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THE PERSPECTIVES OF DEVELOPMENT OF ITALIAN PENSION FUNDS AND THE EFFECTS ON THE ITALIAN AND EMU AREA FINANCIAL MARKETS

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Abstract

We simulate the development of Italian pension funds in the medium and long run (to 2050) using a cohort model, tracking their potential impact on the Italian and EMU area financial markets.
In the baseline, active membership is assumed to rise to a maximum of 11.6 million in 2025, about half of total people in employment; thereafter, membership rates stabilize, while participants fall in absolute number because of the underlying demographic trends. The amount of resources flowing into pension funds rises substantially in the medium run: annual net contributions reach 0.6% of GDP at around 2025, falling however in the following period and becoming slightly negative from 2040 onwards. Pension funds' assets increase from 3.9% of GDP in 2005 to around 20% in 2035 and then stabilize; to this, a further 10% of GDP must be added, held by the insurance companies in charge of the payment of annuities.
Net flows into equity markets reach a maximum in 2025, with 7 billion Euro (at 2005 prices), of which, however just 350 million invested on the home market and less than 2 billion in the all EMU area. Overall, the effects on the domestic financial market (in particular on the stock exchange) are moderate, in spite of the country bias. Furthermore, it is likely that a large fraction of the resources flowing into pension funds will not come from genuine additional saving, as in the case of the TFR or of contributions coming from a mere individuals' portfolio reallocation.

Keywords: pension funds, institutional investors, cohort-based simulation models

JEL: G23, G15, H55

Contents

Summary

- We built a cohort model that simulates the development of Italian pension funds in the medium and long run (to 2050) to track the potential impact of their diffusion on Italian and EMU financial markets.
- Four factors contribute to the determination of the results: firstly, the demographic and employment trends; secondly, the degree of diffusion and the level of pension fund contributions; thirdly, general economic trends and those for productivity and interest rates in particular; finally, the asset allocation choices made by pension funds, which manage individuals' contributions during their working life, and by insurance companies, which pay the annuity once an individual retires.
- While population and employment trends are set as exogenous, a baseline scenario is considered for the other three dimensions and the robustness of the results is assessed using sensitivity analysis.
- Our results suggest that, in spite of the ageing process and the expected reduction in both the share and the absolute size of active population, the amount of financial resources flowing into Italian pension funds could rise substantially in the medium run. Nevertheless, pension funds' accumulation is likely to start to slow already in the 2030s, when the system is expected to become fully operational, and to come to a halt in around 2050. Furthermore, the effects on Italian financial markets should be moderate, above all with regard to investment in risk capital.
- An underlying assumption of our results is that pension fund membership will grow gradually but substantially until 2025, which is consistent with the stated policy goal and with a series of actions undertaken in order to foster the development of private provision. Accordingly, in our baseline scenario pension fund (active) membership would reach a maximum of 11.6 million in 2025, around half of total people in employment. After that, while fund members as a percentage of total employment will remain basically unchanged, the number of members will drop because of the underlying demographic trends and the population ageing.
- In terms of GDP, annual gross contribution flows into pension funds (which depend on demographic, occupational and earnings dynamics as well as on contribution rates) will increase until 2025 and then stabilize at around 1% of GDP. At the same time, however, outflows will grow exponentially, with the increase dependent on (unfavorable) population trends, on returns on assets (constant at 2%) and on the system gradually reaching maturity. It follows that, after reaching 0.6% of GDP in around 2025, net contribution flows will fall to become negative (around -0.1%) from 2040 onwards.

- The assets accumulated into pension funds will increase: while in 2005 these amount to a modest 3.9% of GDP, they will reach 20% in around 2035 and will then stabilize. A further 10% is held by the insurance companies which take responsibility for the payment of annuities. The returns on assets (assumed to be greater than GDP growth) will provide further inflows to pension funds and insurance companies, allowing them to both meet their obligations, in spite of low or negative net annual flows at the end of the simulation horizon, and to stabilize the assets to GDP ratio.

- In the baseline scenario, the net annual resource flow onto equity markets will reach its maximum in 2025: approximately 7 billion Euro at 2005 prices (5.8 due to pension funds, 1.2 due to insurance companies) will be invested in equities, of which, however, only 350 million on the home equity market and less than 2 billion in the overall EMU area. The net flow into debt securities is greater, at 10.7 billion Euro per year around 2025, of which 2.7 billion Euro invested in Italian bonds and 8.3 billion on the EMU market.

- Although the new funds invested each year are of a certain entity, at least for the first 30 years of the simulation, the effects on domestic financial markets are, as said, moderate. This is primarily because, even if account is taken for a home country bias, the limited importance of the domestic market (the stock exchange above all) obliges pension funds to diversify their investments geographically. Furthermore, it is likely that a large portion of the resources collected by pension funds will not come from genuine additional saving, as in the case of the TFR (a deferred wage component of employees' income) or of contributions which will come from savings currently held in investment funds or real estate.

- The sensitivity analyses are based on alternative scenarios built by making more favorable (high scenario) and less favorable (low scenario) assumptions as regards to membership rates, contribution levels, the macroeconomic framework (productivity growth and financial returns) and asset allocation.

- The sensitivity analyses confirm the trends of the baseline scenario. However, some significant differences emerge, particularly in the case of alternative assumptions for membership and contribution rates, which should be borne in mind, as these are the most sensitive to policy intervention.

1. Introduction

With assets below 4% of GDP in 2005, the private pension system appears in Italy still in its infancy if compared to countries like the US, UK, Netherlands or Suisse, where pension funds' assets account for between 50% and 100% of GDP.

However, a lot of effort has been spent in the last decade to promote private provision. The 2004 pension reform law explicitly states such goal once more, to this aim increasing fiscal incentives and introducing a silent-consent clause to divert to private funds the deferred wage component of private sector employees (TFR - Trattamento di Fine Rapporto), amounting to 6.91% of payroll. The following 2005 Legislative Decree on pension funds implemented such provisions, setting 1.1.2008 as the date for the silent-consent clause to go into operation[1,2] and drastically reducing the tax rate on private pensions.

The general view is that private provision should supplement – if not substitute for – public provision, allowing people to get in the future pensions not lower than current retirees are enjoying and possibly cheaper. Furthermore, private provision would foster saving, allowing to increase the size and efficiency of the financial markets, thus granting easier and cheaper access to capitals and promoting investments and economic growth.

While strong reservations have been expressed by many sides on the opportunity, the extent and the effects of social security privatization, the two above mentioned arguments can still be considered as a sort of "mainstream" in the pension reform debate, both at the national and international levels.

However, considering here the second argument, remarkably little attention has been paid in Italy to the quantification of the potential impact of pension funds development on the domestic financial market, in spite the argument being often quoted in the debate[3]. It thus makes sense to try to

[1] Within six months of the new legislation coming into force, or of the date of starting their first job, workers may transfer the TFR accruing since that moment to a supplementary pension scheme of their choice or decide to keep the TFR with their employer (a decision that can be subsequently revoked). If workers do not express their desire to the contrary within the six month deadline the TFR will be transferred to the schemes already set by collective agreements between employers and trade unions at sectorial or local level (generally closed-end pension funds). If more than one of such funds is already in force, TFR flows are transferred to that with the greatest number of members (unless there is a different agreement at firm level). If no pension scheme has been agreed yet, the TFR is transferred to a special supplementary pension scheme set up by the National Pension and Insurance Institute (INPS).

[2] The introduction of the silent-consent mechanism was delayed until 2008 mostly because of the need to compensate firms for the loss of the ability to manage by their own the TFR (which traditionally they see as a source of cheap financing) and because of a dispute between the pension fund industry in the strict sense and the insurance world (which offers pension insurance policies, which in the Italian framework are also classified as pension funds). This may have the effect of slowing the development of private provision for a while; however, the more recent data already show that some acceleration of new pension membership, particularly in the pension insurance policy segment, is already taking place.

[3] See for example Group of 10 2005 and, in the Italian framework, the "old" Fornero 1999 (p. 42) and the "new" Messori 2006 (in particular the foreword by the Chairman of Assogestioni, the association of finance managing firms).

quantify the consequences the take-off of pension funds may have on the national and EMU area financial markets. Indeed, such effects are far from being straightforward.

Firstly, it has been noted (Group of 10 2005 and Marano 2002 among others) that resources diverted to private pension provision do not necessarily constitute new saving. The clearest example in Italy is private employees' TFR, which currently constitutes compulsory saving for workers, being managed by firms and only paid to workers when their contract of employment is terminated. Along the same lines, it is likely, particularly for the self-employed, that some of the contributions to pension funds will come from a reallocation (driven by tax incentives) of saving currently invested in real estate or investment funds.

Even if we disregard this, as we will generally do in our calculations, a second point concerns the fact that investors geographically diversify their investments, so that not all the resources flowing through pension funds will finance the domestic economy or even be allocated within the EMU area. In fact, each financial market benefits from growth in private pension schemes in proportion to its weight in the global financial space, which means the development of pension funds in a single country generates a positive externality on the others' markets, but only has a limited impact on its own.

Thirdly, population aging is likely to influence pension funds' resource inflows and outflows quite soon, interacting with (and partly balancing) the increasing diffusion among workers of such instrument.

The simulation exercise we have undertaken evaluates the potential effects of the 2004 pension reform on the growth of the Italian private pension system in the medium and long run (from 2005 until 2050). We use a parametric model with overlapping cohorts and observe how key variables such as the absolute number of members, contribution flows, asset accumulation and allocation will evolve. The underlying assumption is that pension fund membership rates will experience a gradual but sustained growth in the next two decades.

The results confirm that Italian pension funds could collect substantial amounts of resources during their growth phase. However, when they reach maturity, asset accumulation basically stops and they then tend to replicate a pay-as-you-go financing mechanism. Furthermore, an important portion of this accumulation will result from the TFR, while the amount of resources allocated into risk capital on the home market is expected to be extremely limited.

Our results are in line with the few other studies that have attempted quantifications: a previous model on pension funds in France, Germany and Italy we developed in 2003 (Marano 2003, ref. 2003) and those for Italy by Fornero 1999, and Ceccarelli, Mattioni and Rinaldi 2005 (also in

Mefop 2005). Our model however has been updated with the latest EU demographic and economic scenarios and has a "finer resolution", since it considers contribution flows for different types of worker, it distinguishes the asset accumulation of pension funds from the one of insurance companies providing the annuities, it quantifies the financial flows towards different types of assets and different geographical areas, it tests the robustness of the results with a sensitivity analysis.[4]

The rest of the paper is structured as follows. Section 2 briefly sketches the basic features of the model and the main assumptions, while section 3 discusses the main results. A more detailed analysis of the baseline scenario is offered in section 4, while section 5 deals with sensitivity analysis. Section 6 concludes, while the mathematical Annex analyses the long run properties of the model.

2. The model and the assumptions

In order to understand what drives the growth of the supplementary private pension system in Italy, one should look at the mechanism through which defined contribution pension funds (*de facto* the only admitted in Italy) operate, a mechanism which is described in a formal way in the mathematical Annex.

Workers' individual contributions and the yield from investment in financial markets add up each year to build a capital which will be used, on retirement, to buy a financial contract called an **annuity**, typically issued by an insurance company. It follows that, at the beginning and until a pension fund starts paying its first pensions, the entire contribution flow and all the financial returns (net of taxes and expenses) add to the fund's assets.

The growth in the fund's wealth continues when the first pensions start being paid, although with less momentum, until the fund reaches "maturity", which means that the ratio of pensioners to active members stabilizes and individuals retire claiming full seniority in the fund. From that moment onwards, growth in the fund's assets stops (except for what is due to the normal wage and employment dynamics, which means that the assets to GDP ratio remains constant) and these constitute a pool from which to draw on if the retirement flow exceeds new memberships: in this case the annuities will be bought at least in part decumulating assets and, under the extreme

[4] Our findings are also in line with some general result reported in Börsch-Supan, Ludwig and Winter 2004. However, few comparisons are possible: while we aim at a punctual and detailed quantification of the effects of pension funds' development in Italy, their paper rather focuses on the building of a general equilibrium model to assess the effects of aging and pension reforms on international capital movements, interest and saving rates; furthermore it considers the overall Germany+France+Italy area and does not provide data for each country; finally, it considers a reform scenario with transition to a funded system which is not comparable with the one considered here.

assumption of no new members entering, the pension fund's wealth will fall to zero when the last member retires. It follows that the amount of saving conveyed by pension funds depends upon two key elements: on the one hand the **demographic** and **employment** trends, on the other the **degree of development** of pension funds themselves (worker membership and members' average seniority in the funds).

With a lag of few years, a mechanism similar to that described for inflows to pension funds applies to the insurance companies which issue the annuities. In fact, in the initial years the amount transferred from the pension funds to insurance companies is greater than the pensions paid by them to pensioners. When the pension funds reach the maturity stage, first the rate at which insurance companies accumulate assets reduces and then stabilizes, converging, as in the previous case, to the GDP growth rate.

Accordingly, in spite of the demographic crisis and of the negative net turnover on the labor market expected for the future in Italy (as in other EU countries), one can expect a substantial rise in the amount of saving conveyed by pension funds, because membership, currently still quite low, is likely to rise strongly in the years to come, while the number of pensioners will only begin rising with a significant time lag, i.e. when new members reach retirement age.

The main assumption of the parametric model used for the simulations are presented in Table 1. The model assumes the demographic trends contained in the projections to 2050 drawn up by Eurostat in 2005 (Eurostat 2006). Five-years cohorts are considered, distinguishing by gender, and the analysis is also performed on intervals of five years[5]. The employment rates are those of the projections made by the Ageing Working Group of the Economic Policy Committee of the European Union (Economic Policy Committee 2005). From these demographic and employment rate trends absolute numbers of people in employment are obtained, by gender and age cohort. On the basis of these projections, it is forecast that the population over 15 years of age will increase until 2020 and then decrease, while the population directly concerned with pension fund membership (that between 25 and 64 years, see below) will already begin to decrease in 2010, falling from over 32 million to 24 million in 2050. People in employment in the same age band will continue to increase until 2020, as a result of rising employment rates.

Employment trends, together with those for productivity (again based on the Economic Policy Committee projections), depict the underlying macroeconomic scenario and give the real GDP growth rate. The average rate of growth in GDP between 2006 and 2050 is 1.2% (higher in the first

[5] We generally refer to the middle year as representing the five-years period (i.e. 2005 refers to 2003-2007 and 2040 to the 2038-2042 period), however notice that wealth accumulation is calculated as at the end of period, thus, strictly speaking, refers to 2007 and 2042.

twenty years and decelerating afterwards), while productivity will increase at an average annual rate of 1.6%. The real rate of return on pension fund assets (net of management expenses and taxation incurred) is set at 2%, a value higher than GDP growth, but coherent with the rate used at the EU level[6] (Economic Policy Committee 2005, Social Protection Committee 2006).

The analysis considers three components of employment: private sector employees, public sector employees and self-employed workers. One assumes that pension fund membership rates gradually but substantially grow between now and 2025 for all three components, although each one differently (and by gender). Membership in absolute numbers is derived from this growing participation scenario and from the demographic and macroeconomic trends. It should reach 9 million in 2050 (up from 3 million in 2005) of which more than half (4.8 million) would be private sector employees, 2.7 million self-employed and 1.8 million public sector employees. One assumes no membership of workers (even self-employed) younger than 25 or older than 65, so that the contribution period concerns the 40 years between 25 and 64 years of age. Membership is assumed to be the same within each five-years age group in this interval. Furthermore, for employees, only full time workers with permanent contracts of employment have been considered as potential members of private schemes[7]. Finally, one assumes that a certain percentage of pension fund members exits the private schemes each period before reaching 65[8], the associated savings thus being cashed in before the assumed normal age threshold is reached.

As for earnings and contribution rates (in % of earnings), different hypotheses have been assumed for the three categories. The model considers the wage of the Average Production Worker (APW), as calculated by the OECD for 2004, as a benchmark, assuming it applies to private sector employees in the 45-49 year age group[9]; an individual career component (0.5% per year) has also been considered, which adds to annual growth in productivity. Earnings of pension funds members have been assumed to be 125% higher than the average of their colleagues at the beginning of the simulation period, while converging to the average (by 5% every 5 years) as participation to pension funds increases. As for contribution rates, these are set at the level of the TFR (6.91%) for private sector employees and at 5% for the self-employed from 2008-2012 onwards. A higher rate (TFR +2%) has been assumed for public sector employees, however for these workers only the 2% actually goes into pension funds because of a peculiar mechanism in the legislation (see below).

[6] 3% in real terms and gross of pension fund expenses (0,5%) and taxation.

[7] Although the law allows both part-time and fixed-term contract employees to enter private schemes, it seems unlikely that such workers will be in condition to enter into the long term commitment associated with membership of a private pension scheme.

[8] 5% every five years.

[9] For public sector employees and self-employed persons, the average income is set higher by 10% and 40% respectively.

The inflow into pension funds is obtained from overall working-related earnings (resulting from population age structure and size, employment rates and individual income), pension fund membership and contribution rates. With a time lag, inflows, together with the returns on pension fund assets, determine outflows, which constitute inflows to insurance companies that pay the annuities to individuals during retirement. Attention has been paid, in the evaluation of pension fund assets and outflows, to wealth already accumulated in such schemes up to 2005.

Pension fund assets are assumed to be allocated to different asset classes in such a way that they will tend to a hypothetical long-run equilibrium portfolio, in which equities, bonds and liquidity are in a 40:55:5 ratio. Since this differs from the current distribution between bonds and equities (held either directly or by holding shares in collective investment institutions), the flows are immediately adjusted to this 40:55:5 proportion. As for the allocation to different areas (Italy, EMU, EU non EMU+Switzerland, other) the relative weight derived from mainstream benchmark indices is corrected taking account of a country and "currency" bias in favor of investment in Italy and the EMU area.

Table 1 - The main assumptions

	2005	**2025**	**2050**
Real annual growth rate of GDP	0.3%	1.1%	1.1%
Real annual growth rate of labour productivity	-0.7%	1.8%	1.7%
Real return rate (net of taxes and administrative costs)	2.0%	2.0%	2.0%
People in employment (millions)	22.6	23.6	19.1
Pension fund membership (millions)	3.0	11.6	9.3
Pension fund members as % of workers aged 25-64:			
- private employees (full time, undetermined term contract)	*21.0%*	*65.8%*	*65.8%*
- public employees	*3.8%*	*67.9%*	*67.9%*
- self-employed	*21.8%*	*68.4%*	*68.4%*
Contribution rates			
- private employees	*6.91*	*6.91*	*6.91*
- public employees	*2.0*	*2.0*	*2.0*
- self-employed	*3.0*	*5.0*	*5.0*

3. The main results in the baseline scenario

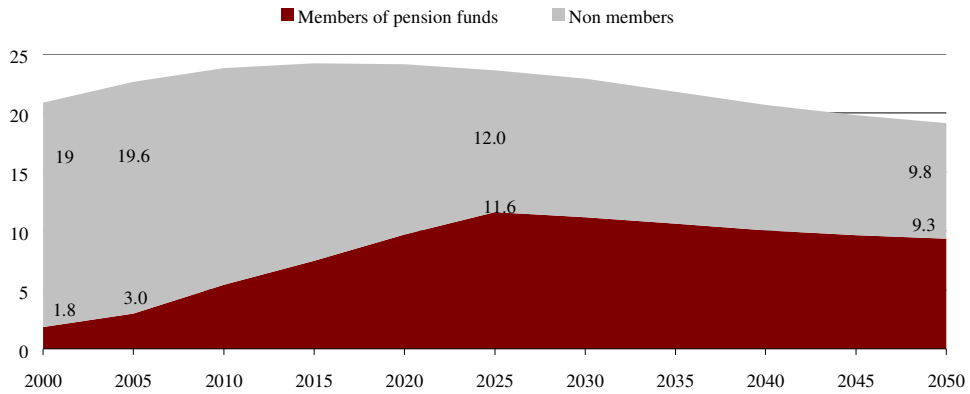
The main results of the baseline simulation are presented in this section, while Section 4 discusses the model and the baseline more in details and Section 5 examines alternative scenarios within the framework of a sensitivity analysis. Results for the baseline are shown in Graphs 1-17, while tables A1-A14 (at the end) report detailed data in both the baseline and the alternative scenarios.

3.1. Membership

The number of pension fund members increases in the first half of the simulation period, as a result of increasing membership rates for all categories of workers. The maximum number of active members is reached in 2025 (11.6 million, about half the persons in employment)[10]. Thereafter the number of members starts falling, reaching 9.3 million in 2050. However, as can be seen in Graph 1, such fall runs parallel to the fall in the number of non members, while membership in percentage of total employment remains basically unchanged; the fall is thus determined solely by demographic trends (an ageing population).

Among the different categories of workers, the increase is stronger for public sector employees, who are supposed to fully catch up on their current (almost null) participation, due to the delay with which pension funds for civil servants are being designed (the first scheme only started operating in 2005) (Graph 2).

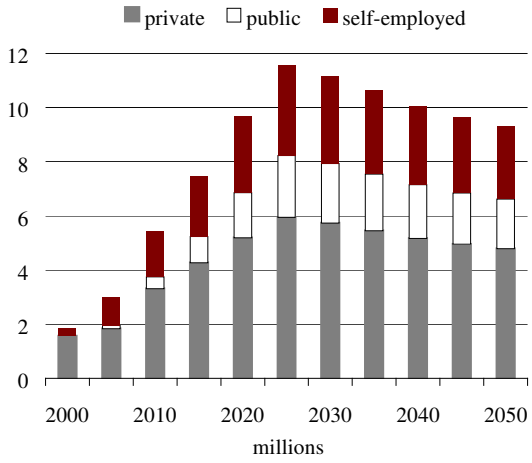
Graph 1 - Pension funds' membership



Millions; the sum ot the two components is the total number of employed

[10] The percentage, amounting to 49% in 2025, is lower than the assumed membership rate for the three categories of workers considered because here at the denominator we are considering all persons in employment, even part-time employees and those on fixed-term contracts, as well as workers below or above the 25-64 year age bracket, who are assumed not to participate to private pension schemes.

Graph 2 - Pension funds' membership by category



3.2 Contribution flows

The annual flow of contributions to pension funds increases at significant rates until 2025, as a result of growth in membership and because the average income of fund members (on which the contribution is calculated) in the first half of the simulation period is assumed to be higher than the average income of non members (for the same type of employment and age band).

When membership stabilizes as a ratio of total employment (2025), the growth rate for inflows slows down; in fact demographic and employment trends offset the effect of income growth, which in any case decelerates. The ratio of contribution flows to GDP rises from a modest 0.31% in 2005 to a maximum in 2025 (1.03%), to then stabilize for the whole second half of the simulation period at levels slightly below 1%.

In addition to receiving contributions, pension funds also liquidates the capital of those entering retirement (transferring it to an insurance company) and reimburse those leaving the scheme. Outflows must therefore also be quantified, being a function of demographic trends, the return on investments and the degree of maturity of the pension system[11]. In the initial years outflows very small (1.9% of contributions in 2010), then they increase exponentially with the system gradually approaching maturity and demographic trends becoming unfavorable, to peak at 122% of contributions (and 0.96% of GDP) in 2045. However, also contributions paid before 2005 must be considered, which implies also considering the gradual decumulation of the assets accumulated

[11] See on this the mathematical Annex.

prior to the start year of the simulation, as those who had already joined private pension schemes enter retirement. Considering this, outflows rise to 28% of contributions in 2010, the difference between the two outflows reducing to zero by 2040, with the exhausting of already accumulated wealth.

The synthesis of these two trends (rapidly growing inflows in the initial years followed by a stabilization, constantly growing outflows) is given by the curve for **net** contribution flows (Graph 3). The annual net flow of 2.9 billion Euro in 2005 will rise to more than 14.5 billion in around 2020 to then fall at a fast pace and become **negative** in around 2040, as result of the demographic crisis, of pension funds gradually reaching maturity and of the higher income of early pension fund members. In terms of GDP, the annual net flow is never greater than 0.62%, but it remains above 0.4% for about fifteen years, between 2010 and 2025.

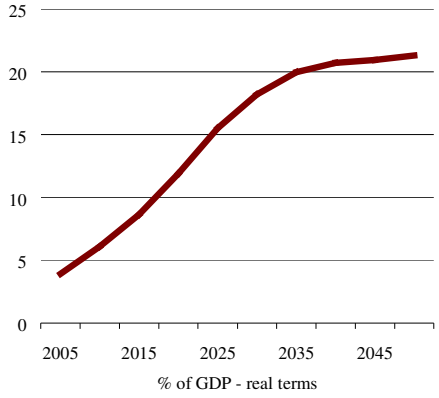
3.3 Wealth accumulation

Pension fund assets (valued at the end of each five-year period) show a marked growth, rising from a modest 3.9% of GDP in 2005 to a more substantial 20% in 2035 (Graph 4); the growth rate decelerates sharply in the following period, coming close to that of GDP itself. It follows that the ratio of assets to GDP (21.3% in 2050) tends to stabilize too.

Changes in the assets accumulated by pension funds are determined not only by net contribution flows, as described in the previous section, but also by returns on assets themselves (the annual net real return rate being assumed constant at 2%). In effects, while in the second part of the simulation period outflows tend to more than offset inflows, the modest increase in the assets to GDP ratio is due to the difference between the return rate and the GDP growth rate, which is around 1% on average in the period.

Graph 3 - Net annual contribution flow to pension funds

Graph 4 - Pension funds' wealth



3.4 The role of insurance companies

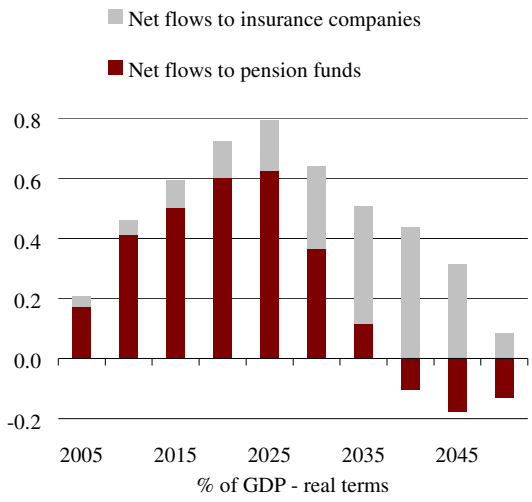
Each worker is assumed to retire at 65, when the wealth accumulated in her/his behalf is used by the pension fund to buy an annuity issued by an insurance company, so that the entire capital flows out of the pension fund and into an insurance company at the moment of retirement. The growth of pension funds therefore translates into a subsequent accumulation of funds by insurance companies.

The growing importance of insurance companies can be seen from Graphs 5 and 6, which show the trends for net flows and asset accumulation for both pension funds and insurance companies. As can be seen from the first, net flows into of insurance companies increase over time until at least 2040 (from 0.03% of GDP in 2005 to 0.44% in 2040), as a result of the increasing maturity of the system in the first half of the period, which brings a growing flow of capital compared to a more modest increase in benefits. This situation changes in the final part of the simulation, when demographic trends and the maturity of the system cause the benefits paid out by insurance companies to grow faster than the assets transferred from the pension funds[12].

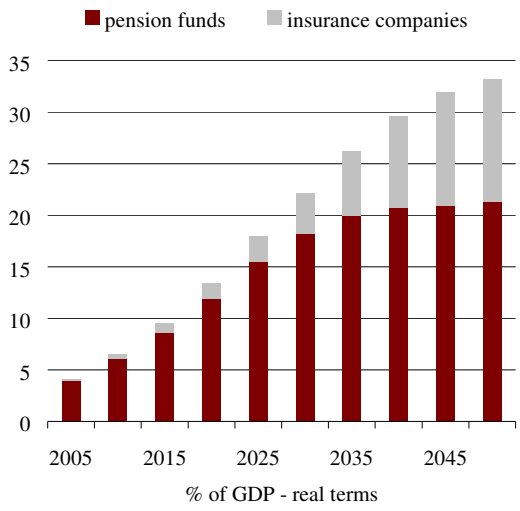
Total assets accumulated by pension funds and insurance companies continue to grow for the entire simulation period, although at a decelerating rate (from 4.1% of GDP in 2005 to 22% in 2030 and to 33.2% in 2050). Clearly, the distribution of assets between pension funds and insurance companies changes over the years in favor of the latter: while insurance companies account for less than 5% of total accumulated assets in the first part of the simulation period, this proportion increases as time goes on and reaches 36% of total assets in 2050.

[12] Net flows into insurance companies become negative in a scenario which extends beyond 2050, just as net flows into pension funds, and this is consistent with the mathematical model in the Annex, under the given assumptions for GDP growth and interest rates.

Graph 5 - Net annual resource



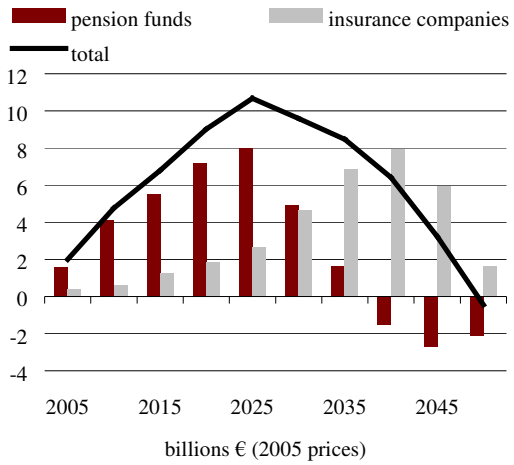
Graph 6 - Total assets



3.5 Contribution flows into the domestic and EMU area financial markets

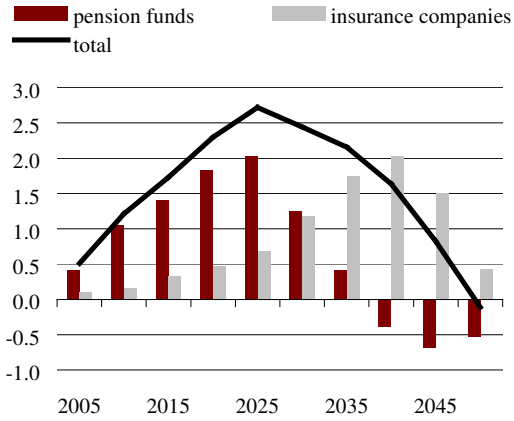
The flow of contributions invested in equities on the domestic market depends on the net contribution flow for the two components (pension funds and insurance companies) and on the assumptions made for the allocation of their respective assets. Under our assumptions, the net flow into equity markets reaches its peak in 2025, with almost 7 billion Euro (at 2005 prices) invested in equities; of this, 350 million at the most is destined to the home market, while slightly less that 2 billion are invested in the overall EMU area. The flow towards debt securities is greater and tops at almost 11 billion Euro in 2025, a quarter of which invested in Italian bonds (2.7 billion Euro) and 8.3 billion allocated in the overall EMU area (Graphs 7-10).

Graph 7 - Net annual resources invested in debt securities



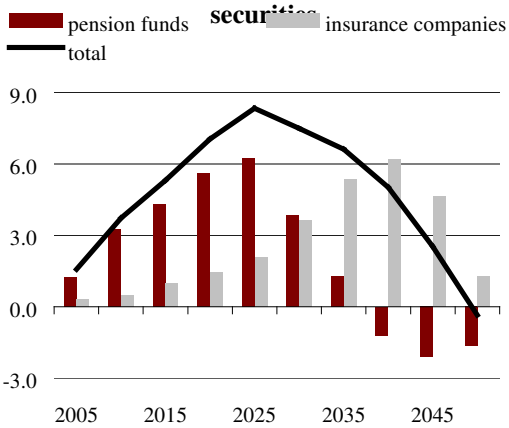
billions € (2005 prices)

Graph 8 - Net annual resources invested in Italian debt securities



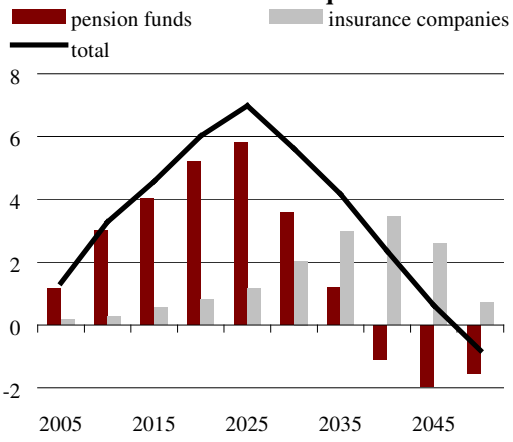
billions € (2005 prices)

Graph 8a - Net annual resources invested in EMU area debt securities



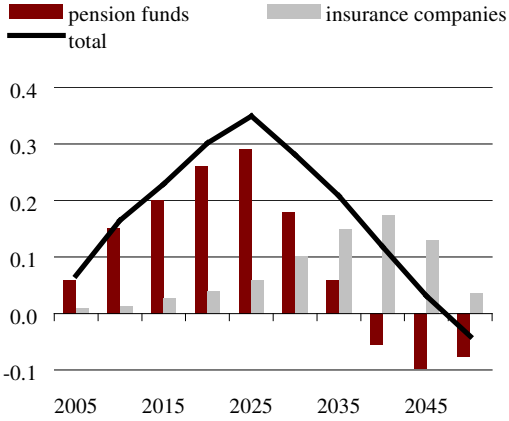
billions € (2005 prices)

Graph 9 - Net annual resources invested in equities



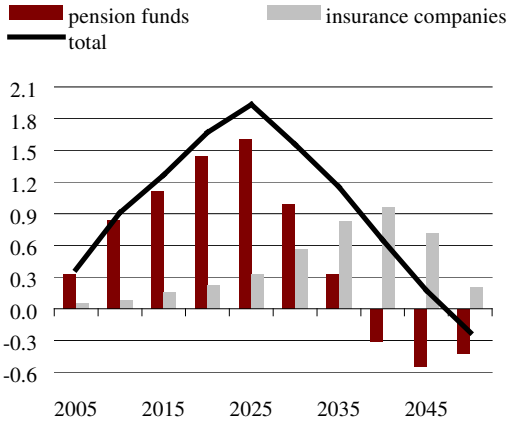
billions € (2005 prices)

Graph 10 - Net annual resources invested in Italian equities



billions € (2005 prices)

Graph 10a - Net annual resources invested in EMU area equities



billions € (2005 prices)

3.6 Some qualifications

A few caveats must be added to this summary of the results.

Firstly, it must be stressed that the specific asset accumulation in pension funds and insurance companies examined here not necessarily reflects **new** accumulation, often rather representing a different allocation of **already existing** wealth. The passage of private sector workers' TFR to pension funds in particular, which constitutes the entire contribution that we have hypothesized for such category, basically consists of a different (and probably more efficient) allocation of compulsory saving, already existing and currently managed by firms. The part that could derive from authentically new saving is probably limited to that associated with contributions from the self-employed (amounting to 5% of their incomes) or the additional contribution of public sector employees (2%). It is nevertheless very likely that at least a part of these will also reflect a mere reallocation of wealth currently held in particular in real estate and investment funds.

A second point is worth signaling concerns public sector employees. The contribution rate we assumed actually turns out to be 8.91%, which is higher than for the other categories. However, the TFR component of their income is only virtual and is not really transferred from the public employer to pension funds, being rather transferred at the moment of retirement (the final capital being calculated on the basis of returns on a portfolio of pension funds). Thus, for public employees, only a 2% contribution is assumed to flow into pension funds during their working lives, while the entire 8.91% flows towards insurance companies when they retire.

Another point must be stressed once more is the **distinction** between the roles of **pension funds** (which in our model also include pension insurance policies) and **insurance companies** (which here are considered only as issuers of annuities): pension funds receive contributions from their members and invest the accumulated wealth on financial markets to generate returns that increase the value of members' capital. When each individual retires, pension funds transfer her/his accumulated wealth to an insurance company, which in exchange takes charge of the payment of the pensions, through annuities.

It must also be considered that our simulation concentrates on a period (45 years) in which the accumulation dynamics is determined above all by the gradually increasing diffusion of pension funds. Thus their wealth continue growing, although the growth rate strongly decelerates in the simulation final years. However, in our same framework in the following period (around 2070) the system would become fully operational and the assets of pension funds (as those of insurance companies) would stabilize in terms of GDP at levels not very different (20%) from those reached

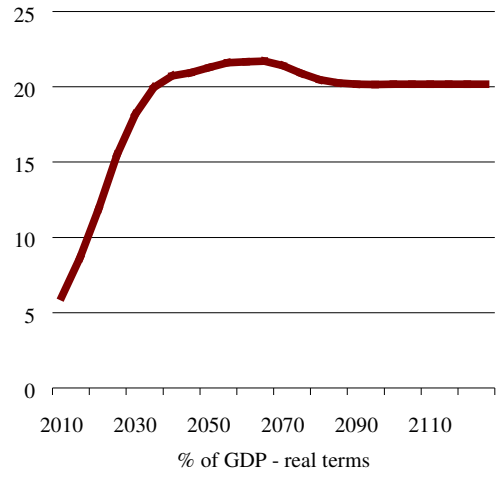
in 2050, as shown in Graph 11[13].

Finally, when reasoning about the impacts of private pension provision on **financial markets**, it must be remembered that it is not possible to reason in terms of the effects on the domestic market only. Although we take into account an home (as well as currency) bias in the allocation choices (French and Poterba 1991), pension funds' horizon needs necessarily to be worldwide. Thus:

1. pension funds' growth has an effect on all financial markets, and not just the domestic one (possibly with the exception of the USA and the UK, where pension funds' portfolios are strongly biased in favor of domestic securities);

2. while the Italian financial market may benefit from the global growth of the pension fund industry, to count on Italian pension funds as a substantial source of resources for the Italian financial market itself may be fruitless in a long term perspective.

Graph 11 - Pension funds' wealth in the long term



[13] The long term properties of the model are presented in the mathematical Annex. In the actual simulation, the long run scenario presented in Graph 11 has been built leaving all parameters constant as of 2050 and making population size and structure gradually converge on a long run equilibrium. This equilibrium has been built assuming that the size of the first age cohort considered (15-19 years) remains constant from 2050 onwards and that cohorts' mortality between each five-year age bracket is the same as that implicit in the Eurostat projections for 2045 and 2050. This makes population in our model stabilize and reach long term equilibrium in 2110.

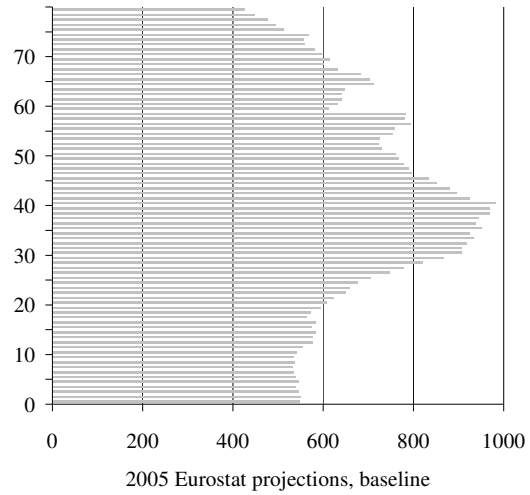
4. The basic simulation scenario

It is now worth looking in more detail at the main features and assumptions of the simulation exercise, starting with the demographic and employment scenario and then considering the macroeconomic framework, pension fund membership rates, earnings, contributions and benefits and finally asset allocation.

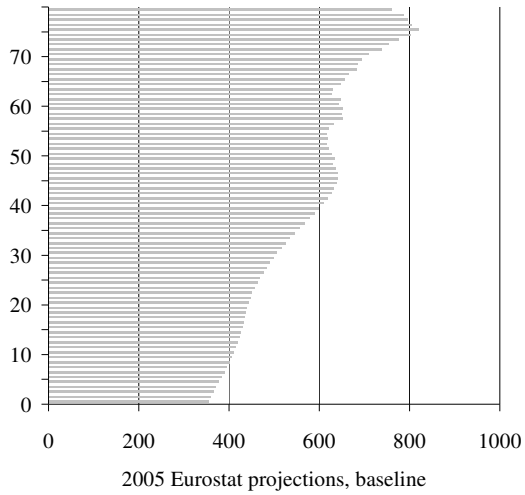
4.1 Demographic and employment trends

The demography is based on the 2005 Eurostat projections (base year 2004, baseline variant – Table 2). The fertility rate will increase[14] in the first part of the period, rising from 1.31 children per woman in 2004 to 1.38 in 2010 and to 1.4 in 2020, where it will remain. It will be therefore at a level well below that of 2.1, which demographers consider is needed to stabilize population size and age structure. Projected life expectancy at birth is assumed to grow, with an increase of 5.5 years for men (from 77.3 in 2004 to 82.8 in 2050) and of 4.6 years for women (from 83.2 to 87.8). Large part of the projected gains in life expectancy will result from lower mortality rates at older ages (thus, an increase in life expectancy at 65). Net migration flows, are assumed to be 150 thousand persons per year, which means an "accumulation" of more than 7 million people between 2004 and 2050.

Graph 12 - Italy population - 2005



Graph 13 - Italy population - 2050



[14] Due solely to the exhaustion of the temporary (statistical) effect on the rate of the current trend to postpone childbearing.

Table 2 - The principal assumptions of Eurostat demographic projections

		2004	2010	2020	2030	2040	2050	*change*
		(children per woman)						
Fertility rate		1,31	1,38	1,40	1,40	1,40	1,40	*0,09*
		(years)						
Life expectancy at birth	*M*	77,3	78,3	79,9	81,1	82,1	82,8	*5,5*
	F	83,2	84	85,3	86,4	87,2	87,8	*4,6*
								cumulated
		(thousands)						
Net migration flows		150	150	150	150	150	150	*7050*

Source: Eurostat 2006

As a result of these assumptions, the Italian population will be smaller and older in 2050: the total is projected to rise from 57.9 million in 2004 to a peak of 58.7 million in 2013 and to then decline to 52.7 million in 2050. Even more dramatic changes will occur to the age structure of the population. In 2004, the large bulges in the distribution were persons of working age, with 40 being the most numerous age cohort. By 2050, an inverted cone shape is evident, reflecting the passage of baby-boomers into their retirement years, increased life expectancy and the effects of prolonged low fertility rates (Graphs 12, 13).

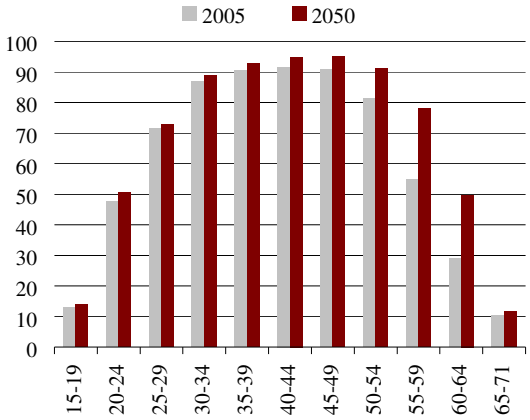
As a consequence, the population between 25 and 64 years (the most likely to become member of a pension fund) will fall from 31.7 million in 2005 to 23.8 million in 2050. Moreover, exit flows from pension funds will start rising relatively early in the simulation, because quite soon very large cohorts (although at the beginning with low seniority in the funds) will start retiring.

The actual number of workers has been obtained by multiplying labor forces by employment rates, based on calculations by the Ageing Working Group of the Economic Policy Committee (Economic Policy Committee, 2005). These projections assume an increase in employment rates, especially for women and the older workers (between 55 and 64 years) (Graphs 14, 15). These are the result of social factors (such as longer schooling of young cohorts or changes in the role of women in households), demographic factors (such as the changes in age structure), institutional factors (disappearance of early retirement schemes and changes in the minimum retirement age thresholds), economic factors (such as the level of the unemployment rate, part-time employment as a percentage of total employment or the share of the services sector in the economy).

The falling numbers of people of working age (between 15 and 64 years, starting to decrease in 2010) and the growing employment rates have strong and opposite effects on the number of persons in employment, which, as a whole (also considering the marginal contribution of the over 65's) will

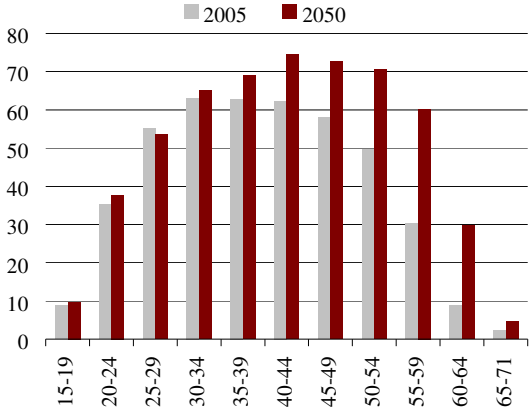
increase till 2015 and fall sharply since 2025 (Graph 16, Table 3). Between 2015 and 2025 only a moderate fall emerges, thanks to the increase in female employment, determined by higher participation despite unfavorable demographic trends. But also female employment will start to decrease since 2025, which will reinforce the fall in total employment generated by the male component.

Graph 14 - Italy - Employment rates - Men



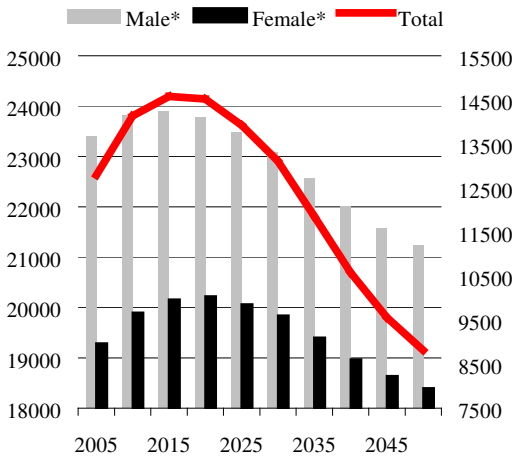
% - 2005 Ageing Working Group projections

Graph 15 - Italy - Employment rates - Women



% - 2005 Ageing Working Group projections

Graph 16 - Italy - Employment



thousands; (*) right scale

Table 3 - The principal assumptions and results of AWG macroeconomic projections

% annual average growth

	2004-10	2011-20	2021-30	2031-40	2041-50	2004-50
Projected potential growth rates	1,9	1,8	1,2	0,8	1,1	1,3
Determinants						
Employment	1,1	0,2	-0,5	-0,9	-0,6	-0,2
Labour productivity	0,7	1,6	1,7	1,7	1,7	1,6
Determinants of labour productivity						
TFP	0,5	1,1	1,1	1,1	1,1	1,0
Capital deepening (contribution in %)	0,2	0,6	0,6	0,6	0,6	0,5

Source: Economic Policy Committee 2005

4.2 The macroeconomic framework

Since 2015-2020, given the falling labor force and employment, GDP growth will only originate from labor productivity growth, which should more than compensates for the reduction in the number of workers.

As for employment rates, also productivity growth rates are taken from the projections of the Economic Policy Committee (Economic Policy Committee 2005). These assume that on the long run (at the end of the projection period) the annual labor productivity growth rate converges to 1.7%, the historical EU-15 average in the period 1975-2004. In the intermediate period, projections are based on a production function approach and on assumptions about total factor productivity growth and capital stock developments; furthermore, they also take into account the effect of population growth on labor productivity in the medium run, through changes in capital intensity (Table 3)[15].

As regards to the real rate of return, we assume a rate of 2% per year over the entire period, net of administrative costs and taxation of returns on pension funds. This figure is consistent with the 3% real return assumed at EU level, an inflation rate of 2% and a taxation of pension fund (nominal) financial returns at 11%, as is the current rule in Italy (Social Protection 2006, Economic Policy Committee 2005). Financial returns are thus assumed to be higher than the real growth rate of GDP, which is consistent with the assumption of a positive intertemporal discount rate.

[15] Potential GDP can be represented using a production function which combines factor inputs and multiplies by total factor productivity (TFP), which establishes the technological level. The potential output is calculated over the long run using time series methods to extrapolate short-term developments and a combination of specific assumptions for the longer term. Over the medium run (until 2009), the projection for TFP growth and the growth in capital per worker (capital deepening) are the key drivers of projected labour productivity. In the long run, the economy should reach its steady state equilibrium, where the ratio of capital stock to labour (in efficiency units) remains constant over time. Therefore, in the long run (2010-2050), the growth in labour productivity (output per employed person) roughly coincides with TFP growth divided by the labour share (i.e. the share of labour costs in total value-added).

4.3 Pension fund membership

Given demography and employment trends, pension fund membership can be derived looking at the employment structure and assuming some participation rate to private schemes. As said, private sector employees, public sector employees and self-employed are considered separately, also distinguishing by gender.

Only employed persons between the ages of 25 and 64 have been considered; in other words, it was assumed that very young workers (under 25) and very old workers (over 64) will not be members of pension funds; the former because it is not very likely that they will have the money and the job security to pay supplementary pension contributions so early in their working lives; the latter because they have already reached the age for the right to an old age pension from the public sector pension system. Within this 25-64 age bracket it is assumed that (active) membership rates[16] are equal for each 5-year age group, and that they are greater for males than for females.

Also, it is assumed that some individuals abandon the scheme before reaching 65 (5% of members each 5-year period), cashing in their savings (as allowed by the law to buy a first home or to meet unemployment or extraordinary health expenses) and being replaced by others belonging to the same cohort.

Among private sector employees, only full time employees on permanent contracts have been considered, since it is likely that, mostly, pension fund membership will only concern them.

As we are focusing on a subset of total employment (as said, with regards to both age and the type of employment contract), we set initial values from membership rates (in 2000 and 2005) generally higher than those reported by COVIP (the Italian private pension authority), which refer instead to a larger population. Indeed, as opposed to what is commonly thought, at least for private sector employees current pension fund membership rates are **low** but **not extremely low** once those groups which would find it difficult to join private schemes are excluded from the potential membership base.

This also suggested to consider as baseline scenario one were pension fund membership rates growth linearly rather than exponentially. In any case growth is assumed to be substantial till 2025, while thereafter membership rates are assumed to be constant (Table 4).

For private sector employees the increase of participation is assumed to be very high (15%) in the first five-year period of the projection (from 25% to 40% for males, from 15% to 30% for females),

[16] *Active* membership refers to the period where an individual pays contributions, while passive membership refers to the period where she/he receives the benefits.

as a consequence of the silent-consent mechanism introduced by the 2004 reform. Thereafter membership is assumed to rise by 10 points every 5-year period till 2025, since when it stabilizes at 60% and 70% respectively for males and females.

Membership growth is assumed to be particularly marked for public sector employees. There have been substantial delays in setting up supplementary schemes for this category of workers, due to the pay-as-you-go financing of their TFR and the effects on the public budget of the additional employer contributions that should be injected into the system[17]. As a result, the first pension fund for public sector employees (for school workers) didn't start to operate until 2004 and this explains the low initial membership rate considered (Table 4)[18]. Thereafter, membership is assumed to increase moderately in the first period (by 8 and 10 points respectively for females and males between 2005 and 2010) and then to accelerate (+15% in the following five years and +20% in the subsequent decade) to reach 70% for males and 65% for females from 2025 onwards.

As concerns self-employed workers, growth in participation is assumed to be not too different from that assumed for public sector employees, with a more moderate increase between 2005 and 2015 and a similar growth subsequently, with the result that in 2025 and thereafter membership rates will be 10% less than for private sector employees.

Table 4 - Membership rates (baseline scenario)
% (for workers aged 25-64 years)

		2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Private employees full time on permanent contracts	Male	25	40	50	60	70	70	70	70	70	70
	Female	15	30	40	50	60	60	60	60	60	60
Public employees	Male	5	15	30	50	70	70	70	70	70	70
	Female	2	10	25	45	65	65	65	65	65	65
Self-employed	Male	20	30	40	50	60	60	60	60	60	60
	Female	15	23	30	40	50	50	50	50	50	50

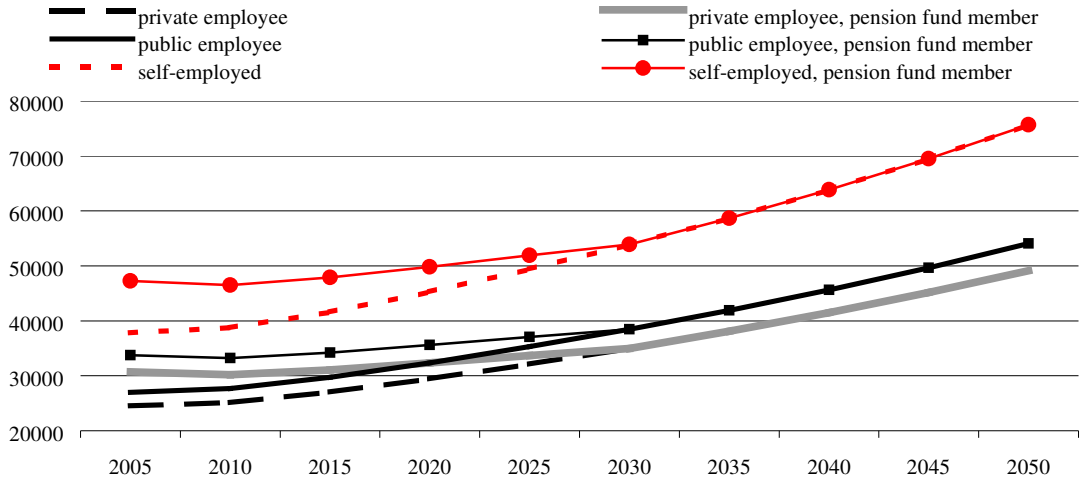
[17] See Sections 2 and 3 above and Reforme (2005).
[18] Table 4 also takes into account that a certain number of public sector employees appears having bought pension insurance policies in the most recent years.

4.4 Earnings

The model considers the wage of the Average Production Worker (APW), as calculated by the OECD for 2004, as a baseline. It is assumed that this applies to private sector employees in the 45-49 age group, while for public sector employees and the self-employed the average income is set higher by 10% and 40% respectively. An individual career profile has also been considered, with a career component which adds 0.5 percentage points per year to the productivity growth rate (see section 4.2).

However, particularly in the first phase of pension funds' growth, the income of members is likely to be substantially greater than the average, the two values tending to converge as membership expands; consequently, in the absence of detailed data on pension fund members' income, this has been set, for each of the three categories considered, at 1.25 times the average in 2005, the difference decreasing by 5 percentage points every 5-year period until convergence is achieved (Graph 17).

Graph 17 - Annual income for age group 45-49



4.5 Contributions and benefits

In order to evaluate annual flows into pension funds, an assumption must be made concerning individual contribution rates as a percentage of earnings. In the baseline scenario the contribution rates remain unchanged for the whole of the simulation period at 2005 levels, with the exception of self-employed workers (for whom the rate is increased from 3% to 5% in 2010). The rate for private sector employees is set at 6.91%, the same as the annual contribution to the TFR, all of which

would flow into private pension schemes.

As said, the contribution deriving from public sector employees' TFR is not considered as flowing into pension funds because it is "virtual": it is only paid at the moment of retirement (the amount due being estimated on the basis of the average return of a portfolio of pension funds) and may therefore be thought of as flowing directly to the insurance companies which issue the annuities. However, a further "real" contribution of 2% has been considered for public sector employees: this corresponds to the additional contribution that the public sector employer and the employees must make on the basis of the existing collective agreements establishing pension funds.

On reaching 65 years of age, pension fund members stop making contributions and, as said, the pension funds transfer the accumulated assets to insurance companies which will pay the pensions to the retired (passive) members. Annuities are assumed to be actuarially fair and paid on a deterministic basis for 5 periods (25 years).

4.6 Asset allocation

The assumptions made with regard to the allocation of pension funds' and insurance companies' assets take the following into account:

- the actual current composition of the financial portfolios of pension funds and insurance companies, as taken from official sources (COVIP, Bank of Italy);
- an hypothetical balanced portfolio, representative of a typical asset allocation;
- the home country bias (French, Poterba 1991, Tesar, Werner 1992), which in the long run will remain important not only for Italy but also for the whole Euro area.

Portfolios in Italy at the start of the simulation period are characterized by a high degree of prudence: bonds account for more that two thirds of the total, both for pension funds and for insurance companies. It was therefore assumed that, to reach a more balanced position with regards to equities, closer to what could be considered the general attitude in more mature private pension systems at the international level, the future cash flows will be invested into equities in a higher proportion than today.

More specifically, it was considered a "typical" pension fund portfolio as containing a balance of equities, bonds and liquidity in a ratio of 40:55:5 respectively. This allocation might be assumed as a point of arrival in view of the convergence between the portfolio composition of pension funds in more equity oriented countries (UK, USA) and in more bond oriented countries (Europe above all, Japan). In was then assumed that net **flows** invested in equities are immediately adjusted to the level

of the equilibrium portfolio (40% as already stated).

As for the allocation of investments in equities to different markets, a distribution was hypothesized which replicates the importance of the different markets as taken from a global equity index (the benchmark chosen was that of the MSCI All Country World index). Since the relative importance of different equity markets is calculated on the basis of market capitalization, this distribution "penalizes" (or underweights) countries which today have relatively poorly developed equity markets such as Italy, which accounts for less than 2% of the world market on this basis. This factor is partly corrected by assuming that a substantial home country bias persists over time (the assumption actually adopted triples the proportion of Italian equities as compared to the benchmark portfolio). The small importance, above all in the long run, of "regional" markets such as the Italian one suggested adopting a substantial country bias also for the overall Euro area (which doubles its importance with respect to the benchmark, raising it from 14% to around 28%).

The distribution of investment flows into bonds follows the same rules adopted for equities: the benchmark employed is the JPM Global Bond Index, while the country and EMU area bias are the same.

Table 9 in Section 5 below shows in detail the allocation of flows hypothesized, separately for pension funds and insurance companies. For these last, it was assumed that investments would follow relatively more prudent policies (only 30% in equities), in line with their function of guaranteeing the payment of annuities to pensioners.

Investment flows of quite some size result from this set of assumptions, peaking at almost 18 billion Euro in 2025 (7 allocated in equities, 11 in bonds). Of these, 3 billion are destined to "domestic" securities. The flow into Italian equities, however, remains relatively small, amounting to about 350 million Euro, a very modest figure compared to the current market capitalization of listed Italian companies (greater than 730 billion Euro). Moreover, as seen, the figures for investment flows substantially fall after the peak, as net inflows decelerate till becoming negative around 2050.

If it is considered that, in any case, part of the investment flows originate from a mere reallocation of existing savings, it is easy to understand that it would be unrealistic to place too much trust in pension funds to drive the growth of the domestic financial market. More important benefits would rather come in the eventuality of a stronger growth of pension funds in all developed countries, as the Italian market would in this case receive a share of global pension savings that, although modest in absolute terms, would be substantial in relation to the size of our market.

Nevertheless, it should be stressed, as last point, that the outstanding assets of pension funds and insurance companies undergo substantial growth in the simulation, even if they are small in

comparison with that recorded in other industrialized countries when private provision was set up in periods when demographic trends were more favorable. In fact, as seen above in Graph 6, they would reach 34% of GDP in 2050, while in the very long run (see note at the end of Section 3 and Graph 11 above) they would peak at 35% of GDP in 2075 and then stabilize around 30% (20% due to pension funds, 10% to insurance companies).

5. Alternative scenarios and sensitivity analysis

In this section the results of simulations performed using alternative assumptions to those employed for the baseline scenario are presented. The sensitivity analysis looks at the following dimensions:

a) pension fund membership rates;

b) contribution levels;

c) the macroeconomic scenario;

d) the asset allocation of pension funds and insurance companies.

5.1 Membership rates

As seen above, a substantial increase was assumed in the baseline scenario for private scheme membership rates, which are supposed to rise up to 2025 and then to stabilize at the highest levels as a ratio of total employment. A similar path is considered in the two alternative scenarios (high and low) but to different degrees (Table 5).

Higher membership rates are considered in the high scenario: the difference with respect to the baseline is 3% in 2010 for each category of workers, and increases by 3% every five years to reach 12% in 2025. The mechanism in the low scenario is the same, but the difference is negative (i.e. membership rates are 12% lower in 2025 than in the baseline).

Results are reported in Graphs 18-23 and in Tables A1-A4 at the end.

The first dimension on which these different assumptions have an impact is obviously the number of pension fund members. While the maximum (reached in 2025) was 11.6 million in the baseline, accounting for 49% of total employment, it rises to 13.8 million in the high scenario, or 58% of total employment. The picture for the low scenario is the opposite, with membership which does not exceed 9.4 million in 2025 and the percentage on total employment which remains below 40% (Graph 18).

As a consequence, also net annual contribution flows to pension funds are different: while these

reached 0.62% of GDP (in 2025) in the baseline, they rise to 0.78% of GDP in the high scenario, while remaining below 0.47% in the low scenario (Graph 19). The difference is more pronounced in the middle part of the simulation, when the asset accumulation is substantial. In the final phase, on the other hand, the greater (lower) benefits that must be paid in the high (low) scenario, due to the higher (lower) membership, offset the higher (lower) contributions paid by active members; it follows that the difference in terms of net flows becomes minimal (a total difference of -0.02% of GDP between the high and low scenarios in 2045).

The differences in net contribution flows also determine differences in the wealth accumulation under the various scenarios: while pension funds' assets stabilize at approximately 20% of GDP (21.3% in 2050) in the baseline, they run at a level 5 points higher in the high scenario (25.4% of GDP in 2050) and at a lower level in the low scenario (17.2% of GDP in 2050) (Graph 20).

Net flows to insurance companies perform similarly to net flows to pension funds, although with a lag. They top at 0.44% of GDP in 2040 in the baseline, falling in subsequent years (0.08% of GDP in 2050 with negative values thereafter). In the high scenario the maximum, again in 2040, becomes 0.53% of GDP, which falls to 0.35% in the low scenario (Graph 21).

As for annual net investment flows, given the assumed portfolio allocation, in the baseline they peak in 2025 at 7 billion Euro and at 10.7 billion Euro respectively for equities and debt securities. Such maxima rise to 8.6 and 13.1 billion Euro in the high scenario, falling instead to 5.3 and 8.3 billion Euro in the low scenario (Graphs 22, 23).

Table 5 - The alternative scenarios: participation rates

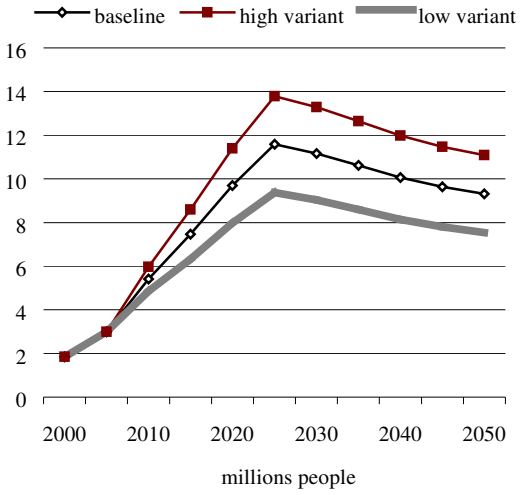
Pension fund membership in % of the workers of the cathegory

Base case		2005	2010	2015	2020	from 2025
all workers 15-24 and 65-74		0	0	0	0	0
all part time or temporary contract employees		0	0	0	0	0
private employees	Male 25-64	25	40	50	60	70
	Female 25-64	15	30	40	50	60
public employees	Male 25-64	5	15	30	50	70
	Female 25-64	2	10	25	45	65
self-employed	Male 25-64	20	30	40	50	60
	Female 25-64	15	23	30	40	50

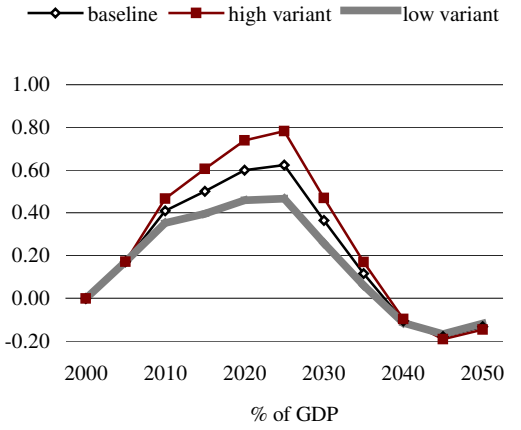
High variant: each increase adds 3 points		2005	2010	2015	2020	from 2025
all workers 15-24 and 65-74		0	0	0	0	0
all part time or temporary contract employees		0	0	0	0	0
private employees	Male 25-64	25	43	56	69	82
	Female 25-64	15	33	46	59	72
public employees	Male 25-64	5	18	36	59	82
	Female 25-64	2	13	31	54	77
self-employed	Male 25-64	20	33	46	59	72
	Female 25-64	15	26	36	49	62

Low variant: each increse is 3 points less		2005	2010	2015	2020	from 2025
all workers 15-24 and 65-74		0	0	0	0	0
all part time or temporary contract employees		0	0	0	0	0
private employees	Male 25-64	25	37	44	51	58
	Female 25-64	15	27	34	41	48
public employees	Male 25-64	5	12	24	41	58
	Female 25-64	2	7	19	36	53
self-employed	Male 25-64	20	27	34	41	48
	Female 25-64	15	20	24	31	38

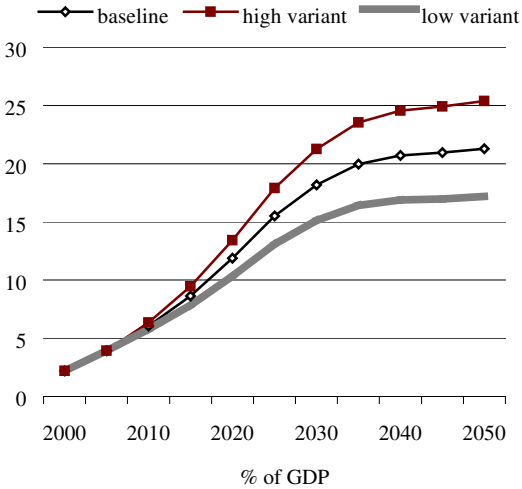
Graph 18 - Membership



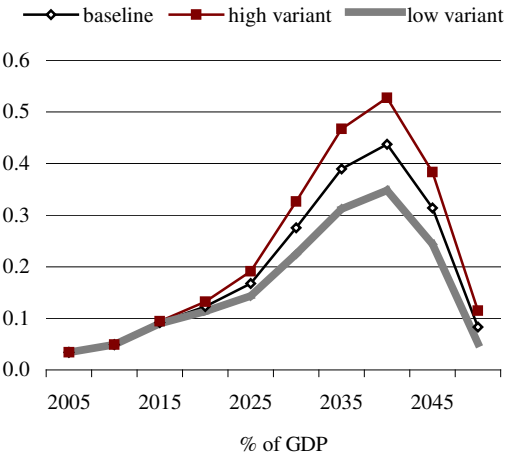
Graph 19 - Net annual contribution flow to pension funds



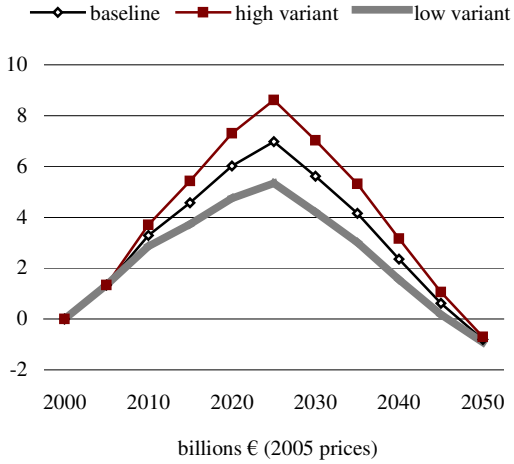
Graph 20 - Pension funds' wealth



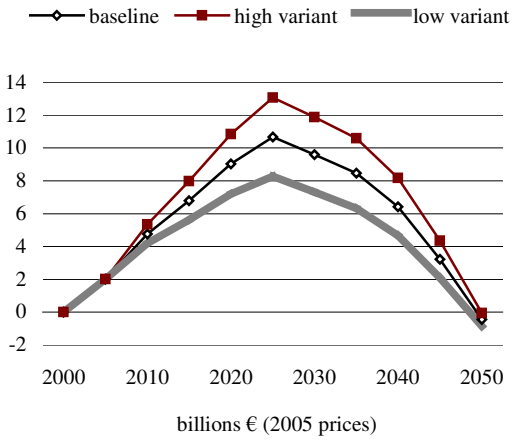
Graph 21 - Net annual resource flow to insurance companies



Graph 22 - Net annual resources invested in equity securities



Graph 23 - Net annual resources invested in debt securities



5.2 Contribution rates

In this case one assumes different trends for contribution rates, as shown in (Table 6).

In the baseline contribution rates were considered stable at 6.91% for private sector employees and at 2% for public sector employees (plus the TFR, accounted for virtually and paid to insurance companies when workers retire). For the self-employed, contribution was assumed rising from 3% to 5% between 2005 and 2010 and constant thereafter.

In the high scenario we now assume a bigger increase for self-employed workers (whose contribution is set at 6% from 2010 onwards) as well as higher rates for both private and public sector employees. The contribution rate for the former rises from 6.91% to 9.35% since 2010; the rate for public sector employees is set at 2.44% (plus the TFR), which when added to the TFR amounts to precisely 9.35%, the same as the rate assumed for private employees[19].

In the low scenario, instead, contribution rates remain stable at 2005 levels for public sector employees and self-employed workers, while falling since 2010 at just 5% for private sector employees. Furthermore, also the TFR rate for public sector employees falls from 6.91% to 3%, so that their total contribution sums to 5% too[20].

Results are reported in Graphs 24-28 and in Tables A5-A7 at the end.

While membership is identical in the three scenarios, net annual contribution flows into pension funds are higher (lower) in the high (low) scenario in the middle part of the simulation period, when accumulation predominates (Graph 24). At the peak (in 2025) net contributions reach 0.83% of GDP in the high scenario, with a difference of 0.21 points with respect to the baseline; in the low scenario the peak becomes 0.41% of GDP, half the level reached in the high scenario, and 0.22 points below the baseline.

However, notice that in the final part of the simulation, when the liquidation of assets prevails (paid to insurance companies) the negative net contribution flows to pension funds is less in absolute value in the low (-0.13% of GDP in 2045) than in the high scenario (-0.22% of GDP).

As consequence of the higher (lower) contributions paid in the high (low) scenario, also asset

[19] 9.35% is currently the average contribution of private employees hired after 1993 who decide to contribute to a pension fund established through an employer - trade union agreement. The law requires such worker to contribute with the entire TFR, and the agreement to foresee additional contributions (charged to both the employee and the employer) in order to exploit tax benefits. The new decree on silent-consent however only involves TFR, not additional contributions (although it does not exclude such eventuality). Accordingly, in our base scenario we only assumed a contribution rate equal to the TFR. See Reforme 2005 for more on this.

[20] 5% corresponds to the current average contribution paid by private sector employees hired before 1993 who decide to contribute to a pension fund established through an employer - trade union agreement. As opposed to those hired after that year, these workers need to contribute with just half of their TFR (to which an additional contribution must be added in order to exploit tax benefits).

accumulation reaches higher (lower) levels (Graph 25). In the high scenario pension fund wealth stabilizes at more than 25% of GDP (27.4% in 2050), 6 points above the baseline and more than 12 points above the level reached in the low scenario (where assets in 2050 are below 15% of GDP).

Net flows to insurance companies (Graph 26) peak at 0.44% of GDP in 2040 in the baseline; the performance is similar, although at higher and lower levels, in the alternative scenarios (peaks at 0.55% of GDP in the high scenario and at 0.27% in the low).

As a consequence of these different flows, the difference in the amount invested by pension funds and insurance companies in equities and debt securities is not negligible, at least in the middle section of the simulation period (Graphs 27, 28). In the high scenario a maximum net flow (in 2025) of 9.2 billion Euro per year will be invested in equities, which falls to 4.6 billion in the low scenario (compared to 7 billion in the baseline). Annual flows invested in debt securities will top at 14 billion Euro per year in the high scenario and at just 7 billion in the low scenario.

Table 6 - The alternative scenarios: contribution rates

Contribution rate to private pension funds in % of gross earnings

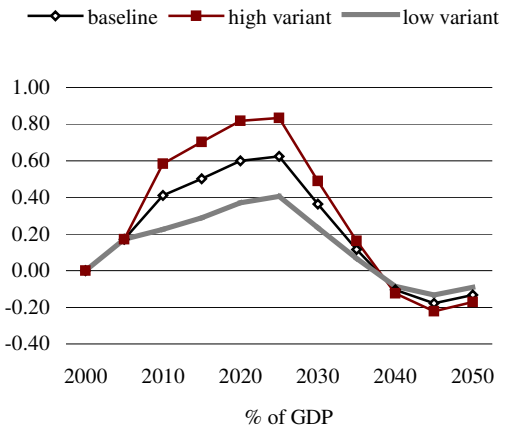
Base case		**2005**	**from 2010**
private employees		6.91	6.91
public employees [(1)]	additional contrib	2	2
	TFR	6.91	6.91
self-employed		3	5

High variant		**2005**	**from 2010**
private employees		6.91	9.35
public employees [(1)]	additional contrib	2	2.44
	TFR	6.91	6.91
self-employed		3	6

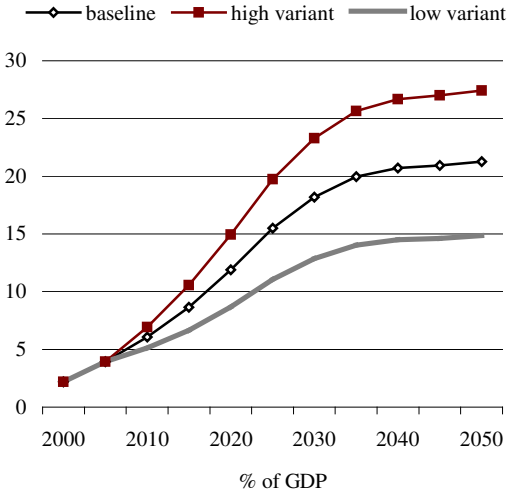
Low variant		**2005**	**from 2010**
private employees		6.91	5
public employees [(1)]	additional contrib	2	2
	TFR	6.91	3
self-employed		3	3

[(1)] For civil servants one has to remember that contribution coming fromt the TFR is "virtual" in that is liquidated to the pension fund only at the moment of retirement (although an interest rate is recognised equal to the one on a portfolio of funds). The pension fund thus should get the money and immediately turn it to the insurance which issues the annuity.

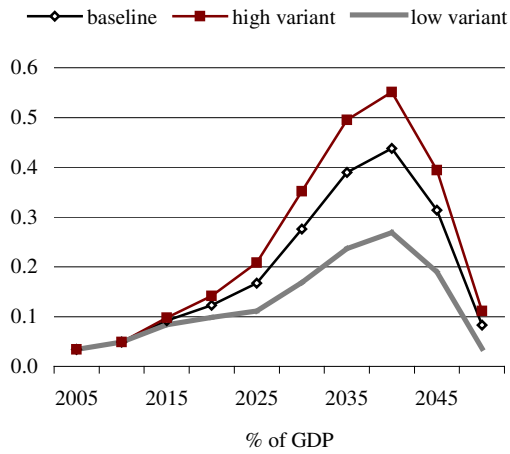
Graph 24 - Net annual contribution flow to pension funds



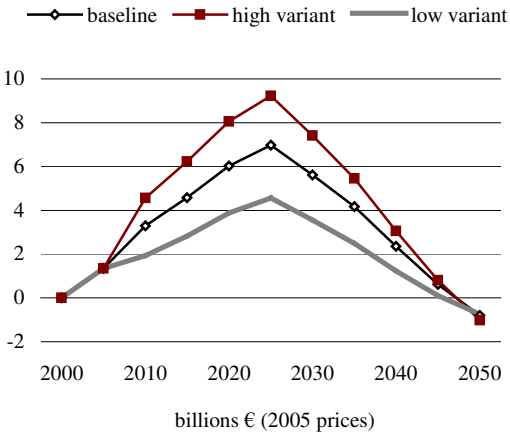
Graph 25 - Pension funds' wealth



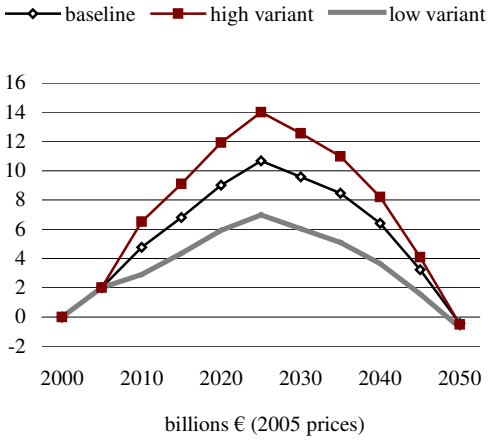
Graph 26 - Net annual resource flow to insurance companies



Graph 27 - Net annual resources invested in equity securities



Graph 28 - Net annual resources invested in debt securities



5.3 The macroeconomic framework

Two exercises were performed to analyze sensitivity of the results to macroeconomic variables. The first assumes a different trend for productivity, while the second considers alternative assumptions on real rates of return on pension funds' and insurance companies' investments.

5.3.1 Average annual GDP growth is around 1.5% for the first twenty years in the baseline scenario; it then decelerates to around 1%. Part of this performance is the result of the demographic and employment trends considered, which here remain unchanged; the remaining part, on the other hand, is determined by labor productivity trends, which now change. In particular, here we examine the effects of assuming an annual growth rate of productivity 0.25% higher or lower than in the baseline (Table 7).

Results are reported in Graphs 29-33 and in Tables A8-A10 at the end.

Generally, few differences are observed in terms of contribution flows as a percentage of GDP. In fact, while there is more (less) growth in income in the high (low) scenario and therefore in contributions, this also affects GDP, so that basically no changes in the ratios result. This also shows in the wealth accumulation, which is very similar in all three cases (20.6%, 21.3% and 22% of GDP in 2050 in the high, baseline and low scenarios respectively) (Graph 29).

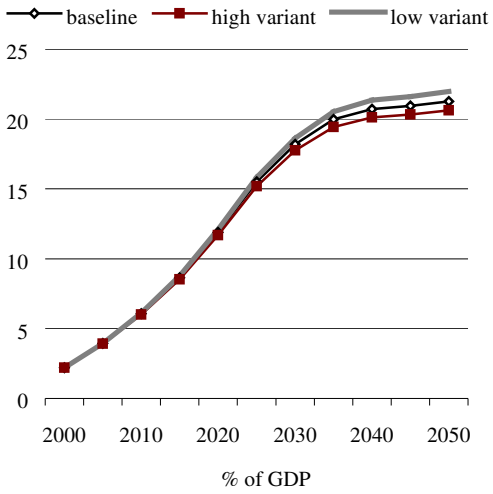
As concerns net contribution flows in % of GDP, some difference is seen in the second half of the simulation period, with less negative values reached in the high scenario than in the baseline (vice versa in the low scenario) (Graph 30). Net resource flows to insurance companies only show marginal differences in terms of GDP in the three cases for the entire simulation period (Graph 31).

The differences in net contributions invested in debt securities and equities (Graphs 32, 33), which are greater in the decumulation phase, replicate those already observed for net flows.

Table 7 - The alternative scenarios: productivity growth

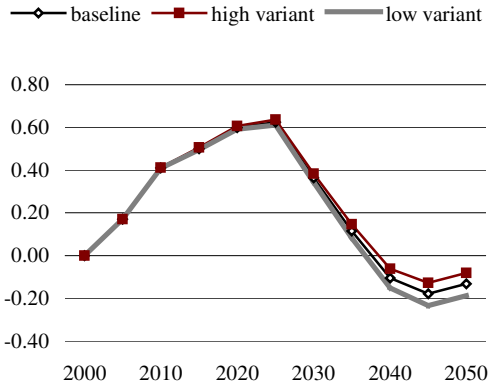
		2005	2010	2015	2020	onwards
Annual growth rate of labour productivity	base scenario	-0,72%	1,17%	1,67%	1,75%	…..
	high scenario	0,25% more in each year from 2005				
	low scenario	0,25% less in each year from 2005				

Graph 29 - Pension funds' wealth



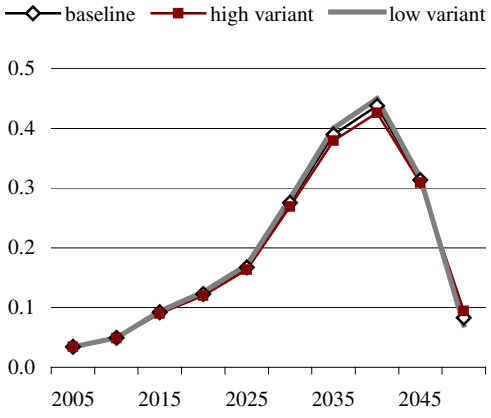
% of GDP

Graph 30 - Net annual contribution flow to pension funds



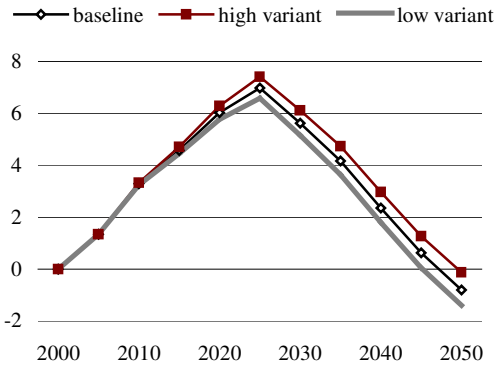
% of GDP

Graph 31 - Net annual resource flow to insurance companies



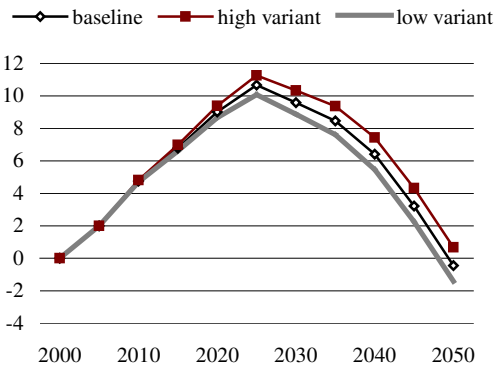
% of GDP

Graph 32 - Net annual resources invested in equity securities



billions € (2005 prices)

Graph 33 - Net annual resources invested in debt securities



billions € (2005 prices)

5.3.2 In the second exercise the real return rate on pension funds' and insurance companies' assets was varied. It stood at 2% in the baseline; it was set at 3% (for the whole simulation period) in the high scenario and at 1% in the low scenario (Table 8).

Results are reported in Graphs 34-38 and in Tables A11-A13 at the end.

In this case, as opposed to the previous, the differences observed in the results are not negligible. Pension funds' wealth increases much more in the high scenario, given the higher return on invested assets: the pension funds' assets to GDP ratio becomes 24.2% in 2050, more than 5 points higher than in the low scenario, where it remains below 19% (Graph 34).

As concerns net contribution flows to pension funds (Graph 35), a larger (smaller) fall in net contributions as a percentage of GDP for the high (low) scenario is observed in the final part of the simulation. Considering the high scenario, this difference emerges because when the disinvestment prevails there is a much greater decumulation of assets, due to the higher rate with which contributions are capitalized, at a time when GDP is decelerating and new contribution flows are small because of demographic trends. In fact, the difference between the return rate on assets and the GDP growth rate reaches levels twice as high as GDP growth itself in the high scenario in the second half of the simulation period, which makes the outflows increase significantly more than GDP. The opposite occurs in the low scenario. It follows that the net contribution flow falls to -0.42% of GDP in 2045 in the high scenario, while it only falls to around zero in the low scenario (0.01% of GDP).

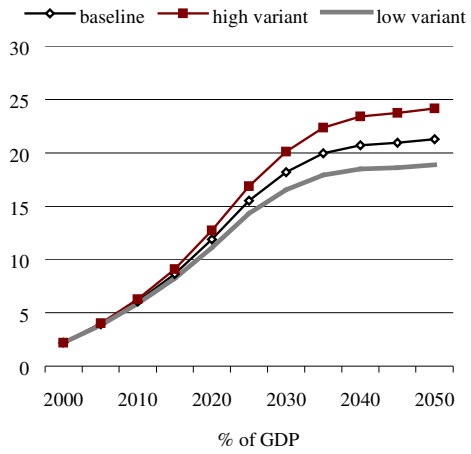
Some differences were also observed in net financial flows to insurance companies (Graph 36). First, in the high (low) scenario flows become greater (lower) than in the baseline, peaking at 0.5% of GDP in 2040 (0.4% in the low scenario). When, however, the payment of benefits prevails, the net flow falls more in the high scenario than in the baseline and in the low.

As for annual net flows invested in debt securities and equities (Graphs 37, 38), a difference is seen in the disinvestment phase; since the level of benefits to be paid is higher in the high scenario, more than 4 billion Euro of equities and 5.5 billion Euro of debt securities are subtracted each year from the market in the final period of the simulation, while the net flow remains positive in the low scenario, at 1.7 and 3.3 billion Euro for the equity and bond markets respectively.

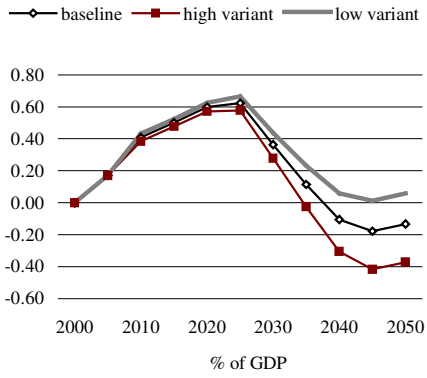
Table 8 - The alternative scenarios: real interest rate

Annual return rate on pension funds (net of administrative costs and taxes)	**base scenario**	2,0%
	high scenario	3,0%
	low scenario	1,0%

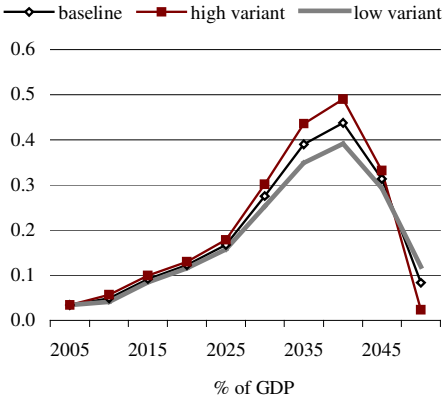
Graph 34 - Pension funds' wealth



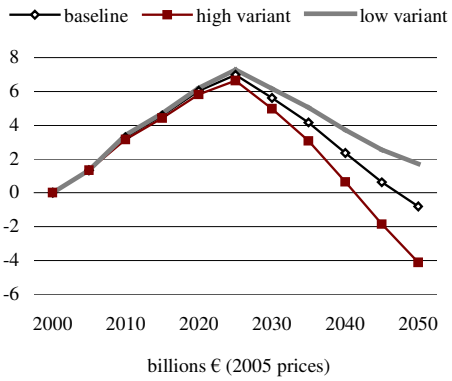
Graph 35 - Net annual contribution flow to pension funds



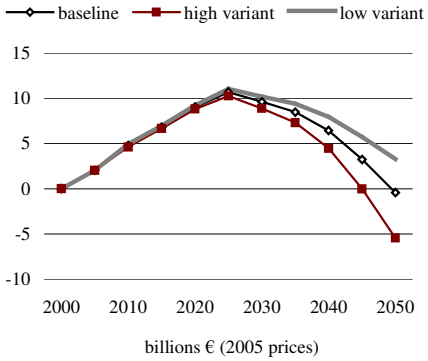
Graph 36 - Net annual resource flow to insurance companies



Graph 37 - Net annual resources invested in equity securities



Graph 38 - Net annual resources invested in debt securities



5.4 Asset allocation

As concerns asset allocation, only one alternative to the baseline was considered. From the viewpoint of the growth of domestic financial markets (in the dual sense of Italy and the EMU area), the baseline can be considered as being a "low" assumption because, although corrected by country bias, the reduction in the importance of domestic markets to that predominant in the benchmark indexes does in fact constitute the projection over the simulation period of conditions of low development in Italian (and also European) financial markets, compared to that of other areas (USA and UK).

The alternative hypothesis, on the other hand, assumes no change in the composition of portfolios compared to the current situation. In other words, it assumes the predominance of debt securities over equities and the continuation of a strong country bias above all in favor of the Italian market. The absence of a negative "benchmark" effect therefore increases the flow of investment on domestic markets, maintaining its current importance as a destination for investment.

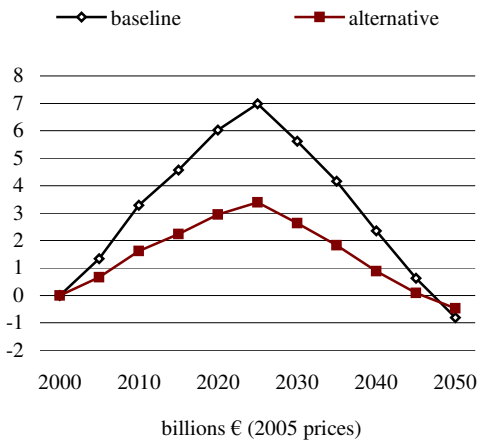
Table 9 specifies the assumptions of the baseline and alternative scenario, while the results are reported in Graphs 39-40 and in Table A14 at the end.

Graphs 39 and 40 show that at the point when maximum funds are available for investment (2025) net annual flows into equity markets are half in the alternative scenario than they were in the baseline, the difference being now allocated in bonds. However, as shown in Table A14, the flow into Italian equities rises and almost doubles (from 350 to 620 million Euro), while the flow into Italian debt securities almost triples as a result of maintaining the current substantial country bias. Net annual investments in the EMU area equities are roughly the same, while investment in Euro bonds substantially increase (from 7.5 to 11.3 billion).

Table 9 - The alternative scenarios: asset allocation

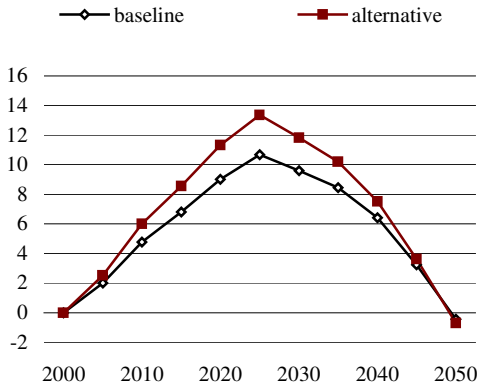
	Baseline scenario		Alternative scenario	
	Pension funds	*Insurance*	*Pension funds*	*Insurance*
Net annual contribution flow invested in equity securities	**40%**	**30%**	**20%**	**12%**
Net annual contribution flow invested in EMU area equity securities (Italy included)	11,1%	8,3%	12,0%	9,4%
Net annual contribution flow invested in Italian equity securities	2,0%	1,5%	3,0%	4,7%
Net annual contribution flow invested in EU, non EMU, and Swiss equity securities	7,1%	5,3%	3,0%	1,0%
Net annual contribution flow invested in non-European equity securities	21,8%	16,3%	5,0%	2,0%
Net annual contribution flow invested in debt securities	**55%**	**69%**	**70%**	**82%**
Net annual contribution flow invested in EMU area debt securities	43,0%	53,8%	65,0%	80,1%
Net annual contribution flow invested in Italian debt securities	14,0%	17,5%	50,0%	39,0%
Net annual contribution flow invested in non-EMU area debt securities	12,0%	15,0%	5,0%	1,8%
Net annual contribution flow invested liquidity and other	**5%**	**1%**	**10%**	**6%**

Graph 39 - Net annual resources invested in equity securities



billions € (2005 prices)

Graph 40 - Net annual resources invested in debt securities



billions € (2005 prices)

5.5 An assessment

The baseline and the sensitivity scenarios we built necessarily suffer from a certain degree of arbitrariness in the assumptions, which is unavoidable given that we speculate on the development of a private pillar which is currently not very developed in Italy; moreover, its actual future will be deeply affected by policies and choices made by individuals. This, however, does not mean that the scenarios were drawn up out of the blue, but rather that we selected a baseline and what we believe are some possible variations of it from among the possible developments of the system, as justified by current conditions, policymaker stated goals and policy actions undertaken. In this sense, our simulation should be considered more as tracking the potential development of pension funds in Italy, rather than showing a truly expected path.

In any case, the results of the sensitivity analysis should not be ignored: as seen, contribution and membership rates are the major determinants of private schemes' accumulation; the interest rate also has a significant impact, while the growth rate of productivity has no substantial effect on the final results. Also, making different assumptions for asset allocation, within reasonable limits, is unlikely to affect the qualitative results.

Since contribution and membership rates are the most critical parameters, it may be noted that they are both highly influenced by policy actions, as well as by individual attitudes toward private pensions. The first consideration partly explains the extent of the pressure on policymakers, not only in Italy. As concerns individual attitudes, there are two critical elements. One is the extent to which people look at private provision as a **supplementary** pension rather that as a crucial ingredient of their retirement income; the other is the extent to which people feel comfortable enough to be able to afford a long-term commitment as is membership of a private scheme. As seen, these two elements are more critical than wage growth by itself.

6. Conclusions

Although the Italian private pension system is still small, its development has been a primary goal of Italian policymakers ever since the early '90s, being viewed as a way to compensate for the gradual decrease in public sector pensions. Further stressing its commitment, the government recently introduced a silent-consent clause to automatically divert the TFR of private sector employees into private schemes. The silent-consent clause should start operating from 2008 and is expected to further and strongly increase pension funds membership.

We developed a cohort-based simulation model of the potential accumulation of private pension

schemes in Italy which, accordingly, incorporates their expected greater diffusion in the years to come. The baseline scenario was built with fairly favorable assumptions, so it should be considered as depicting pension funds potential accumulation, rather than a truly expected outcome.

The results confirm that during the start-off phase net annual inflows to pension funds and insurance companies selling annuities could become substantial, reaching a maximum of 0.8% of GDP in around 2025. Assets accumulated in pension funds and insurance companies could also become substantial, amounting to around 20% and 10% of GDP respectively at the end of the period considered (2050).

However, a much weaker effect should be expected on the domestic financial markets and particularly on the Italian stock exchange: in fact, institutional investors diversify their investments geographically, as they have to do in the interest of their members or subscribers. It follows that even at the climax (around 2025), one should not expect more than 350 million and 2 billion Euro per year (at 2005 prices) to flow onto Italian and EMU risk capital markets respectively.

Moreover, the private pension system is likely to reach maturity not much later than 2050, with the consequence that net inflows will first go to zero and then, at around the end of the simulation period, even become slightly negative, while asset accumulation will stabilize in terms of GDP. Consequently, no significant amounts of new resources will enter the system anymore.

In addition, a substantial portion of the flows diverted into pension funds is likely to come from a mere reallocation of individuals' and households' portfolios, rather than from genuinely new saving: while this clearly applies to the TFR flows diverted into pension funds, it may also be true for part of the resources that the self-employed in particular will inject into the system.

The results of the simulation are robust to a number of parameter changes: however, the sensitivity analysis shows that the most critical determinants of pension funds accumulation are individual membership and contribution rates, which are both highly dependent upon policies. In any case, since the base scenario we built is very favorable to pension funds' growth, it is unlikely that financial flows will result at the end much higher than we estimated.

Overall, although the resources that accumulate in pension funds could become quite large in the next years and for about 25-30 years, and although pension funds could become important institutional investors, it is unlikely that the size of the flows will be such that it will significantly affect the domestic, EMU and international financial markets.

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Annex - The mathematical model

The mathematics underlying the model we developed for the accumulation and decumulation of assets of both the pension funds and the insurance industry which takes charge of the payment of annuities, is based on finite difference equations.

We can write:

$$[1]\ K_{t+1}^{pf} = (1+r)^5 K_t^{pf} + (\overline{IN_{t+1}^{pf}} - \overline{OUT_{t+1}^{pf}})\left(\sum_{l=0}^{4}(1+r)^l\right);$$

$$[2]\ K_{t+1}^{ins} = (1+r)^5 K_t^{ins} + (\overline{IN_{t+1}^{ins}} - \overline{OUT_{t+1}^{ins}})\left(\sum_{l=0}^{4}(1+r)^l\right),$$

where K is the stock of end-of-5-year period assets, r the annual interest rate[21] and $\overline{IN}$ and $\overline{OUT}$ the annual inflows (excluding returns on assets) and outflows for either pension funds (*pf*) or insurance companies (*ins*).

We can make things simpler considering five years as a single period, which allows to write (with the suitable redefining of variables – in particular $(1+r)^5 \equiv 1+i$):

$$[3]\ K_{t+1}^{pf} = (1+i)K_t^{pf} + (IN_{t+1}^{pf} - OUT_{t+1}^{pf});$$
$$[4]\ K_{t+1}^{ins} = (1+i)K_t^{ins} + (IN_{t+1}^{ins} - OUT_{t+1}^{ins});$$
$$[5]\ OUT_{t+1}^{fp} \equiv IN_{t+1}^{ins}.$$

where the last identity derives from the assumption we made that at the moment of retirement the pension fund transfers the entire individual's saving to an insurance in exchange for an annuity.

We are interested in ratios to GDP, which is assumed to growth at the (five-year rate) g. Using lower case k, *in*, *out* to indicate ratios to GDP, one arrives to:

$$[6]\ k_{t+1}^{pf} = \frac{1+i}{1+g}k_t^{pf} + (in_{t+1}^{pf} - out_{t+1}^{pf});$$

$$[7]\ k_{t+1}^{ins} = \frac{1+i}{1+g}k_t^{ins} + (in_{t+1}^{ins} - out_{t+1}^{ins});$$

$$[8]\ out_{t+1}^{pf} = in_{t+1}^{ins}.$$

The dynamics is thus determined by the inflows and outflows, together with initial conditions on the two k^{pf} *and* k^{ins}, which here are assumed to be 0[22].

The following assumptions allow to simplify the math and the main long-term properties of the model to emerge. Individuals live (deterministically) 80 years each, but we are not interested in

[21] In real terms and net of pension funds' expenses and taxes levied on their financial returns.
[22] In the actual simulation model the stock of assets already held by pension funds has been taken into account, although it has been dealt with separately with respect to new accumulation.

what happens till 25. The remaining 13 5-year periods of each individual's life are as follows: from period 1 to 8 the individual works and contributes with probability p a percentage a to a pension fund; in the 9th period the individual retires and starts getting a pension, while the pension fund transfers the money to an insurance company that pays the pension from period 9 to period 13 (thus for 25 years). Members never exit from pension funds before reaching 65, the end of their working activity. In each period wages W_t do not depend upon age (thus we assume no individual career component), while they grow at the productivity growth rate w. Population and employment grow at rate n from cohort to cohort, so that the GDP growth rate g is such that $(1+g)=(1+w)(1+n)$. $N_{t,j}$ defines the numerosity of the (worker) cohort that at time t is in the jth of the 13 periods of life which are relevant, while N_t indicates the total number of active workers at t (thus excluding retirees): $N_t = \sum_{j=1}^{8} N_{t,j}$. As life length is deterministic, the numerosity of all cohorts is constant through their life ($N_{t,j}=N_{t-1,j-1}$), thus $N_{t,j}$, N_t and total population all grow at rate n.

In such framework, we can describe the dynamics of asset accumulation and decumulation showing that the following propositions hold:

1. Pension funds' inflows are a constant proportion of GDP;
2. Starting from period 9, pension funds' outflows are a constant proportion of GDP;
3. In steady state the ratio of pension funds' assets to GDP is given by the balance inflows-outflows in % of GDP times (1+g)/(g-i);
4. In a stable environment like the one we assumed (n constant – which we label demographic equilibrium –, w constant, i constant), the steady state is actually reached from period 9 onwards;
5. The same mechanisms drive the accumulation and decumulation of assets in the insurance industry that takes charge of the payment of annuities.

A.1. Pension funds' inflows are a constant proportion of GDP

To prove this, notice that IN_{pf} can be written as:

[9] $IN_t^{pf} = paW_tN_t$.

For given p and a, it is immediate to see from eq. [9] that the total inflows – which is noting else that (total salaries) times (contribution rate) times (probability of being member of a pension fund) – will always grow at the sum of the growth rates of W and N, thus at g, the growth rate of the economy.

A.2. From period 9 pension funds' outflows are a constant proportion of GDP

Pension funds' outflows correspond in each period to the total life-long contribution of the cohort that in that period reached 65, capitalized to the financial rate of return. Thus, outflows will be:

- 0 at time 1;
- the contribution of the $N_{1,8}$=$N_{2,9}$ people that in period 1 were aged between 60 and 64 (capitalized once) at time 2;
- the contribution (paid for 2 periods and suitably capitalized) of people that in period 1 were aged between 55 and 59 at time 3;

and so on, till, from time 9 on, the capitalized contribution of generations having contributed for all their 8 periods of work[23]. We can write:

$$[10]\ OUT_t^{pf} = paN_{t,9}\sum_{j=1}^{t-1} W_{t-j}(1+i)^j \text{ for } t = 2,...,8, \text{ being } OUT_1^{pf} = 0,$$

$$[11]\ OUT_t^{pf} = paN_{t,9}\sum_{j=1}^{8} W_{t-j}(1+i)^j \text{ for } t \geq 9.$$

We can rewrite [11] as:

$$[12]\ OUT_t^{pf} = paN_{t,9}W_t\sum_{j=1}^{8}\left(\frac{1+i}{1+w}\right)^j \text{ for } t \geq 9\,.$$

The only two components in [12] that depends upon time are $N_{t,9}$ and W_t (g being the sum of the respective growth rates), while p, a and the argument of the summatory do not depend upon time. Thus, for $t \geq 9$, OUT_t^{pf} grows at the same rate of the economy, g.

A.3. In steady state the ratio of pension funds' assets to GDP is given by the balance inflows-outflows in % of GDP times *(1+g)/(g-i)*

[9] and [12] show that, from time 9 and forever since, flows in and out from pension funds tend to be constant in % of GDP. Thus the difference between inflows and outflows is also constant as % of GDP:

$$[13]\ s_t \equiv \frac{S_t}{Y_t} = \frac{IN_t^{pf}}{Y_t} - \frac{OUT_t^{pf}}{Y_t} = in_t^{pf} - out_t^{pf} = s \neq f(t) \text{ for } t \geq 9.$$

s does not need to be 0. Indeed, it will be 0 when i=g, it will be >0 when i<g and <0 when i>g. In other words, when the interest rate is bigger than the rate of growth of the economy, outflows will

[23] One could very easily take into account – as actually done in the simulation presented in the text – that retirement happens at the very beginning of the 9th period, not in the middle, i.e. at 65, not at 67.5 years of age.

be larger than inflows. However, the pension fund assets will themselves be a constant proportion of GDP. What happens is that the difference *s* will be covered by the excess returns on the assets with respect to what is needed to maintain it constant as % of GDP. The opposite will hold when $i<g$.

This result is made possible by the fact that during the first 8 periods people retires with shorter contributions that the maximum 8 periods, while contributions are already at their full level. Thus during these periods the pension fund builds its own stock of assets, as inflows are larger than outflows. Since period 9, instead, inflows, outflows and the stock of assets become a constant proportion of GDP and from that moment on the pension fund somehow mimics a pay-as-you-go system in that contribution revenues tend to be transferred to people retiring[24].

To show that the pension fund assets will be a constant proportion of GDP, we first find the steady state level and then, in the next paragraph, show that the steady state is actually reached in period 9.

One can use eq. [6] and [13] to write:

$$[14]\ k_t^{pf} = \frac{1+i}{1+g} k_{t-1}^{pf} + s \quad \text{for } t \geq 9,$$

which in steady state implies:

$$[15]\ k^{pf} = \frac{1+i}{1+g} k^{pf} + s;$$

$$[16]\ k^{pf} = \left(\frac{1+g}{g-i} \right) s \quad \text{for g} \neq \text{i},$$

which, as said, holds in a steady state and, in any case, not before $t=9$ (notice that when $g=i$ the steady state requires $s=0$).

A.4. In the demographic equilibrium the steady state is actually reached from period 9

Under our assumptions of given *n*, *i* and *w*, which capture the long terms properties of the accumulation dynamics, the steady state is actually reached starting in period 9. To prove it, it is enough to show that in such period (minus) the balance between inflows and outflows is exactly equal to the returns on the assets accumulated in period 8 minus the amount needed to guarantee a constant assets to GDP ratio.

Thus one must prove that:

[24] With the above mentioned supplementary use of excess financial revenues in case of high interest rates and vice versa.

$$[17] - S_9 = (i-g)K_8^{pf},$$

where:

$$[18]\, S_9 = IN_9^{pf} - OUT_9^{pf} = paW_9N_9 - paW_9N_{9,9}\sum_{j=1}^{8}\left(\frac{1+i}{1+w}\right)^j;$$

$$[19]\, K_8^{pf} = \sum_{j=1}^{8}\left[\left(IN_j^{pf} - OUT_j^{pf}\right)(1+i)^{8-j}\right].$$

Firstly, [18] can be rewritten as:

$$[20]\, S_9 = paW_1(1+g)^8\left[N_1 - N_{1,9}\sum_{j=1}^{8}\left(\frac{1+i}{1+w}\right)^j\right].$$

Also, looking at the inflows component of [19]:

$$\sum_{j=1}^{8} IN_j^{pf}(1+i)^{8-j} = \sum_{j=1}^{8} paW_jN_j(1+i)^{8-j} = \frac{paW_1N_1(1+i)^8}{1+g}\sum_{j=1}^{8}\left(\frac{1+g}{1+i}\right)^j,$$

thus:

$$[21]\sum_{j=1}^{8} IN_j^{pf} = \frac{paW_1N_1}{g-i}\left[(1+g)^8 - (1+i)^8\right].$$

Concerning the outflows component of [19], OUT_1 will be 0 and it will be:

$$\sum_{j=1}^{8} OUT_j^{pf}(1+i)^{8-j} = \sum_{j=2}^{8} paN_{j,9}(1+i)^{8-j}\left(\sum_{z=1}^{j-1} W_z(1+i)^{j-z}\right),$$

thus:

$$[22]\sum_{j=1}^{8} OUT_j^{pf}(1+i)^{8-j} = \frac{paW_1N_{1,9}(1+i)^8}{1+g}\left(\frac{1+i}{w-i}\right)\sum_{j=2}^{8}\left[\left(\frac{1+g}{1+i}\right)^j - \frac{1+w}{1+i}(1+n)^j\right].$$

Given the assumed worker population dynamics, the following relation holds between $N_{1,9}$ and N_1 (remember that N_1 is the sum of active workers, thus excludes retirees):

$$[23]\, N_1 = \frac{(1+n)^9 - (1+n)}{n}N_{1,9}.$$

Equations [19], [20], [21], [22] and [23] allow to prove the thesis, represented by eq. [17]. The proof involves straightforward, although boring calculations[25], and requires to insert the solution of

[25] An easier way to check the result is to assume a shorter period of contribution, which could even be just 1 period instead of 8, which dramatically simplifies the algebra.

the summatories[26]. Substituting the expressions [19]-[23] in [17] one can first get ride of *p, a, W_1, $N_{1,9}$*. Then a term $(1+g)^8\left[\frac{(1+n)^9-(1+n)}{n}\right]$ adds on both sides and simplifies, then the same happens for a term $(1+g)^8\left(\frac{1+i}{i-w}\right)$. This allows to eliminate a multiplicative factor $(1+i)^8$ and, after some more algebra, to verify the result.

A.5. The same mechanisms drive the accumulation and decumulation of assets in the insurance industry that take charge of the payment of the annuities.

The same mechanisms we described for pensions funds also holds for insurance companies that issue the annuities. The insurance industry inflows are exactly the same as pension funds' outflows, as these are supposed to turn all the money of the individuals who retire to insurance companies immediately. Insurance companies start paying pensions during the same 9th period of "life" of the individual and for 5 periods, till the individual disappears, at the end of period 13. Thus the insurance companies gradually liquidate to the worker the retirement savings (and the returns on the residual capital) during a 5-periods term (25 years). It follows that the insurance outflows will show in full only from period 13 onwards.

We do not derive the same analytical results as above (as the mechanisms are the same) but only give below the expressions for the flows in and out:

[24] $IN_t^{ins} = OUT_t^{pf}$;

[25] $OUT_t^{ins} = \frac{1}{5}\sum_{j=0}^{4} IN_{t-j}^{ins}(1+i)^j$.

[26] Remember that $\sum_{j=1}^{t} x^j = \frac{x^{t+1}-x}{x-1}$, that $\sum_{j=2}^{t} x^j = \frac{x^{t+1}-x^2}{x-1}$ and that $(1+g)=(1+w)(1+n)$.

Additional tables

Table A1- Sensitivity to membership rates - Membership

Pension fund members	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
high scenario	2.989.606	5.971.661	8.600.116	11.393.692	13.788.893	13.283.967	12.635.870	11.975.707	11.471.791	11.092.857
low scenario	2.989.606	4.847.017	6.322.750	7.981.635	9.371.694	9.027.251	8.587.482	8.139.386	7.797.144	7.539.740

Table A2 - Sensitivity to membership rates - Net annual contribution flows to pension funds

€ millions	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
high scenario	2.919	8.583	12.144	16.108	18.205	11.545	4.348	-2.544	-5.258	-4.243
low scenario	2.919	6.489	7.961	10.002	10.855	6.374	1.545	-3.008	-4.575	-3.405

Table A3 - Sensitivity to membership rates - End of period pension fund assets

€ millions	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
high scenario	68.530	120.329	196.052	300.284	426.279	530.727	608.593	658.696	699.892	750.656
low scenario	68.530	109.431	162.253	231.192	311.746	377.361	424.676	453.224	476.585	508.466

Table A4 - Sensitivity to membership rates - Investments by pension funds and insurance companies

€ millions		2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Net annual contribution	baseline scenario	1.343	3.285	4.575	6.026	6.981	5.618	4.163	2.356	622	-806
flow invested in equity	high scenario	1.343	3.703	5.426	7.307	8.618	7.028	5.316	3.158	1.061	-698
securities	low scenario	1.343	2.866	3.724	4.744	5.344	4.209	3.009	1.553	182	-914
Net annual contribution	baseline scenario	67	165	229	302	350	281	209	118	31	-40
flow invested in Italian	high scenario	67	186	272	366	432	352	266	158	53	-35
equity securities	low scenario	67	144	187	238	268	211	151	78	9	-46
Net annual contribution	baseline scenario	372	910	1.267	1.669	1.934	1.556	1.153	652	172	-223
flow invested in EMU	high scenario	372	1.026	1.503	2.024	2.387	1.947	1.473	875	294	-193
area equity securities	low scenario	372	794	1.032	1.314	1.480	1.166	834	430	50	-253
Net annual contribution	baseline scenario	2.007	4.764	6.799	9.022	10.670	9.591	8.459	6.416	3.227	-445
flow invested in debt	high scenario	2.007	5.340	7.982	10.839	13.074	11.873	10.589	8.171	4.360	-43
securities	low scenario	2.007	4.188	5.616	7.204	8.266	7.308	6.330	4.662	2.094	-846
Net annual contribution	baseline scenario	511	1.213	1.732	2.298	2.718	2.443	2.155	1.634	822	-113
flow invested in Italian	high scenario	511	1.360	2.033	2.761	3.330	3.024	2.697	2.081	1.111	-11
debt securities	low scenario	511	1.067	1.430	1.835	2.105	1.861	1.612	1.187	533	-215
Net annual contribution	baseline scenario	1.569	3.726	5.316	7.055	8.344	7.500	6.615	5.017	2.524	-348
flow invested in EMU	high scenario	1.569	4.176	6.242	8.476	10.224	9.285	8.280	6.389	3.410	-34
area debt securities	low scenario	1.569	3.275	4.391	5.634	6.464	5.715	4.950	3.645	1.637	-661

Table A5 - Sensitivity to contribution rates - Net annual contribution flows to pension funds

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
high scenario	***2.919***	10.737	14.106	17.815	19.413	12.027	4.172	-3.257	-6.117	-4.959
low scenario	2.919	4.162	5.808	8.087	9.448	5.774	1.685	-2.258	-3.652	-2.631

Table A6 - Sensitivity to contribution rates - End of period pension fund assets

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
high scenario	***68.530***	131.536	218.637	334.101	469.901	581.400	663.623	715.742	758.403	811.534
low scenario	68.530	97.322	137.676	194.092	263.464	320.936	363.108	389.149	410.649	439.695

Table A7 - Sensitivity to contribution rates - Investments by pension funds and insurance companies

€ millions		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Net annual contribution	baseline scenario	1.343	3.285	4.575	6.026	6.981	5.618	4.163	2.356	622	-806
flow invested in equity	high scenario	1.343	4.564	6.233	8.051	9.222	7.408	5.459	3.059	806	-1.019
securities	low scenario	1.343	1.934	2.828	3.877	4.558	3.553	2.488	1.227	104	-739
Net annual contribution	baseline scenario	67	165	229	302	350	281	209	118	31	-40
flow invested in Italian	high scenario	67	229	312	403	462	371	273	153	40	-51
equity securities	low scenario	67	97	142	194	228	178	125	61	5	-37
Net annual contribution	baseline scenario	372	910	1.267	1.669	1.934	1.556	1.153	652	172	-223
flow invested in EMU	high scenario	372	1.264	1.726	2.230	2.554	2.052	1.512	847	223	-282
area equity securities	low scenario	372	536	783	1.074	1.263	984	689	340	29	-205
Net annual contribution	baseline scenario	2.007	4.764	6.799	9.022	10.670	9.591	8.459	6.416	3.227	-445
flow invested in debt	high scenario	2.007	6.523	9.110	11.919	14.015	12.567	10.980	8.205	4.090	-517
securities	low scenario	2.007	2.905	4.352	5.918	6.981	6.026	5.085	3.640	1.577	-729
Net annual contribution	baseline scenario	511	1.213	1.732	2.298	2.718	2.443	2.155	1.634	822	-113
flow invested in Italian	high scenario	511	1.661	2.320	3.036	3.570	3.201	2.797	2.090	1.042	-132
debt securities	low scenario	511	740	1.108	1.507	1.778	1.535	1.295	927	402	-186
Net annual contribution	baseline scenario	1.569	3.726	5.316	7.055	8.344	7.500	6.615	5.017	2.524	-348
flow invested in EMU	high scenario	1.569	5.101	7.124	9.321	10.960	9.827	8.587	6.416	3.198	-405
area debt securities	low scenario	1.569	2.272	3.403	4.628	5.459	4.712	3.976	2.846	1.234	-570

Table A8 - Sensitivity to productivity growth - Net annual contribution flows to pension funds

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
baseline scenario	2.919	7.536	10.053	13.055	14.530	8.959	2.946	-2.776	-4.917	-3.824
high scenario	2.919	7.644	10.377	13.692	15.522	10.025	4.028	-1.754	-3.848	-2.589
low scenario	2.919	7.429	9.735	12.439	13.585	7.961	1.957	-3.682	-5.836	-4.866

Table A9 - Sensitivity to productivity growth - End of period pension fund assets

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
baseline scenario	68.530	114.880	179.153	265.738	369.012	454.044	516.635	555.960	588.239	629.561
high scenario	68.530	115.441	181.457	271.598	380.643	472.433	542.568	589.911	631.283	683.513
low scenario	68.530	114.324	176.886	260.030	357.789	436.457	492.066	524.119	548.298	580.044

Table A10 - Sensitivity to productivity growth - Investments by pension funds and incurance companies

€ millions		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Net annual contribution flow invested in equity securities	baseline scenario	1.343	3.285	4.575	6.026	6.981	5.618	4.163	2.356	622	-806
	high scenario	1.343	3.328	4.706	6.288	7.403	6.117	4.733	2.969	1.269	-123
	low scenario	1.343	3.242	4.447	5.772	6.577	5.150	3.635	1.800	48	-1.395
Net annual contribution flow invested in Italian equity securities	baseline scenario	67	165	229	302	350	281	209	118	31	-40
	high scenario	67	167	236	315	371	306	237	149	64	-6
	low scenario	67	162	223	289	330	258	182	90	2	-70
Net annual contribution flow invested in EMU area equity securities	baseline scenario	372	910	1.267	1.669	1.934	1.556	1.153	652	172	-223
	high scenario	372	922	1.304	1.742	2.051	1.694	1.311	822	351	-34
	low scenario	372	898	1.232	1.599	1.822	1.426	1.007	499	13	-386
Net annual contribution flow invested in debt securities	baseline scenario	2.007	4.764	6.799	9.022	10.670	9.591	8.459	6.416	3.227	-445
	high scenario	2.007	4.823	6.980	9.389	11.275	10.341	9.369	7.446	4.319	667
	low scenario	2.007	4.705	6.621	8.666	10.092	8.882	7.613	5.474	2.251	-1.412
Net annual contribution flow invested in Italian debt securities	baseline scenario	511	1.213	1.732	2.298	2.718	2.443	2.155	1.634	822	-113
	high scenario	511	1.229	1.778	2.391	2.872	2.634	2.386	1.897	1.100	170
	low scenario	511	1.198	1.686	2.207	2.571	2.262	1.939	1.394	573	-360
Net annual contribution flow invested in EMU area debt securities	baseline scenario	1.569	3.726	5.316	7.055	8.344	7.500	6.615	5.017	2.524	-348
	high scenario	1.569	3.772	5.458	7.342	8.817	8.087	7.327	5.823	3.377	522
	low scenario	1.569	3.680	5.177	6.777	7.892	6.946	5.953	4.281	1.760	-1.104

Table A11 - Sensitivity to interest rates - Net annual contribution flows to pension funds

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
baseline scenario	2.919	7.536	10.053	13.055	14.530	8.959	2.946	-2.776	-4.917	-3.824
high scenario	2.919	7.073	9.588	12.446	13.460	6.874	-642	-8.066	-11.466	-10.785
low scenario	2.919	7.981	10.496	13.618	15.482	10.757	5.960	1.558	330	1.691

Table A12 - Sensitivity to interest rates - End of period pension fund assets

€ millions	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
baseline scenario	68.530	114.880	179.153	265.738	369.012	454.044	516.635	555.960	588.239	629.561
high scenario	69.965	118.660	188.463	284.559	401.341	501.758	578.265	627.544	666.621	715.536
low scenario	67.115	111.249	170.465	248.628	340.286	412.516	463.958	495.573	522.536	557.815

Table A13 - Sensitivity to interest rates - Investments byt pension funds and insurance companies

€ millions		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Net annual contribution flow invested in equity securities	baseline scenario	1.343	3.285	4.575	6.026	6.981	5.618	4.163	2.356	622	-806
	high scenario	1.343	3.142	4.434	5.829	6.628	4.975	3.078	656	-1.847	-4.110
	low scenario	1.343	3.422	4.709	6.204	7.288	6.162	5.057	3.720	2.549	1.710
Net annual contribution flow invested in Italian equity securities	baseline scenario	67	165	229	302	350	281	209	118	31	-40
	high scenario	67	157	222	292	332	249	154	33	-93	-206
	low scenario	67	171	236	311	365	309	253	186	128	86
Net annual contribution flow invested in EMU area equity securities	baseline scenario	372	910	1.267	1.669	1.934	1.556	1.153	652	172	-223
	high scenario	372	870	1.228	1.615	1.836	1.378	853	182	-512	-1.139
	low scenario	372	948	1.304	1.719	2.019	1.707	1.401	1.030	706	474
Net annual contribution flow invested in debt securities	baseline scenario	2.007	4.764	6.799	9.022	10.670	9.591	8.459	6.416	3.227	-445
	high scenario	2.007	4.606	6.646	8.794	10.255	8.880	7.290	4.462	-30	-5.465
	low scenario	2.007	4.916	6.942	9.225	11.025	10.178	9.403	7.953	5.722	3.298
Net annual contribution flow invested in Italian debt securities	baseline scenario	511	1.213	1.732	2.298	2.718	2.443	2.155	1.634	822	-113
	high scenario	511	1.173	1.693	2.240	2.612	2.262	1.857	1.136	-8	-1.392
	low scenario	511	1.252	1.768	2.350	2.808	2.592	2.395	2.026	1.457	840
Net annual contribution flow invested in EMU area debt securities	baseline scenario	1.569	3.726	5.316	7.055	8.344	7.500	6.615	5.017	2.524	-348
	high scenario	1.569	3.602	5.197	6.877	8.019	6.944	5.701	3.489	-23	-4.274
	low scenario	1.569	3.844	5.428	7.214	8.622	7.959	7.353	6.219	4.474	2.579

Table A14 - Sensitivity to asset allocation - Investments by pension funds and insurance companies

€ millions		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Net annual contribution flow invested in equity securities	baseline scenario	1.343	3.285	4.575	6.026	6.981	5.618	4.163	2.356	622	-806
	alternative scenario	656	1.619	2.239	2.943	3.389	2.632	1.822	877	86	-466
Net annual contribution flow invested in Italian equity securities	baseline scenario	67	165	229	302	350	281	209	118	31	-40
	alternative scenario	115	269	389	518	620	589	558	462	260	-1
Net annual contribution flow invested in EMU area equity securities	baseline scenario	372	910	1.267	1.669	1.934	1.556	1.153	652	172	-223
	alternative scenario	405	989	1.381	1.819	2.111	1.715	1.293	757	224	-231
Net annual contribution flow invested in debt securities	baseline scenario	2.007	4.764	6.799	9.022	10.670	9.591	8.459	6.416	3.227	-445
	alternative scenario	2.522	6.013	8.549	11.332	13.361	11.825	10.208	7.517	3.623	-701
Net annual contribution flow invested in Italian debt securities	baseline scenario	511	1.213	1.732	2.298	2.718	2.443	2.155	1.634	822	-113
	alternative scenario	1.687	4.120	5.747	7.573	8.786	7.127	5.356	3.122	909	-970
Net annual contribution flow invested in EMU area debt securities	baseline scenario	1.569	3.726	5.316	7.055	8.344	7.500	6.615	5.017	2.524	-348
	alternative scenario	2.365	5.620	8.013	10.630	12.564	11.254	9.879	7.446	3.711	-554