi_t R^*_t q^{b*}_t} = e_t P^x_t \left(C^x_t + I^x_t\right) - e_t P^*_t \left(C^m_t + I^m_t\right) + e_t B^*_t$$

$$C^d_t + C^x_t + I^d_t + I^x_t + G_t + I^g_t \leq Y_t - a\left(u^k_t\right) K^p_{t-1} - \kappa_t \upsilon_t \tag{3.9}$$

where $\kappa_t v_t$ is a time-varying shock affecting GDP.

The variables expressed in real terms are scaled with respect to the trending technology process and the resulting equations are then log-linearized around the non-stochastic steady state.

In short, though it seems that *Quota 100* might actually be sustainable in the medium-long term, these results present an extremely high level of uncertainty linked to several factors (behavioural, legal, macroeconomic) which should be considered as further cost. Nevertheless, the trend scenario is not sustainable as it is right now: according to the IMF forecasts, Italy's real GDP growth rate will be lower than 1% while Pizzuti suggests that it should well higher than that number to sustain future pension expenditures. It was proposed by the INPS to focus on the *APE* mentioned in chapter 1, which essentially presents more flexible requirements for the exit windows than those introduced by the Monti Fornero reform, but the data show "la difficoltà di implementazione delle misure e la stringenza dei requisiti posti in essere"[29].

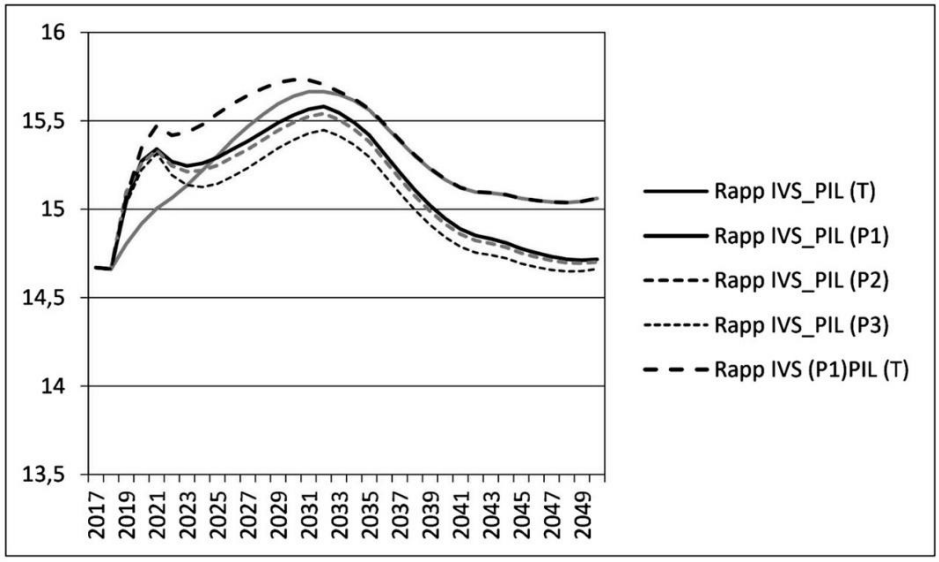

Figure 3.1

Source: [27]. Pension expenditure will be, on average, higher than the trend scenario only if there is no growth in GDP.

Impact on macroeconomic variables

The high unreliability on the level of participation makes forecasts too volatile. In order to have a more accurate perspective of the effects on different variables, in his simulations Pizzuti considers three different

levels of usage of the available resources: 100%, 75%, and 50%. Albeit by a small degree, the variables positively affected are GDP, consumptions, and investments; net exports seem to suffer severe losses.

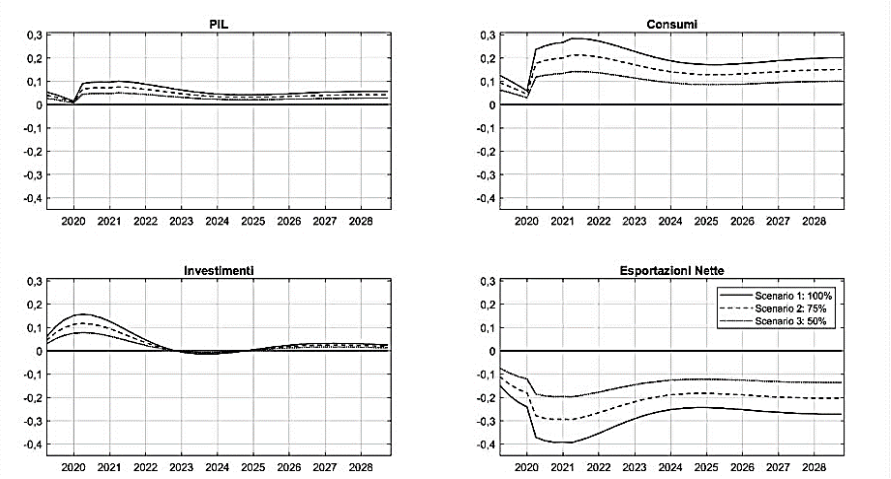

Figure 3.2 Source: [27]. Values are relative to their trend counterpart.

The main drivers should be identified in consistent higher private consumptions, which are expected to rise thanks to the income of the newly employed, and in a higher inflation, which lowers the real interest rate thus facilitating investments. On the other hand, it is exactly the rise in consumptions that lowers the net exports by a large margin. Relative to the trend, in the best scenario GDP will grow by 0,1% to later settle arond 0,06% while investments are presumed to experience an initial growth of 0,15% only for two years, after which the growth rate will revert back close to 0%.

We mentioned that to finance *Quota 100* and other policies Italy will rise new debt, in the hope to stimulate GDP through consumptions and investments to have overall a lower debt to GDP ratio, currently one of the highest in the world. However, as the figure above shows, the positive shocks are too modest to balance the large expenditures, resulting on average in a net increase of 0,1% of the debt to GDP ratio: this is confirmed by the multiplier which is below 0,2, meaning that around 20% of the resources actually stimulate GDP[37]. The reason is that the increase in consumptions is mainly oriented towards basic necessities while the newly retiree will tend to save the incomes from *Quota 100*[38].

Impact on labour market

In the previous chapter we saw that the lump of labour, i.e. the theory where for each retiree person a new job is created, does not hold. This is further proved by Brugiavini and Peracchi (2010), who found that in Italy the relationship is actually procyclical: a "higher labour force participation of the old is associated with

[37] This result comes from the ratio between the variation of GDP due to *Quota 100* and the resources employed.
[38] Many models show that in case of uncertainty regarding sources of income, people tend to increase savings because they are not sure those sources will be still available in the long run.

a lower unemployed rate of the young […] because both are driven by the business cycle" [13]. This proof of evidence however does not take into account the more recent events in the Italian (and European) framework.

The effects of the 2008/2011 crises and an unexpected pension reform

Researches on more recent datasets have brought some interesting results: empirical studies that employ data up to 2016 show that in our Country some slight form of the lump of labour theory seem to hold. Using data from the Italian Labour Force Survey (LFS) from 2004 to 2015 and Eurostat, Bertoni and Brunello (2017) show that if the pool of people (PT) older than 50 but younger than minimum retirement age (senior workers) increases by one thousand additional, then it is expected an increase of the number of employees among the old and a decrease in the number of employees among the young. This result is not consistent across time: during growth phases of the economical cycle this ratio is much lower, and it relies on the not-so-mild assumption that the effects of the national policies on the local labour markets are inconsequential, conditioning for local changes in the pool. They start with the following equation

$$N_{pt}^{Q} = \alpha + \theta PT_{pt} + \gamma_T + \gamma_P + \delta X_{pt-\tau}^{Q} + \varepsilon_{pt} \tag{3.10}$$

where N measures unemployment and inactivity in thousands of individuals for province p at time t, γ_T is a vector of time dummies and γ_P a vector of province dummies, PT_{pt} too is in thousands, $X_{pt-\tau}$ is a set of demographic and economic lagged[39] (to attenuate endogeneity) controls for the various provinces in different years, and Q refers to the age group. To avoid endogeneity, we take the value of PT in 1991 as an IV, however in order to not have serial correlation between the instrument and ε, we study a dynamic version of (3.10). GMM are employed to address the potential bias linked to the presence of the new lagged component.
In formulae

$$\begin{aligned} PT_{pt} &= \alpha_1 + \vartheta PT_{p1991} + \upsilon_{pt} \\ N_{pt}^{Q} &= \alpha + \beta N_{pt-1}^{Q} + \theta \widehat{PT}_{pt} + \gamma_T + \gamma_P + \delta X_{pt-\tau}^{Q} + \nu_{pt} \end{aligned} \tag{3.11}$$

Table 3.1 presents the results of different regressions using both OLS and TSLS, safe for the last row that adopts GMM estimates: row (1) does not control for any demographic or economic variable, in rows (2) and (3) the controls are lagged once and twice respectively, and in row (4) the vector X contains province dummies

[39] Controlling for lagged GDP allows to test if pension reforms affect youth unemployment regardless of the present level of output.

interacting with lagged aggregate GDP. Row (5) uses GMM estimators on the second equation of (3.11).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age group	16-24	16-24	25-34	25-34	35-49	35-49	50-70	50-70
Estimation method	OLS	IV	OLS	IV	OLS	IV	OLS	IV
(1) Without X	0.084***	0.087***	0.047***	0.047***	0.081***	0.083***	-0.040	-0.064
	(0.021)	(0.019)	(0.009)	(0.007)	(0.010)	(0.011)	(0.070)	(0.067)
(2) With lagged X	0.055***	0.053***	0.060***	0.062***	0.076***	0.080***	-0.042	-0.051
	(0.010)	(0.010)	(0.017)	(0.014)	(0.013)	(0.014)	(0.043)	(0.043)
(3) With X lagged twice	0.054***	0.053***	0.055***	0.054***	0.070***	0.077***	-0.027	-0.046
	(0.016)	(0.014)	(0.021)	(0.015)	(0.010)	(0.011)	(0.051)	(0.05)
(4) With lagged X and province dummies * lagged GDP interactions	0.035***	0.030***	0.027	0.029	0.076***	0.079***	-0.020	-0.026
	(0.012)	(0.012)	(0.020)	(0.015)	(0.029)	(0.029)	(0.037)	(0.039)
(5) With lagged N and lagged X (Arellano Bond GMM estimates)	-	0.072***	-	0.003	-	0.018	-	0.010
		(0.017)		(0.025)		(0.032)		(0.047)

Table 3.1 Effects on the unemployment (gross of inactivity) from an increase in PT. Computation from the authors show that the IVs are always relevant (F-test > 10). Source: [36]

Similar results have been obtained by Boeri et al. (2016) when they analysed the effects of an unexpected reform, such as the Monti Fornero reform, on the labour market. Suppose a firm has a quasiconcave function to identify the level of output y, for example a Cobb-Douglas function, where the inputs are labour N and capital K. Since capital is not relevant in this analysis, we will consider it as a simple parameter, that is y = f (N) for some K. Workers are divided in three categories according to their age: young (L_1), prime aged (L_2), and older workers (L_3) and the following relationship holds: N=g (L_1, L_2+aL_3), where prime aged and older workers are perfect substitutes but complementary with the young, a<1, there are constant returns to scale, and the partial derivatives g_1 and g_2 are strictly positive. Finally, suppose the composite function φ (L_1, L2) ≡ f (g (L_1, L_2)) is strictly concave. In equilibrium the marginal productivity of each working category must be equal to their wages, that is

$$f'(N)g_1(L_1, L_2) = w_1 \tag{3.12}$$

$$f'(N)g_2(L_1, L_2) = w_2 \tag{3.13}$$

Assume now that, unexpectedly, the government requires the firms to employ at time T and for just one period ΔL older workers and that there is employment protection legislation (EPL), i.e. firing prime aged workers and older workers is costly. If wages are fixed at time T but flexible at time T+1, then the salary of prime age workers in that period is still equal to their marginal productivity, however "as a result, the continuation value of hiring a young worker in period T in period T + 1 is zero"[10]. This means that differentiating (3.12) gives

$$f''(N)g_1\left[g_1\frac{dL_1}{\Delta L}+g_2\right]+f'(N)\left[g_{11}\frac{dL_1}{\Delta L}+g_{12}\right]=0 \tag{3.14}$$

which can be rewritten as

$$\frac{dL_1}{\Delta L}=k[f'(N)g_{12}+f''(N)g_1g_2] \tag{3.15}$$

where k = -1 / (g^2_{11} f "(N) + f'(N) g_{11}) = -1 / φ_{11} > 0 by construction. We focus now on the two terms in square brackets, especially the latter: the first one maps the degree of complementarity between the young and the old and its sign depends on g_{12} which is not specified, while the second one is always negative and represents the effects of *decreasing returns to scale in production*. Since the older workers cannot retire, other things being equal, output will increase, but the marginal product of the young will be affected due to the decreasing returns to scale, thus reducing their hiring. To estimate the empirical effects, they use data from the interval 2011-2014 referring to firms in the private sector with more than 15 employees. Following a cross section on employment differences equation

$$dyoung_i=\alpha+\beta X_i'+\gamma locked\_in\_year_i+\varepsilon_i \tag{3.16}$$

where $dyoung_i$ is the reduction in youth employment for firm i, X_i' is a vector of firm-controls, and $locked\_in\_year_i$ measures the person-year of locked-in workers for the i-th firm in December 2011, simple OLS computations are applied.

VARIABLES	(1) dyoung	(2) dyoung	(3) dyoung	(4) dyoung	(5) dyoung
locked_in_year	-0.119***	-0.124***	-0.137***	-0.134***	-0.134***
	(0.0295)	(0.0389)	(0.0435)	(0.0433)	(0.0432)
totworkers		0.0146***	0.0144***	0.0129***	0.0133***
		(0.00327)	(0.00331)	(0.00332)	(0.00331)
totworkers2		-3.23e-05***	-3.11e-05***	-2.87e-05***	-2.92e-05***
		(8.59e-06)	(8.62e-06)	(8.64e-06)	(8.65e-06)
oldshare			3.262***	3.625***	3.531***
			(0.644)	(0.643)	(0.639)
dwageo				1.54e-05***	1.57e-05***
				(2.11e-06)	(2.12e-06)
dwagey				3.99e-05***	4.03e-05***
				(2.73e-06)	(2.77e-06)
Lblueshare					2.551***
					(0.666)
Lwhiteshare					2.520***
					(0.732)
Lwomshare					0.272***
					(0.103)
Constant	-1.362***	-1.841***	-2.093***	-2.075***	-4.557***
	(0.0724)	(0.0822)	(0.0914)	(0.0916)	(0.639)
Observations	78,540	78,540	78,540	78,540	78,540
R-squared	0.009	0.012	0.013	0.016	0.017

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.2 Different estimations for $dyoung_i$. Source: [10]

Even adding several controls, the OLS estimator for γ is always negative and statistically significant at the 1% level. Define now ϵ_γ as the average elasticity of the variation in youth employment with respect to $locked\_in\_year$, that is

$$\epsilon_\gamma = \hat{\gamma} \frac{\overline{dyoung}}{\overline{locked\_in\_year}} \tag{3.17}$$

where $\overline{dyoung} = -2.06$ and $\overline{locked\_in\_year} = 3.93$. With $\hat{\gamma}$ ranging between -0.12 and -0.13, the average value of ϵ_γ is 0.23, meaning that a young worker lost their job for every five locked-in workers per year. A rolling regression robustness check is performed on the coefficients: the data are divided into smaller groups of at least 100 observations each, then for each cell an OLS regression based on (3.16) is done. Of the 212 total coefficients, the average value for $\hat{\gamma}$ is -0.19. 200 are negative and 130 of them are statistically significant at the 10% level.

Quota 100, employment, and equity

It seems then that *Quota 100* and its incentives on early retirement could be at least an initial solution to the issues brought by the Monti Fornero reform and finally stimulate youth employment. However, although employment is expected to increase by 0,04% with respect to its trend level, this difference is due to higher deficit expenditures, meaning that keeping productivity equal there would be no difference in the level of hiring. Furthermore, the increase in the stock of debt could be a source of potential risk for Italy, specifically Country risk, that may lead to restrictions to the monetary supply. Lastly, using the BeTa model, real wages will have an initial average increase respect to their trend values of 0,06% to then become negative after 2023 by -0,025%.

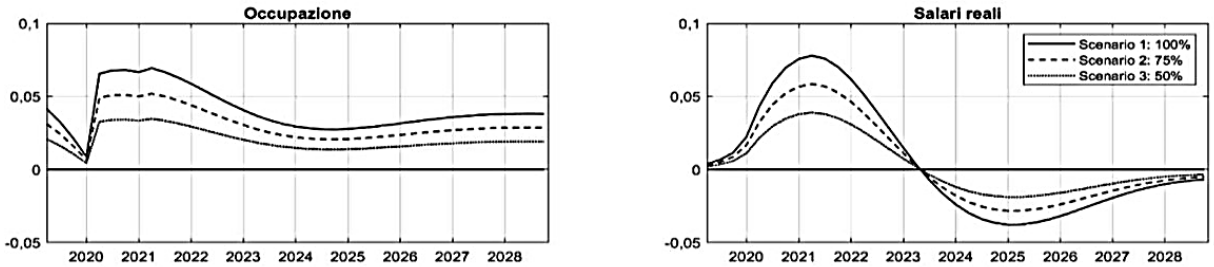

Figure 3.3 Values are relative to their trend counterpart. Source: [27]

On the one hand *Quota 100* might help a great part of the unemployed older than 50, a group that counted 500.800 people in 2016 whose opportunities to get a new job are rather small and who often do not

even receive subsidies[40]. On the other hand according to the simulations made by the P.B.O., the reform is highly selective: first, 70% of those who would benefit are men, mostly from the private sector; second, 42,2% of the newly retirees will be from the North where there is already a higher turnover than the rest of Italy.

CONCLUSIONS

The ageing population trend poses serious problems to PAYG social security systems. Future workers will have to bear the burden of an older and more dependent population which will lead to a less dynamic labour force and an increase in pension expenditure in spite of the growing employment rate for senior workers, caused also by tighter eligibility requirements. We have seen how the former plays a significant role in the increase of the LFP of elderly workers, since in the past many OECD Countries had rather loose conditions that incentived the exit from the labour force under a utilitarian point of view, i.e. working one more year would have made them worse-off. At the aggregate level and in the long run, this does not affect the youth labour market, Significant negative effects are observed for either males or females in the short run, though.

Quota 100 seems to follow the long Italian trend of being unable to lower public expenditures devolved to social security. Despite addressing one of the main issues brought by the recent crises and the unexpected pension reform, i.e. a drop in the youth employing rate, its effects are negligible and do not balance the newly raised public debt, the former being the main source of -modest- growth.

However, not only *Quota 100* may help a relevant amount of people who cannot find a job and are forced to wait to be 67 years old to be eligible for their old-age pension, but more importantly it lays the basis for a much needed structural reform on retirement flexibility which was tightened by the Monti Fornero reform: according to Alberto Brambilla, president of the reseach center *Itinerari Previdenziali*, since from now on people will retire under a full DC system, a lack of flexibility implies that around 65%-70% of young workers might be cut out given the present retributions. Taking this important element into account plus the fact that after 2021 there is the risk of going back to the previous pension system with a 5 years *scalone* for many workers, some proposals have been made, for example maintaining an actuarially fair old-age pension of 67 years of age with least 20 years of contribution payments while substituting *Quota 100*, the *Opzione donna*, the social *APE*, and so on. Flexible retirement should be actuarially fair, set at 64 years of age with at least 38 of contribution payments (*Quota 102*), while early retirement should depend only on the number of years of contribution payments: 42 years and 10 months for men and one year less for women, without the

[40] The only choices are to either wait to be 67 years old for the old-age pensions or to retire early, however the requirements for the latter are very strict.

possibility of building up pension income with work income. As of January 2020, *Quota 102* is one of the alternatives considered for the post-2021 pension scenario, though trade unions such as Cisl and Uil have expressed their opposition to it due to the 20%-30% loss in value caused by a revaluation of contribution payments.

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SUMMARY

The objective of this paper is to analyse the impact of the ageing population trend and early retirement on the welfare and the labour market, in a framework where the OECD Countries keep getting older, by looking at the extensive literature available and by the employment of econometric and macroeconomic models. In the first chapter we will review the several Italian pension systems from 1969 to 2018, the changes in the eligibility requirements and the reasons why each reform was adopted. In the second chapter we will consider the consequences of this aging trend, the effects of early retirement incentives on the general employment rate and the link between old-age employment and youth unemployment rate. The study on early retirement employs the analysis of an implicit tax rate and the Option Value model proposed by Stock and Wise in 1988, while for the latter the examination will be performed by looking at the impact that policy-induced early retirement (or a postponement in the retirement age) had on the young of several national labour markets. Concerning this last aspect, we will see that not only it does not have any negative statistically significant effects on the counterparts, but sometimes a decrease in the labour force participation (LFP) of senior-workers causes a decrease in the level of youth employment, thus spreaking of "the lump of labour fallacy", i.e. the erroneous theory that the maximum number of jobs in an economy is fixed. These results however hold only in the long run and at the aggregate level. In the third chapter we will have an in-depth view of *Quota 100* as a form of early retirement, about its sustainability and the effects on the labour market and the macroeconomical environment. While this reform could be actually sustainable in the long run, the high level of uncertainty contributes to higher costs despite the new lower expenditures under the "Yellow-Red" Government. Moreover, the impacts on GDP are too low to offset the rise in public debt which was needed to finance several policies. Employment is going to slightly increase on average, but the main reason is attributed to the higher deficit and not to the reform per se. Finally, studies adopting more recent datasets suggest that the lump of labour theory seems to hold to some extent in the Italian labour market after the 2008 and 2011 crises, mainly because of the way the Fornero-Monti reform was designed.

We conclude the paper with some general considerations on the empirical evidence thus analyzed and on the reform, summarizing its pros and cons. Although the final judgement on its effects is negative, *Quota 100* may be the starting point to overcome some of the most critical aspects of the Fornero reform, that is its lack of flexibility which might heavily affect future young workers.

CHAPTER 1. OVERVIEW OF THE ITALIAN PUBLIC PENSION SYSTEM FROM 1969 TO 2018

Until 1992 the PAYG system was funded through a payroll tax where the employer contributed aroud

two thirds (plus 7.41% to the severance pay fund) while the employee for the remaining part. This was done to guarantee pensioners a standard of living as close as possible with that of active workers. Men could retire if they were 60 years old and women if they were 55 years old, with a minimum seniority of 15 years, however if public employees had a seniority of 20 and 15 years for males and females respectively, starting from 1973 it was possible for them to retire early with no actuarial penalty. For private employees the seniority requirement was set at 35 years.

In 1969 it was introduced an indexation mechanism which became effective after two years, so that pensions were aligned with the statutory minimum wage. Benefits were computed as follows: for private employees a 2% rate of return was applied to the last 5 years average salary; for public employees the rate of return was applied to the last monthly salary; for self-employed workers the rate of return was applied to the average earnings of the last 10 years.

In 1992 the Amato Government changed radically the pension system also due to the exchange rate crisis and the need to cut the deficit according to the Maastricht Treaty. The three main drivers of the reform were: expenditure trends, labour market, and equity considerations. First, pension expenditure went from 5% of GDP in 1960 to 14.9% in 1992 with a projection made by the *Ministero del Tesoro* of 25% by the year 2030, mainly because of how the eligibility conditions, the pension formula, and the indexation mechanism were structured. The interest rate was higher than the rate of growth of the social security wage base, thus ususstainable. Second, the lack of an actuarial correlation between pension benefits and the age of retirement caused a huge decline in the employment rate of older men and women since there was an implicit tax on continuing to work. Third, the previous system was particularly beneficial to workers whose salary grew considerably in the last years of employment. Furthermore, the rates of return on the contributions paid by the self-employed were two to three times higher than those on the contributions paid by private-sector employees. There were clearly equity problems.

The reform progressively increased the eligibility requirements for old age pensions, which went from 55 to 60 years for women and from 60 to 65 years for private employees; the total payroll tax passed from 24.5% to 27.17% of gross earnings; the pension formula was unified across private, public, and self-employed, taking now into account the average of *whole working life* earnings for those workers with fewer than 15 years of contribution in 1992 while older worker's reference period consisted in the last 10 years o accrued contribution. Each earning was adjusted for inflation, which became the new indexing mechanism, and further revalued by 1% per year. The minimum number of years of contributions for old age pensions was raised from 15 to 20 years. For public sector employees the minimum number of years of contributions for seniority pensions was gradually raised to 35 years.

Although this new pension system reduced net pension liabilities by one fourth, it failed to produce enough savings. Lastly, "the exclusion of individuals with at least 15 years of contributions from changes in the pension formula implied a long transition period and an uneven distribution of the reform burden" [1].

In 1995 the Italian pension system was completely overhauled, as a response to the severe projections released by INPS and the Ministry of Treasury on expenditure prospects. This reform had a wider scope than the 1992's: its objective consisted in stabilizing the percentage of pension expenditure on GDP, in addressing distortions in the labor market, and in making the system more fair by tightening the eligibility conditions for seniority pensions, which were risen every year from 1996 to 2008 and reached either 40 years of paid contributions independently of age or alternatively 57 years of age and 35 years of paid contributions, to gradually abolish them.

Italy went from a DB to a DC system, meaning that now the pension formula was based on the accrued contribution payments -not the average salary anymore- which were capitalised at the GDP growth rate and "transformed into a lifetime annuity according to *actuarial fairness* (taking into account the expected age of death)" [2]. Workers were separated in three groups depending on their number of years of contribution at the end of 1995. Despite the new rules on eligibility requirements were introduced for all workers, those with at least 18 years of contributions experienced no changes in terms of benefit calculations, meaning that the DB formula still applied. For newly hired workers the benefit computation method changed completely from DB to DC while for those who were working before 1996 but with less than 18 years of contributions at the beginning of 1996 a mixed system was applied. This difference in treatment raises an equity problem.

Despite these two reforms, the ratio of public pension expenditure to GDP reached 16 percent in 1999 and according to the Ministry of Treasury it was likely to rise even further. This was a crucial aspect because the Stability and Growth Pact requires close-to-balance budgets. Since revenue increases are problematic, the only option are cuts in public expenditures.

In 2004 the Welfare minister Roberto Maroni introduced new incentives for those who had delayed their seniority pensions, who would benefit from an extra bonus close to one third of their wage. At the same time, the eligibility requirements for seniority pensions became tighter, passing from a minimum age of 57 to 60 years for public and private employees, and from 58 to 61 years for the self-employed. For the cohort that was still under the DB system, the minimum retirement age was raised to 65 years for men and 60 years for women. Finally, incentives to continue working after retirement were provided, making possible to combine income from pension benefits and wages.

The *scalone* was supposed to be effective starting 2008, however in 2007 the new Government led by Romano Prodi postponed it to 2011. Eligibility requirements to seniority pensions were further tightened by making them conditional to achieving a given threshold, the so-called *quota*, equal to the sum of age and years of contributions.

Due to the precarious situation Italy was after the Sovereign Debt Crisis, it was essential to cut one of the most expensive elements in the Country, i.e. pension expenditure. The Labour minister Elsa Fornero

abolished seniority pensions starting in 2012 and further increased minimum retirement age from 60 to 66 years for both males and females (in the public sector) and from 60 to 62 for females in the private sector. Moreover, seven additional months were added for males to these new thresholds in the time period from 2013 to 2016, while in the same time interval the minimum retirement age for females employed in the private sector increased by three years and seven month. By 2050 there will not be any difference between men and women, both in the public and private sector, as everyone will meet the eligibility requirements for old-age pensions at 69 years and 9 months. Early retirement pensions were changed too: by 2050, the years of accrued contribution will be 46 for males and 45 for females, irrespectively of the working sector. We mentioned that workers who by 1995 had at least 18 years of contribution payments were still under the DB system; after the Monti Fornero reform, they too shifted to a DC system. Finally, those who by 31/12/2011 had already met the age and contribution payments requirements, still followed the previous retirement rules.

With the new eligibility requirements, the employment rate for people aged 55 -64 experienced a sharp increase, passing from 37.8% in 2011 to 48.2% in 2015 [4], however at the same time the youth unemployment rate went from 29.2% to 40.3% [5]. One of the main criticism of the Fornero reform is the massive toll put on the youth, who in Italy already struggle to get a job.

In 2018 the "Yellow-Green" Government proposed a new reform of the pension system, with the aim to lower the youth unemployment rate.

It is crucial to remember that *Quota 100* does not substitute the Fornero reform: after 2021 Italy will go back to the previous system. Old-age requirements will not change, as this is just an incentive to retire early by relaxing eligibility requirements so that younger workers will get employed easier. Several aspects have been criticised, such as the correlation between old-age employment rate and youth unemployment rate, the effectiveness of these incentives to cause early-retirement, and the sustainability of the reform, a critical aspect if we consider that Italy's GDP growth rate is close to zero and its population keeps ageing.

CHAPTER 2. ECONOMICAL IMPLICATIONS OF AN AGING POPULATION AND EARLY RETIREMENT

We start this section by defining the *dependency ratio*, i.e. the ratio between non-working to employed people. As shown in a paper from Hagemann and Nicoletti (1989), this ratio has grown quite considerably, with overall actual results higher than the projections. We also mentioned that in many Countries pension benefits are financed through a PAYG scheme, that is through contemporaneous payroll taxes, so that social insurance depends on labour income instead of capital income. In spite of the increasing participation of older workers to the labour force to face the ageing population trend, the percentage of people older than 65 keeps increasing. Combining these aspects, it is obvious that PAYG schemes will become unsustainable as future

workers will have to pay more taxes to maintain benefits constant.

According to Razin *et al* (2002) however, this does not seem the case. They use a median voter model with overlapping generations with young workers and old dependants (the former outnumbering the latter), the only tax being proportional to labour income, and a periodical rebalance of the budget constraint. Tax revenues are entirely spent on benefit payments, equal for both the old and the young. The authors then distinguish among the young between skilled and unskilled workers according to a cut-off level that depends on the costs of education, wage, and tax rate. In equilibrium, the gain from higher benefits for the median voter must be equal to the loss caused by an increase in taxation, but since taxes are paid only by the young, the old will always vote for raising benefits and taxes, while the young will base their vote on their level of education/income. Collecting data from 12 European countries and the US over the period 1965-1992, they find that an increase in the dependency ratio is associated with a reduction in benefits and taxation, i.e population ageing has actually reduced per capita expenditures, in constrast with the expectations on the median voter. This apparent puzzle is then further analyzed by Bryant (2003) by considering a disaggregated dependency ratio thus composed to account also for young dependants. Using the same variables and data for 13 OECD countries over the period 1960-1996, the author finds statistically significant results at the 5% level. Specifically, the OLS regression shows that, *coeteris paribus*, an increase in the proportion of population aged 0-14 lowers taxation and benefits per capita while the opposite happens for an increase in the proportion of population aged 65+: overall, the more young people, the lower the level of taxes.

To quantify the impact of ageing in pension expenditure, we start by a simple budget identity: at each time t the revenues from contributions plus the interests on the pension fund's assets must be equal to its expenditures and its variation in assets. After some substitutions, we find that the average contribution rate depends positively on the replacement rate and the dependency ratio.

Many OECD members experienced a drop in the effective retirement age and a subsequent reduction in the LFP of senior workers after the first oil shock that stopped only in the early Nineties when Governments started tightening the eligibility requirements to face the ageing population trend and the rise in pension expenditures. The structure of a social security system directly influences the decision between chosing to retire and remaining in the labour market: in many cases an additional year of working reduced the level of utility, i.e. past a certain age keep working is not an optimal solution. In a paper from 2000, Börsch-Supan takes as example the German public pension system due to its universality and notices how with the 1972 rules the lack of actuarial fairness creates a sort of implicit tax that reaches its minimum exactly when people have the opportunity to retire early [7]. To estimate this tax, he considered a worker who is S years old and plans to retire at age R, then he defined their Social Security Wealth as the present discounted value of benefits minus applicable contributions. From this definition, we define the accrual rate of social security wealth at time t as the ratio between the variation in SSW from time t-1 to t and the SSW at time t-1.

If the accrual rate is negative, it means that working one more year actually reduces the worker's benefits and could be perceived as a tax to continued work at time t. The author found that whenever there is a kink in the accrual rate, the implicit tax rate drops. The first -and highest- kink occurs at 60 years, implying a strong incentive to retire early. These results are consistent with the study made by Duval (2003) about the effects of an increase in the implicit tax on the labour force participation of older workers using a panel estimation for 22 OECD Countries employing data from 1967 to 1999.

A more sophisticated utility-based model to study this effect was proposed by Stock and Wise in 1988. While the model considers the trade-off of working one more year versus the benefits of retiring, meaning that the option value of continuing to work is compared with the value of retiring now, the key aspect consists in reevaluating this decision every time the worker has new informations regarding their future income. Briefly, the worker is at time t and will receive wage income Y_s in year s as long as they do not retire. If that were not the case case, they would receive pension benefit $B_s(r)$, where r is the first full year of the individual's retirement. If the expected value of working from time t to time r-1 is smaller than the expected value of working until time t, then they will retire early.

Applying a slightly modified version the model to the Italian cohort 1945-1949 to account for different exit pathways, we find that for both men and women there is a significant incentive to retire at younger ages through disability insurance or early retirement than considering the old age pathway. The cohort 1940-1944 confirms this result for men but has some differences for women.

Looking now at a recent case of policy-induced form of early retirement, the objective of *Quota 100* is to (temporarily) overcome the Fornero reform to make eligibility conditions more flexible thus creating more jobs for the young, in contrast with the stricter pension regimes recently adopted by several OECD countries to face the ageing population trend. Although we have just seen that the first step may actually work, the validity of the second claim has yet to be verified.

We have just stated that on average when workers have the opportunity to retire early, they typically do that because working just one more year could be seen as an implicit tax. Then, since the tax is linked to the number of older people out of the labour force and its increase should stimulate the youth labour market, it should be positively correlated with the youth employment rate, i.e. the higher the former, the higher the latter, however the empirical correlation is actually negative.

Going back to the German pension system, with the introduction of the actuarially unfair possibility of early retirement in 1972, workers between 55 and 64 experienced an increase in the unemployment rate of 17%, which is why in 1992 a fair reform was introduced to correct this trend, resulting in an increase of 23% between 1997 and 2006. The effects on the unemployment rate of the young were: in the interval 1972-1976 a reduction of 7% in the employment rate of older people was associated with a reduction of 2% in the employment of younger people and with an increase of 1.7% in the unemployment rate of the same category; in the interval 1997-2006 an increase of 15% in the employment rate of older people was associated with no

change in employment rate of the young and a slight reduction in the unemployment rate of the same category.

Let us consider the heterogeneous American labour market over the period 1977-2011, thus including the effects of the Great Recession in the analysis. Munnell and Wu (2012) study the effects of delayed retirement on the level of employment and unemployment of the young, even in conditions of strong crisis through a TSLS estimation. The same procedure is applied to the Chinese labour market using surveys of China's Census Bureau (CCB) for 84 provinces from 1990, 2000, and 2005, using the share of older people who are approaching the retirement age among the oldest part of the labour force due to a lack of data. In both cases the results are statistically insigificant.

We move our focus on the Japanese population, one of the oldest among the industrialized economies. To reduce pension expenditure, the government implemented in 2001 the Pension Reform Act, progressively increasing the retirement age from 60 to 65 years for a part of the pension benefit, and a revision of the Elderly Employment Stabilization Law (EESL) in 2006 to face the gap "between the the pension eligibility age and mandatory retirement age, which was still 60 in most firms"[14] created by the former, allowing essentially for people older than 60 to get reemployed. Collecting data from the Employment Trend Survey (ETS) and the Establishment Enterprise Census (EEC), Kondo (2016) measures the effects of the EESL on the level of employment on different categories of Japanese workers, finding that after the EESL had positive effects also on younger workers.

This and the previous studies show that the so-called "lump of labour theory", i.e. the idea that there is a fixed amount of work in a Country, does not hold. Another piece of evidence comes from the study made by Boldrin *et al.* (1999) when analyzing the degree of correlation between the exit rates from the labour force of the 1931-1940 cohort and the variation in unemployment rates from 1991 to 1996 of the young born in 1965-1975. Collecting data from 260 European regions where early retirement policies had been particularly frequent over different periods, they found that for both men and women the correlation is not statistically significant even after controlling for cohort effects, that is differences in the characteristics of the two cohorts such as propensity to save, or the employment of different lags. Jousten *et al.* (2010) review the methodology adopted by Boldrin and they apply it to the private youth Belgian market. They find that there is a positive correlation between the elder and youth labour market, while unemployment largely depends on other structural factors such as the level of wages and education.

If in the long run and at the aggregate level we do not observe a correlation between youth unemployment rate and old employment rate, in the short run and at the micro level the results seem to be different. Vestad (2013) shows that generous early retirement policies do infact in the short term stimulate the youth labour market, by taking as example the Norwegian early retirement scheme introduced in 1989 and its effects from 1994 to 2004 on the level of occupation among the young, although the magnitude of these effects was not the same between employment and unemployment.

The idea that the lump of labour theory holds in a weak form, at least in the short term and not in the aggregate,

is further confirmed by the analysis of Martins *et al*. (2009) in relationship with the effects of a law in 1993 that increased the retirement age of women, leaving eligibility requirements for men unchanged. They first checked whether the law had a substantial effect on the female labour force by running a logit regression addressed to the ideal target, i.e. women in their mid sixties over the period 1992-2000. The odds ratio associated with this regression showed that it was 31,3% more likely for an older woman to get a job. They then ran a probit regression controlling for the firms directly affected by the reform, using 1992 as the base year, to see the effects on the different probabilities of getting hired: the results show that if on the one hand the effect upon hirings on men younger than 25 was just -0,29 with a t-ratio of -2.83, on the other hand the same effect upon women younger than 25 was -0,45 with a t-ratio of -3,23, implying a stronger level of statistical significance.

CHAPTER 3. A MORE IN-DEPTH VIEW OF QUOTA 100 AND THE ITALIAN LABOUR MARKET

According to the Ministers Di Maio and Salvini in 2018 and in the first half of 2019, *Quota 100* was supposed to help the young in finding a job with the retirement of hundrends of thousands of older workers. At first it was said that there would have been a 1:3 ratio, meaning that for each retiree 3 young people would have been employed, to later change this statement into a 1:2 ratio. Moreover, it was said by the Minister Salvini that in the public administration a 1:1 ratio had been achieved.

There is however a huge discrepancy between what was promised and what actually happened. In the first ten months of 2019, 132.000 people decided to retire via *Quota 100*, two thirds of the number announced by the former Ministry of the Interior. On top of that, it was registered in the same period a drop in employment of 10% among those with less than 30 years, who are the target of the reform. Sticking to the public sector, it seems that especially in the North *Quota 100* has caused a lack of employees as there have been no new public examinations to replace those who retired. Instead, older rankings were used, implying that almost no recently graduated person has been hired. Finally, the Parliamentary Budget Office (P.B.O.) has estimated that in 2020 those who will be able to benefit from this option will be 246.000 people, 19% less than the original prediction. This difference is likely explained by the significant reduction in gross pension that those eligible for *Quota 100* might face compared to the existing system: from 5% if retiring one year earlier to 30% if retiring 4 years earlier.

According to the P.B.O. 2019 report, early retirement was originally going to cost about:

- 4 billion euros in 2019
- 8,3 billion euros in 2020
- 8,7 billion euros in 2021
- 8,2 billion euros in 2022

- 7 billion euros in 2023

These costs had to be added to those for the *Pensione di Cittadinanza*, a form of social security aimed at helping older people that live in poverty conditions who are according to Eurostat in 2016 around 22% of the total over 65 populations, well above the 18,2% European average.

In the Senate deposition of the former INPS president of 4th February 2019, Boeri highlighted how future generations will have to bear the burden of these policies. The amount of these costs depends on whether *Quota 100* and the actuarial adjustment will be confirmed or not after 2021 and 2026 respectively: assuming a discount rate of 4%, in the first case there is going to be an increase in the implied debt of 92,5 billion euros, while in the second case the implied debt will grow "only" by 37,6 billion euros[41].

However, newer estimations suggest that the expediture for *Quota 100* will be lower than what was initially stated: with the 2020 Budget Law it seems that there is going to be a cut of 5 billion euros, due to the scarce number of workers who opted for retiring earlier. In spite of that, the total pension expenditure is actually going to rise, passing from 231,3 to 233,1 billion euros.

There might be the possibility of a "discontinuity effect" near the end of 2021, i.e. a sort of run on the bank's deposits to benefit from the option. This could be the case for two reasons: first there is the issue of those who will be 62 years old in 2022 with 38 years of pension contributions who are going to face a 5 year *scalone*, and second if the law that allows people who have met the eligibility requirements in 2019-2021 for *Quota 100* to claim the pension after 2021 (so that the loss in value is reduced) will be changed. All this uncertainty may lead to higher costs.

The focus of this paragraph is to see if *Quota 100* may be sustainable in the medium-long run considering all these costs and the uncertainty level. In his recent report on the Italian social state, Pizzuti (2019) considers three different levels of participation which are then confronted with the trend scenario (T): 85% (P1) which is the original government expectation, 70% (P2), and 50% (P3). Under some assumptions on future life expectancy, employment rates, birth rate, and productivity[42], the pension expenditure to GDP ratio is expected to rise, on average, by 0,34 GDP percentage points in 2020 to then drop significantly below the trend scenario in 2024-2025 due to the effects of the whole Budget Law on the denominator, however if the growth-oriented policies will not be effective, pension expenditure is going to increase up to some point more than 15,7% of the GDP in 2030. One further aspect that contributes to a lower expenditure level is the reduction of pension benefits relative to wages and labour productivity "dovuta alla riduzione dei periodi di contribuzione implicita all'anticipo del periodo di pensionamento"[27], offset by an increase in pension income[43].

[41] 5,1% and 2,1% of the 2019 nominal Italian GDP level.
[42] Realtive to their 2019 values, in 2050 people will live on average 3 years longer, employment will rise by 6 percentage points, the birth rate will be almost the same, and the growth rate of productivity will rise by1,5 percentage points. The unemployment rate is expected to rise in the short run to later drop at 6,2% (10% in 2019).
[43] Assuming a growth in productivity and GDP.

The model employed was developed by Beqiraj and Tancioni in 2014, hence the name BeTa. It is a dynamic-stochastic model which, in this specific case, assumes an open economy with a centralized monetary policy and focus on fiscal policy and sovereign risk. The domestic country is Italy while the foreign country is the rest of the Eurozone. The equations of the model are obtained by constrained optimization of rational agents such as households, producers of intermediate goods, wholesalers and retailers, and Central Banks, while the parametrization is based both on a Bayesian approach, i.e. by the maximization of the posterior expectation of a utility function, and the usage of dogmatic priors for those parameters that do not satisfy the identification conditions.The different agents are:

Households

We distinguish two types of households: Ricardian and non-Ricardian. The former maximise their intertemporal utility under a budget constraint is given by the purchase of consuption and investment goods cosidering after tax labour and capital incomes, after tax unemployment benefits, dividends and government transfers, and are assumed to be homogeneous with respect to consumption and asset holding. The latter consume their entire net income at each period t.

The intermediate goods sector

Production is associated with a Cobb-Douglas function with labour, private capital, and public investments as inputs in a perfect competition environment. Public investments are not completely exogenous but follow a maximisation process of the difference between production and private capital, i.e. by maximising expenditure efficiency. When deciding the optimal level of wages $w_t^*(i)$ firing is assumed to be exogenous, hence the firm is not able to choose an optimal firing strategy distinguishing between incumbents and newly hired workers. Instead, it simply maximises the surplus of the worker with respect to wage.

Wholesalers and retailers

In this context, firms producers of the final goods are assumed to be in a monopolistic competition framework, meaning that the products and services offered are somewhat similar but not perfect substitutes, allowing companies to apply a time-varying markup. Wholesalers buy the intermediate product from the previous agent and by a linear technology they transform it into the composite final good which is then sold to retailers. The economy is assumed to be open, so both the import and export sector must be considered.

Central Banks and Fiscal Authorities

The Central Bank follows a Taylor rule in setting the nominal interest rate according to the difference between the level of inflation in the Eurozone and its target value which is below, yet close, to 2%. To compute the level of inflation, we simply consider a weighted average of the domestic inflations where the weights

account for the relative influence of each domestic economy in the currency area. As of January 2020, the value is around 1,4% according to Eurostat.

The fiscal authority takes public expenditure and tax rates as partially endogenous, with the exception of public investments that are chosen optimally. It is in charge of the government financial need which is founded in two ways: a fraction through taxation on consumption, labour income, capital, and profits; the remaining part by issuing new public debt.

In short, though it seems that *Quota 100* might actually be sustainable in the medium-long term, these results present an extremely high level of uncertainty linked to several factors (behavioural, legal, macroeconomic) which should be considered as further cost. Nevertheless, the trend scenario is not sustainable as it is right now: according to the IMF forecasts, Italy's real GDP growth rate will be lower than 1% while Pizzuti suggests that it should well higher than that number to sustain future pension expenditures. It was proposed by the INPS to focus on the *APE* mentioned in chapter 1, which essentially presents more flexible requirements for the exit windows than those introduced by the Monti Fornero reform, but the data show "la difficoltà di implementazione delle misure e la stringenza dei requisiti posti in essere"[29].

In order to have a more accurate perspective of the effects on different variables, in his simulations Pizzuti considers three different levels of usage of the available resources: 100%, 75%, and 50%. Albeit by a small degree, the variables positively affected are GDP, consumptions, and investments; net exports seem to suffer severe losses.

The main drivers should be identified in consistent higher private consumptions, which are expected to rise thanks to the income of the newly employed, and in a higher inflation, which lowers the real interest rate thus facilitating investments. On the other hand, it is exactly the rise in consumptions that lowers the net exports by a large margin. Relative to the trend, in the best scenario GDP will grow by 0,1% to later settle arond 0,06% while investments are presumed to experience an initial growth of 0,15% only for two years, after which the growth rate will revert back close to 0%.

To finance *Quota 100* and other policies Italy will rise new debt, in the hope to stimulate GDP through consumptions and investments to have overall a lower debt to GDP ratio, currently one of the highest in the world. However, as the figure above shows, the positive shocks are too modest to balance the large expenditures, resulting on average in a net increase of 0,1% of the debt to GDP ratio: this is confirmed by the multiplier which is below 0,2, meaning that around 20% of the resources actually stimulate GDP. The reason is that the increase in consumptions is mainly oriented towards basic necessities while the newly retiree will tend to save the incomes from *Quota 100*.

In the previous chapter we saw that the lump of labour, i.e. the theory where for each retiree person a new job is created, does not hold. This is further proved by Brugiavini and Peracchi (2010), who found that in

Italy the relationship is actually procyclical: a "higher labour force participation of the old is associated with a lower unemployed rate of the young […] because both are driven by the business cycle" [13]. This proof of evidence however does not take into account the more recent events in the Italian (and European) framework

Researches on more recent datasets have brought some interesting results: empirical studies that employ data up to 2016 show that in our Country some slight form of the lump of labour theory seem to hold. Using data from the Italian Labour Force Survey (LFS) from 2004 to 2015 and Eurostat, Bertoni and Brunello (2017) show that if the pool of people (PT) older than 50 but younger than minimum retirement age (senior workers) increases by one thousand additional, then it is expected an increase of the number of employees among the old and a decrease in the number of employees among the young. This result is not consistent across time: during growth phases of the economical cycle this ratio is much lower, and it relies on the not-so-mild assumption that the effects of the national policies on the local labour markets are inconsequential, conditioning for local changes in the pool.

Similar results have been obtained by Boeri et al. (2016) when they analysed the effects of an unexpected reform, such as the Monti Fornero reform, on the labour market, both theoretical and empirical. Concerning the latter, they use data from the interval 2011-2014 referring to firms in the private sector with more than 15 employees analyzing the relationship between the reduction in youth employment and the person-year of locked-in workers. The average elasticity of the statistically significant coefficient is 0.23, meaning that a young worker lost their job for every five locked-in workers per year.

It seems then that *Quota 100* and its incentives on early retirement could be at least an initial solution to the issues brought by the Monti Fornero reform and finally stimulate youth employment. However, although employment is expected to increase by 0,04% with respect to its trend level, this difference is due to higher deficit expenditures, meaning that keeping productivity equal there would be no difference in the level of hiring. Furthermore, the increase in the stock of debt could be a source of potential risk for Italy, specifically Country risk, that may lead to restrictions to the monetary supply. Lastly, using the BeTa model, real wages will have an initial average increase respect to their trend values of 0,06% to then become negative after 2023 by -0,025%.

On the one hand *Quota 100* might help a great part of the unemployed older than 50, a group that counted 500.800 people in 2016 whose opportunities to get a new job are rather small and who often do not even receive subsidies. On the other hand according to the simulations made by the P.B.O., the reform is highly selective: first, 70% of those who would benefit are men, mostly from the private sector; second, 42,2% of the newly retirees will be from the North where there is already a higher turnover than the rest of Italy.

To conclude, the ageing population trend poses serious problems to PAYG social security systems. Future workers will have to bear the burden of an older and more dependent population which will lead to a

less dynamic labour force and an increase in pension expenditure in spite of the growing employment rate for senior workers, caused also by tighter eligibility requirements. We have seen how the former plays a significant role in the increase of the LFP of elderly workers, since in the past many OECD Countries had rather loose conditions that incentived the exit from the labour force under a utilitarian point of view, i.e. working one more year would have made them worse-off. At the aggregate level and in the long run, this does not affect the youth labour market, Significant negative effects are observed for either males or females in the short run, though.

Quota 100 seems to follow the long Italian trend of being unable to lower public expenditures devolved to social security. Despite addressing one of the main issues brought by the recent crises and the unexpected pension reform, i.e. a drop in the youth employing rate, its effects are negligible and do not balance the newly raised public debt, the former being the main source of -modest- growth.

However, not only *Quota 100* may help a relevant amount of people who cannot find a job and are forced to wait to be 67 years old to be eligible for their old-age pension, but more importantly it lays the basis for a much needed structural reform on retirement flexibility which was tightened by the Monti Fornero reform: according to Alberto Brambilla, president of the reseach center *Itinerari Previdenziali*, since from now on people will retire under a full DC system, a lack of flexibility implies that around 65%-70% of young workers might be cut out given the present retributions. Taking this important element into account plus the fact that after 2021 there is the risk of going back to the previous pension system with a 5 years *scalone* for many workers, some proposals have been made, for example maintaining an actuarially fair old-age pension of 67 years of age with least 20 years of contribution payments while substituting *Quota 100*, the *Opzione donna*, the social *APE*, and so on.