GENERATIONAL ACCOUNTING FOR ITALY

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1 Introduction[1]

The economies of the industrialised countries, largely based on pay-as-you-go social security systems, are set to be profoundly affected by the ageing of their population. While the potential fiscal consequences of ageing have received particular attention over the last decade, some doubts have been raised on whether the traditional indicators of public finances (debt and deficit) are able to capture the long-term implications of current fiscal policies.

New methods have therefore been proposed in order to assess the intertemporal dimension of budgetary policies and to evaluate their impact on both the financial sustainability of public finances and the intergenerational redistribution that takes place through them. The study of these aspects can also contribute to a better understanding of how budgetary policies affect economic growth, savings and the accumulation of capital.

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Generational accounting represents one of these methods of long-term analysis of fiscal policies. They aim at answering a series of questions, such as: how large a fiscal burden does current fiscal policy leave to future generations? is fiscal policy sustainable without major additional sacrifices (either in terms of higher taxes or lower transfers) on the part of current or future generations or major cutbacks in government purchases? what alternative policies would suffice to produce generational balance – a situation in which future generations face the same fiscal burden as do current generations when adjusted for growth (when measured as a proportion of their lifetime earnings)? And finally, how would different methods of achieving such balance affect the remaining lifetime fiscal burdens of those now alive?

In order to answer these questions we define with generational accounts the present value of net taxes (taxes paid minus transfer payments received) that individuals of different age cohorts are expected, under current policy, to pay over their remaining lifetimes. Adding up the generational accounts of all currently living generations gives the collective contribution of those now alive toward paying the government's bills. The government's bills refers to the present value of its current and future purchases of goods and services plus its net debt (its financial liabilities minus its financial and real assets, including the value its public-sector enterprises). Those bills left unpaid by current generations must be paid by future generations. This is the hard message of the government's intertemporal budget constraint – the basic building block of modern dynamic analyses of fiscal policy.

This approach has several advantages. First, it highlights the "zero sum" nature of fiscal policies. Given the initial debt and the present value of current and future purchases of goods and services, any measure which changes net taxes paid by currently living generations must be balanced by a change of opposite sign and equal amount of the net taxes paid by future generations. Second, as it takes into account the whole series of taxes and transfers paid by individuals to the State during their lifetime, it allows to use fiscal indicators that are less sensitive to the choice of a specific accounting terminology and practice. Finally, it takes into account demographic projections and thus makes explicit the budgetary tensions that may arise from programs that redistribute resources across generations (such as health and social security expenditure).

Generational accounting was originally developed by Auerbach, Gokhale and Kotlikoff (1991) and Kotlikoff (1992). Less than a decade old, it has spread to over 25 countries around the globe, from New Zealand to Norway. Much of this accounting is being done at the governmental or multilateral institutional level (among the others, the Federal Reserve and the Congressional Budget Office in the US, the Bank of Japan, the Bundesbank, the International Monetary Fund, and the World Bank have all done generational accounting)[2].

Several studies have applied generational accounting to Italy[3]. This country is characterised by a high and persistent public debt, a relatively generous pension system and a fertility rate that is among the lowest in the world. As will be clear in the following, these three aspects are strongly interrelated (according to some economists, they are linked by a causality relationship[4]), and produce effects that are mutually reinforcing. Therefore, the Italian case is particular relevant for this methodology.

Compared to the precedent studies this work presents a much more detailed set of accounts, as it divides the consolidated account of the Public Sector into more than 80 among taxes and transfers. Most of these aggregates are then allocated among age and gender groups using a vast set of micro data, from the publicly available survey-data to the administrative data provided by several public institutions. The micro-simulation model Itaxmod, available at the ISAE, has been utilised in order to get some of these age and gender profiles. Moreover, because of the recent reforms of the pension system, the old-age and seniority pension profiles (before and after the reforms, and for the long transition

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[2] Generational accounting has also drawn considerable interest from academic and government economists. Haveman (1994), Congressional Budget Office (1995), Cutler (1993), Diamond (1996), Buiter (1997), Shaviro (1997), Auerbach, Gokhale, and Kotlikoff (1994), Kotlikoff (1993, 1997), Mazzaferro (1999), Banks Disney and Smith (1999), and others have debated its merits.

[3] The first study is from 1992, "Generational accounting: the case of Italy" by D. Franco, J. Gokhale, L. Guiso, L. Kotlikoff and N.O. Sartor. The most recent one (1999) is from D. Franco e N.O. Sartor: "Italy: High Public Debt and Population Ageing". For a thorough study on the generational accounts see also N.O. Sartor, 1997.

[4] A whole literature (initiated by Nobel prize Gary Becker) suggests that the decline of fertility rate has to be associates with the development of social security schemes (see Cigno, 1995).

period between the two regimes) were obtained via a simulation model built so as to "fit in" the generational accounting methodology.

This paper is divided in five sections. Section 2 briefly outlines the methodological issues associated with generational accounting. Section 3 presents the dataset used in this work to form the the age- and gender-profiles for taxes and transfers, and shows the generational accounts for Italy. In Section 4 we assess the sustainability of current fiscal policies and estimate the degree of intergenerational redistribution that they achieve. Section 5 contains some concluding remarks. The Appendix describes the simulation model used to introduce the recent reforms of the pension system into the generational accounting framework.

2 What do generational accounts tell us?

Economic theory has extensively emphasised the importance of developing summary indicators that could signal the existence of an "excessive" level of government financial liabilities, and tried to answer the following questions: is public debt detrimental to growth? are there levels of the debt that can trigger financial crisis? to what extent, if any, is public debt a burden to future generations?

Despite their heterogeneity, these issues have been generally addressed in terms of the ratio between public debt and GDP. More than its optimal long-term value, it was the dynamic path of this ratio that attracted most of the attention. In particular, it has been showed that the ratio between the public debt and GDP cannot steadily grow at a rate higher than the difference between the interest rate and the rate of income growth. If this condition is not satisfied we would face a "bubble" phenomenon, inconsistent with macroeconomic fundamentals and bound to come to an unexpected end. At the same time it is possible to show that, assuming that the ratio debt/GDP grows within this "maximum speed value", financial sustainability of public finances amounts to satisfy a simple condition. This is the intertemporal public budget constraint, according to which fiscal polices are sustainable only if they

generate a sequence of primary surpluses whose present value depends on (a) the initial level of public debt and (b) the difference between the interest rate and the rate of income growth[5].

Generational accounting simply translates the intertemporal public budget constraint in a series of "generational" net fiscal positions, so as to find out which generation is going to bear the burden of sustainability. Once we expressed the intertemporal budget constraint in these terms, the net lifetime taxes paid on average by future generations (and expressed in present value) must be equal to the current public debt plus the present value of future government purchases (public expenditure that cannot be allocated among individuals) less the present value of net taxes paid on average by currently living generations[6].

More formally, the intertemporal budget constraint can be expressed as follows:

$$\sum_{s=0}^{D} N_{t,t-s}\, P_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s}\, P_{t,t+s}\, (1+r)^{t-s} = \sum_{s=1}^{\infty} G_{t+s}\, (1+r)^{t-s} - W_t \qquad [1]$$

The first summation on the left-hand side of [1] adds together the generational accounts of existing generations. The second summation on the left side adds together the present values of the generational accounts of future generations[7]. The term $N_{t,k}$ stands for the present value of the average remaining lifetime net tax payment (the generational account measured on a per person basis) at time t of the generation born in year k. The index k in this summation runs from t-D (those aged D, the maximum length of life, in year 0) to t (those born in year 0). The present value is formed as of year t for generations alive at time t and as of the year of birth for generations not yet born. For example, $N_{t,t}$ is the time-t

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5 See Sartor (1997).

6 It is worth stressing here that this method does not impose the condition that public debt should be paid back, but only that fiscal policies should generate primary surpluses that allows the stock of debt to be serviced. By assuming that the real interest rate is larger than the rate of growth of the economy, the sustainability condition amounts to imposing a "non-Ponzi game" condition, preventing current public debt from being serviced through a systematic access to further debt.

7 All terms in [1] are real values, i.e. they are measured at constant prices. Though we distinguish male and female cohorts in the results presented below, we suppress gender subscripts in [1] to limit notation.

present value of the average lifetime net tax payments of those born at time *t* (i.e., it is the generational account of time-t newborns); $N_{t,t-65}$ is the time t-present value of the average remaining lifetime net tax payments of someone aged 65 at t (the generational account of those born at t-65); and $N_{t,t+30}$ is the present value to the year of birth ($t+30$) of the average lifetime net tax payments of someone who will born in 30 years (the generational account of those who will be born 30 years from year *t*).

As the terms $N_{t,k}$ represent the generational accounts measured on a per person basis, the accounts for a whole generation are obtained multiplying these terms by the number of individuals belonging to that cohort. The term $P_{t,k}$ stands for the time-t population of the generation born in year *k*. As each of these generational accounts is expressed in dollars of the respective generation's birth year, they must be discounted back to year t in the summation using the real discount rate r. In the baseline scenario this rate is 5 percent[8].

The first term on the right-hand side of [1] expresses the present value of current and future government purchases. With this term we indicate all public expenditures that (contrary to transfers to households or individuals) cannot be directly allocated to age groups and thus are not included in the accounts. The remaining term on the right-hand side *W* denotes the government's net wealth – expressed as its financial liabilities minus the sum of its financial assets and the market value of its public enterprises.

A set of generational accounts is thus a set of values of $N_{t,k}$, one for each existing and future generation, with the property that their combined present value, when multiplied by the appropriate time-t, generation-specific population counts, adds up to the right-hand side of equation [1].

How shall we evaluate long term fiscal imbalances within this framework? Intuitively, if public debt is sustainable there be no need to change current policies and, therefore, no difference is required between

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[8] The discount rate of 5 percent exceeds the real government short-term borrowing rate in most developed countries, but seems justified given the riskiness of the flows being discounted. However, the "right" discount rate to use is in sufficient question to merit presenting results based on a range of alternative discount rates.

net lifetime taxes paid by those newborn in the base year and by future generations. On the contrary, if current policies are not sustainable some budget items will have to be modified in order to re-establish financial sustainability, and the generational accounts will have to reflect this change as they cover a very long time-horizon (200 years, which in economic terms are a good proxy for an infinite span).

However, while we can certainly tell that something must change, it is not clear how and when this change is going to take place. The first approach to generational accounting sweeps this indeterminacy under the rug by assuming that only future generations bear the burden of the adjustment. As the net lifetime taxes of currently living generations are fixed by current fiscal policies, any imbalance between the two sides of equation [1] is eliminated by changing the net lifetime taxes of future generations. In other words, given the right-hand side of equation [1] and the first term on the left-hand-side, one would determine as a residual the value of the second term on the left-hand side, the collective payment (measured as a time-t present value) required of future generations in order to restore sustainability.

$$\sum_{s=1}^{\infty} N_{t,t+s}\, P_{t,t+s}\, (1+r)^{t-s} = \sum_{s=1}^{\infty} G_{t+s}\, (1+r)^{t-s} - W_t - \sum_{s=0}^{D} N_{t,t-s}\, P_{t,t-s} \qquad [2]$$

Based on this amount, the average present-value lifetime net tax payment of each member of each future cohort is found under the assumption that each successive future cohort pays the same share of its lifetime labour income in net taxes; i.e. that each future cohort faces the same lifetime net tax rate. Assuming that earnings from labour grow in line with labour productivity, the net lifetime taxes for members of each successive future cohorts rise at the economy's rate of labour productivity growth (g).

More formally, let N stand for the growth-adjusted generational account of future generations. N is the amount that each member of a future cohort would pay in lifetime net taxes if her lifetime labour income were the same as that of a current newborn. Hence, the actual amount the cohort born in year *t+1* will pay is N(1+g). The actual amount the cohort born in year *t+2* will pay is $N(1+g)^2$. The actual amount the cohort born in year *t+3* will pay is $N(1+g)^3$, and so on. The value of N is found through the following equation:

$$\sum_{s=1}^{\infty} N\,(1+g)^{s}\,P_{t,t+s}\,(1+r)^{t-s} = \sum_{s=1}^{\infty} G_{t+s}\,(1+r)^{t-s} - W_t - \sum_{s=0}^{D} N_{t,t-s}\,P_{t,t-s} \qquad [3]$$

Since N is the lifetime net tax payment of future generations adjusted for growth, it is directly comparable to that of current newborns, $N_{t,t}$ as both refer to net tax payments over an entire lifetime and are discounted back to their respective years of birth. If N equals $N_{t,t}$ generational policy is balanced. If N exceeds (is smaller than) $N_{t,t}$ future generations face larger (smaller) growth-adjusted lifetime net tax burdens than do current newborns.

However, assuming that only future generations are responsible for restoring long-term balance blurs the distinction between unsustainability and inequality, as the first implies the second and viceversa. Further, the assumption that the generational accounts of all future generations are equal, except for a growth adjustment, is just one of many assumptions one could make about the distribution across future generations of their collective net tax payments to the government. One could, for example, assume a phase-in of the additional fiscal burden (positive or negative) to be imposed on future generations, allocating a greater share of the burden to later future generations and a smaller share to earlier ones. Clearly, such a phase-in would mean that generations born after the phase-in period is over would face larger values of lifetime burdens (the $N_{t,k}$) than we are calculating here.

A different method that allows a clearer distinction between the two concepts is to calculate the accounts for future generations assuming that they too face current fiscal policies (this amounts to apply them the same relative age and gender profiles for taxes and transfers that apply to current individuals), and then to obtain a measure of what is needed to close the gap[9]. This amount is called the *Intertemporal Budget Gap* (or IBG):

$$IBG = \sum_{s=1}^{\infty} G_{t+s}\,(1+r)^{t-s} - W_t - \sum_{s=0}^{D} N_{t,t-s}\,P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t+s}\;P_{t,t+s}\,(1+r)^{t-s} \qquad [4]$$

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[9] This method has been adopted by a study on generational accounting for European countries sponsored by the European Commission.

Another possibility is to assume that future generations pays the same net lifetime taxes (adjusted for growth) as the newborn generation and then estimates how far current policies are from satisfying the intertemporal budget constraint. This gap is defined as the "*Intergenerational Balance Gap*" (or IGG)[10]

$$IGG = \sum_{s=1}^{\infty} G_{t+s}\,(1+r)^{t-s} - W_t - \sum_{s=0}^{D} N_{t,t-s}\,P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t}\,(1+g)^{s}\,P_{t,t+s}\,(1+r)^{t-s} \qquad [5]$$

The intertemporal budget gap will be less than the generational balance gap, if current policy treats future newborns less favourably, in terms of their net lifetime taxes on a growth adjusted basis, than present newborns. Conversely, if the reverse is true the intertemporal budget gap will be greater than the generational balance gap. For example, government policy might be to phase out a particular transfer payment (such as pensions) on a certain date. This might be enough of a reduction in payments to ensure that government policy is sustainable. However, this is achieved by reducing future liabilities or, equivalently, by reducing payments to future generations more than presently living ones. It is therefore unlikely to close the generational balance gap, unless future generations were being treated more favourably than current living generations before the policy change.

Another way of measuring the imbalance in fiscal policy is to ask what immediate and permanent change in a specific tax or transfer payment would be necessary (for all generations) to close either the intertemporal budget gap or the generational balance gap. Because all such policies satisfy the government's intertemporal budget constraint, they are also sustainable.

To be more precise about this type of calculation, suppose, for example, that we want to find the immediate and permanent percentage reduction in government purchases needed to achieve generational balance. Denote this percentage reduction by *d*. We use equation [6] to solve for *d* under the assumption that *N* equals $N_{t,t}$.

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[10] See Cardarelli, Kotlikoff and Sefton (1999).

$$\sum_{s=0}^{D} N_{t,t-s}\, P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t}(1+g)^{s}\, P_{t,t+s}\, (1+r)^{t-s} = \sum_{s=1}^{\infty}(1+d)\, G_{t+s}\, (1+r)^{t-s} - W_t \quad [6]$$

As a second example, consider the immediate and permanent percentage increase in income taxes needed to achieve generational balance. Call this percentage increase *v*. To determine the size of *v*, one tries different immediate and permanent income tax increases until we find the one with the following property: given the new values of generational accounts (the values inclusive of the tax hike), the calculated value of N equals $N_{t,t}$. In contrast to the calculation of *d*, in this calculation of *v*, $N_{t,t}$ the generational account of current newborns, is not held fixed. Like the accounts of all other existing generations, $N_{t,t}$ is higher because of the increase in the income tax. Consequently, so is N.

Similar calculations can be done to ascertain the size of an immediate and permanent percentage reduction in government purchases or increase in income tax required to achieve intertemporal budget balance. However in this case N in equation [6] needs to be replaced by $N_{t,t+s}$ the generational account of future newborns under current policy.

3 Data, relative profiles and the accounts for current generations

The first step in generational accounting is to estimate the net fiscal position for each individual currently alive, identified on the base of his age and gender. The aggregate tax and transfer amounts are thus distributed among individuals of different age and gender and transformed in a series of individual accounts. We start from the 1998 National Accounts data on the receipts and expenditures of the Public Sector ("Pubblica Amministrazione", in the following denoted with PA, mainly central government and local authorities) as reported by Table CN.1 in the *Relazione Generale sulla Situazione Economica del Paese*, 1999. These amounts have been disaggregated further so as to identify the most relevant taxes and transfers that can be allocated among individuals (see Table 1).

In particular, as far as revenues are concerned, using data on the self-assessment tax returns published the Ministry of Finance we distinguish between direct taxes on labour, real capital (equities and real estates) and financial capital. Moreover, we identify the most important categories of indirect taxes, using data from the *Bilancio dello Stato*

contained in the *Relazione Generale* and data on the revenues of the PA from the *Annuario di contabilita' generale* of the National Institute of Statistics (ISTAT).

As far as expenditure are concerned, we identify four main categories of transfers to households and individuals: Pension and Social Security (*Previdenza*), Welfare State and Social Assistance (*Assistenza*), Health (*Sanita'*) and Education. They include not only personal transfers (such as pensions) but also that part of government expenditure (compensation of employees and intermediate consumption) that may be attributed to these key aggregates. This disaggregation is based on (a) the *Conti Economici dell'Assistenza, Previdenza and Sanita'* published in the *Relazione Generale* and (b) data provided by the Ministry of Education.

Once we have identified the aggregate revenues and expenditures of the public sector in the base year, the second step of generational accounting is to obtain an age and gender distribution of as many of these taxes and transfers as possible. This requires building age and gender profiles from household or individual survey data. The main sources of data used in this paper are: the 1995 Bank of Italy's Survey on Households' Income and Wealth; the 1995 Survey on Household Consumption of the National Institute of Statistics (ISTAT); and the 1994 survey "Multiscopo" on the health condition and access to health services, of ISTAT. Further, we use data provided by a host of public administrations, such as the Ministry of Health (data on the access to hospitals services, based on hospital dismissal forms), the Ministry of Education 9datat on the expenditure on education), the Health regional departments (*assessorati*) of Lombardia and Puglia (for the data on consumption of drugs), the National Institute for Social Security (INPS) and ISTAT (both for data on pension expenditure) and the National Institute for the Insurance against Work Injuries (INAIL, for data on work injury benefits)[11].

[11] A detailed appendix describing how the different profiles have been obtained is available on request to the authors.

Table 1. Revenues and Expenditure of the Public Sector, Italy, 1998

(in billions of lire)

	Revenues			Expenditure	
1	Net Operating Surplus	870	1	Compensation of employees	226,005
2	Direct taxes	292,611		Social security	4,291
				Health	45,485
2.1	Taxes on labour	173,047		Assistance	2,235
	IRPEF on labour income	173,047		Education	71,469
				School	62,846
2.2	Taxes on real capital	86,928		Unversity	8,623
2.2.1	Equity and stocks			Other	102,525
	IRPEF on capital	27,180			
	IRPEG	42,184	2	Intermediate consumption	99,375
	Tax on dividends	3,383			
	Tax on net wealth of firms	5,480		Social security	2,684
				Health	22,209
2.2.2	Real Estate			Assistance	3,102
	IRPEF on real estate	4,702		Education	10,751
	INVIM	2,200		School	10,214
	ICI	1,799		Unversity	537
				Other	60,629
2.3	Taxes on financial capital				
	Tax on income from financial capital	17,828	3	Revenues from sales of goods and service	-34,936
			4	Contribution to production	26,303
	ILOR	6,365			
	Vehicle tax on families	4,957			
	Other	3,486	5	Social expenditure	395,849
3	Indirect taxes	290,465	5.	Social Security	329,258
	(net of those paid by public sector)		5.1.1	Retirement pensions	287,095
				Old age and seniority	227,587
	VAT	113,723		employees	191,422
	IRAP on labour income	33,700		self emoployed	36,165
	IRAP on income from capital	6,300		Survival	54,980
	ICI	14,951		employees	46,243
	Stamp duties	20,135		self emoployed	8,737
	Hydrocarbons oil tax	45,512		Invalidity	4,528
	Petroleum and gas tax	9,876		employees	3,808
	Electric Energy	5,747		self emoployed	720
	Tobacco	12,369	5.1.2	Labour market and family	42,163
	Betting, gaming and lottery	13,191		Unemployment and mobility benefit	6,812
	Concessions	2,187		Income support for the unemployed	1,547
	Vehicle tax on families	4,120		Sickness and injuries allowance	3,335
	Other	8,654		Maternity allowance	2,272
				Industrial injuries rent	7,578
4	Social Contributions	270,922		Severance pay	11,559
				Family benefits	7,957
4.1	Employees	78,178		Other	1,103
	employees	55,784			
	self employed	22,394	5.	Assistance	25,448
4.2	Employers	192,744		Social pensions	3,576
				Disability pensions	15,951
5	Other transfers	32,041		War pensions	2,448
				Other	3,473

6	International transfers	631			
			5	Health	41,143
7	Other current revenues	6,097		Hospital care	8,866
				Other health services	19,444
8	Capital tax	7,737		Drugs	12,833
	Inheritance tax	1,810	6	Transfers to non profit institutions	5,565
	Other	5,927			
			7	International transfers	11,918
9	Contribution to investments	2,626			
			8	Other transfers	5,836
10	Other capital revenues	2,502			
			9	Other current expenditure	710
11	Interests	6,087			
			10	Interests	152,609
	Total Revenues	912,589			
			11	Investments	50,740
				Social security and assistance	791
				Health	2,719
				Housing	9,255
				Education	4,679
				Other	33,295
			12	Contributions to investments	20,947
			13	Othert capital account transfers	5,998
				Total Expenditure	966,919
				Net borrowing requirement	-54,330

Survey data are also used as inputs of a static microsimulation model (Itaxmod) that allows us to estimate taxable incomes, tax allowances and several transfers profiles for households of different age and gender. A special treatment is given to pension transfers, due to the reforms that have deeply changed the pension system in the 90s by making it less generous and by making retirement eligibility conditions more stringent. In order to estimate how the reforms have changed the age and gender profile for pension expenditure we have used a model similar to the one built by Sartor (1999).

Some of the fiscal variables included in the public budget of Table 1 can not be distributed among the population by age and gender (for example, the expenditure on public order, or on international cooperation). Contrary to the traditional approach, we allocate these taxes or transfers uniformly among all age groups. Hence all expenditure

included in G_t in equation [1] are treated as transfers in the $N_{t,k}$ terms. In doing so, we let demographic changes affect the growth of these aggregates.

A special treatment is reserved to the revenues from government assets (net operating surplus), which are capitalized at 1998. In other words, we assume that the proceeds from this source will grow in line with labour productivity and discount them to the base year; the sum of the present value of these revenues is then subtracted from the government debt. This is taken as the net financial liabilities of the public sector, as reported by the Table aD.45 of the *Relazione del Governatore sull'Esercizio 1998, Appendice, Banca D'Italia,* 1999.

This is the term W in equation [1]. It does not net out the value of the public sector existing infrastructure, such as parks, highways, and tanks. Including such assets would have no impact on the estimated fiscal burden facing future generations, because this would require adding to the projected flow of government purchases an exactly offsetting flow of imputed rent on the government's existing infrastructures[12].

Relative Profiles

The age and gender profiles for the main taxes and transfers are reported in the Charts 1-9. In order to highlight how the burden of a tax and the benefit of a transfer change with age and gender, the average amounts are normalized with respect to the amount attributed to a 40 year-old male[13].

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[12] If, for whatever reason, the present value of these rents is not equal to the market value of the real assets, then an estimate of this difference should be netted out from *W*.

[13] The benchmark is the 60-year old male for pension transfers and the 15-year old male for education transfers. It should be noted here that allocating taxes and transfers among individuals presents obvious problems of fiscal incidence. As for taxes we should be considering whether their burden is shifted backward or forward, while for transfers whether they benefit someone different from the actual receiver. For the purpose of this study we prefer to adopt a unique, homogeneous criterion and ignore these problems; our general rule is thus to assume that taxes are borne by those paying the taxes and transfers benefited by those who receive them. For the only exception see note 15.

Chart 1. Health

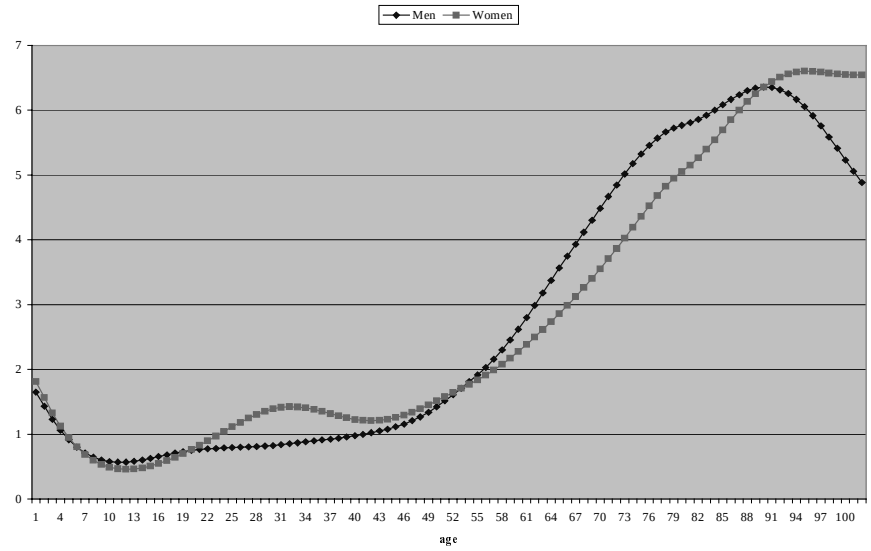


Chart 2. Pensions

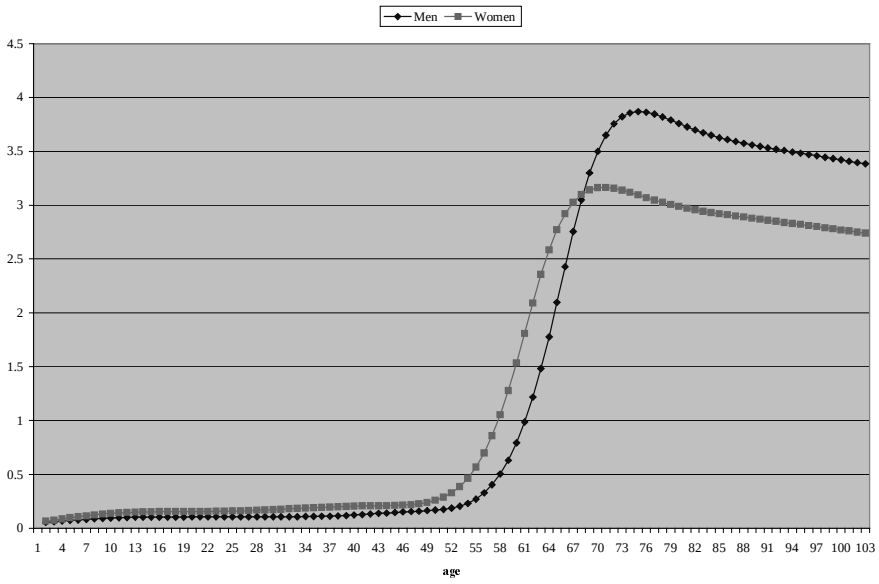


Chart 3. Education

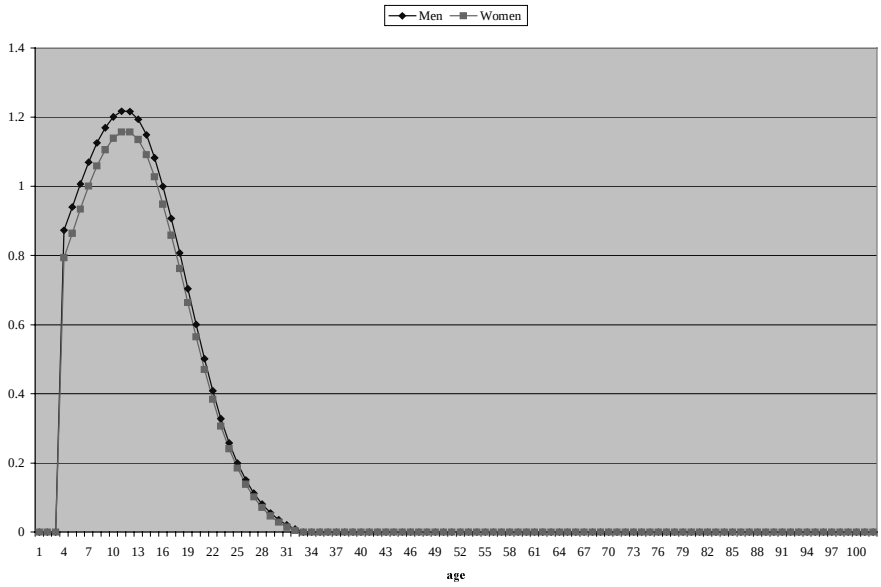


Chart 4. Labour market and Family

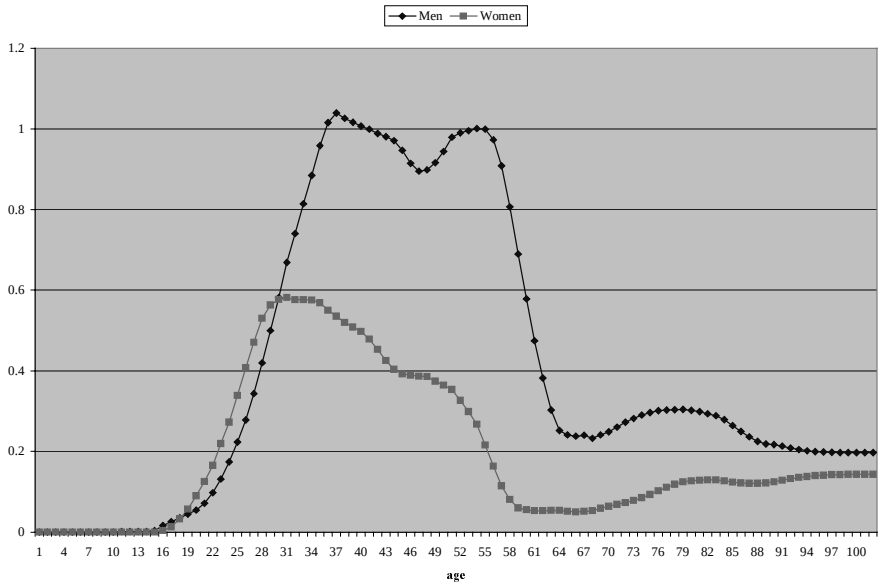


Chart 5. Social assistance

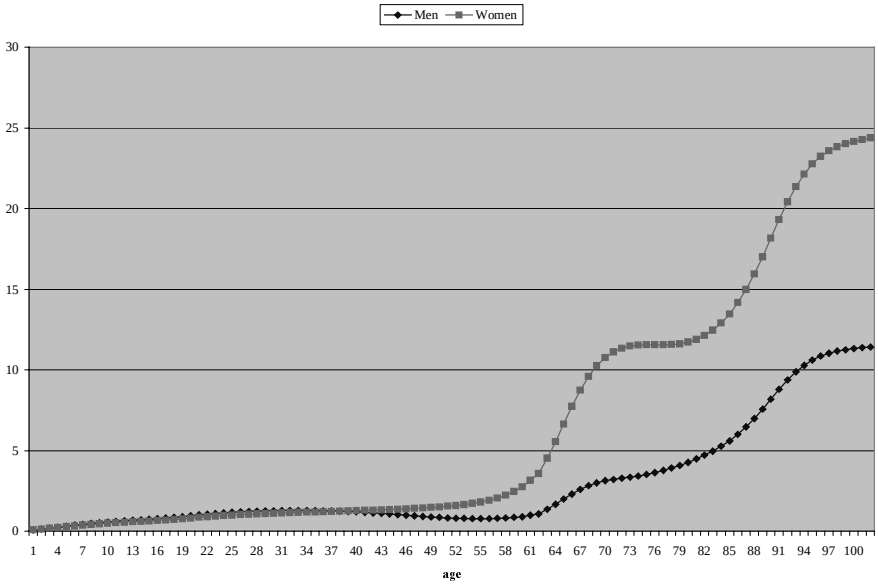


Chart 6. Taxes on labour income

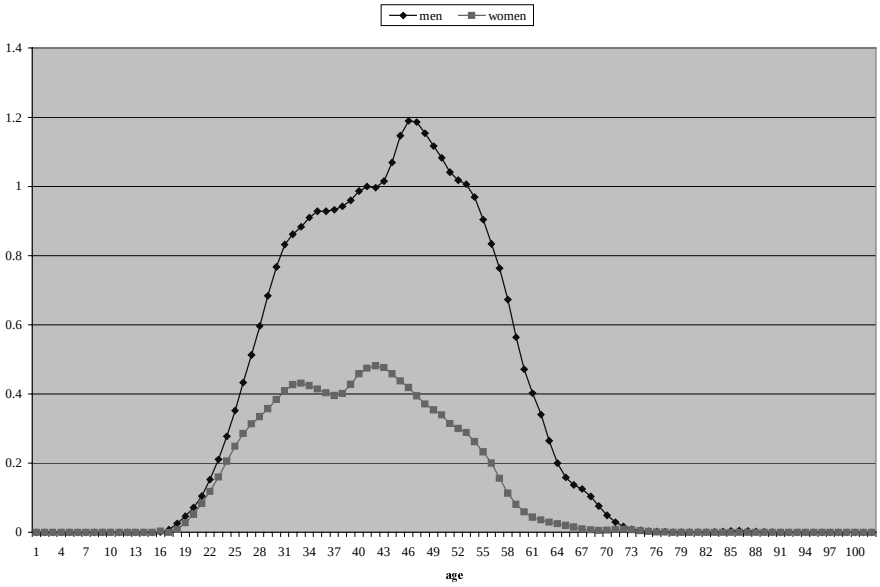


Chart 7. Social contributions

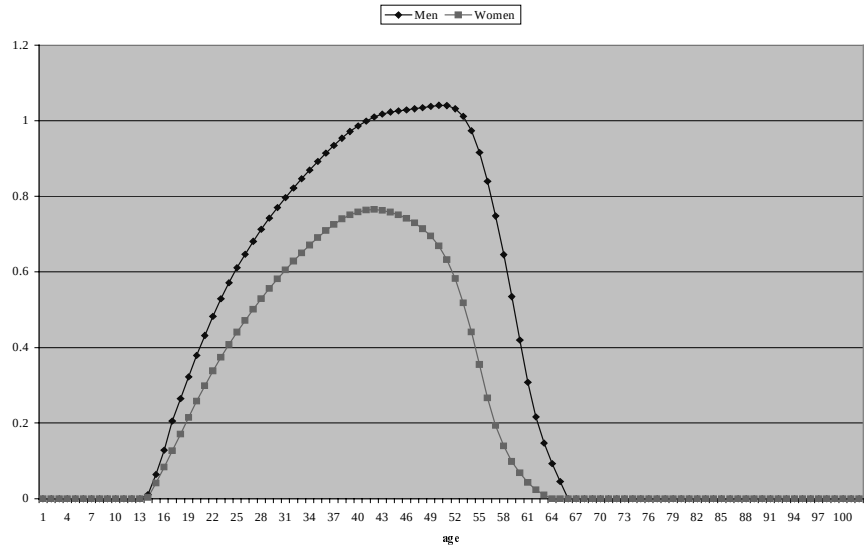


Chart 8. Taxes on capital

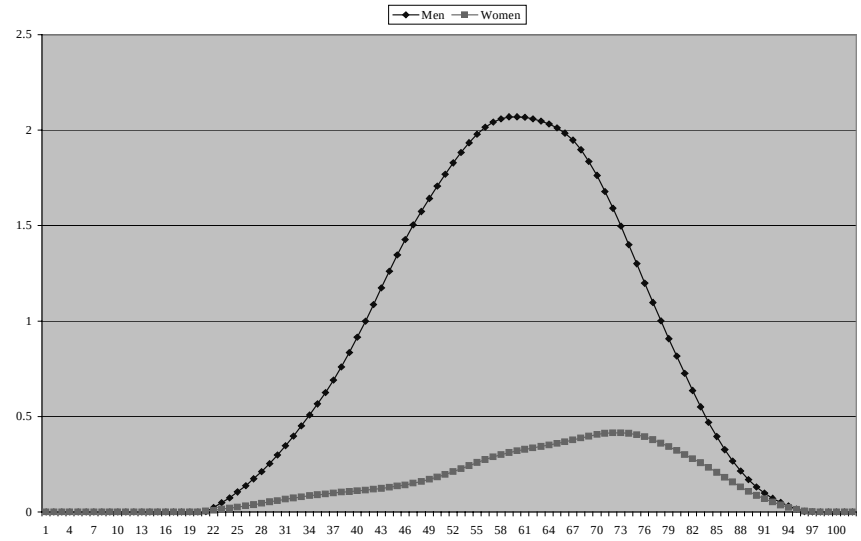
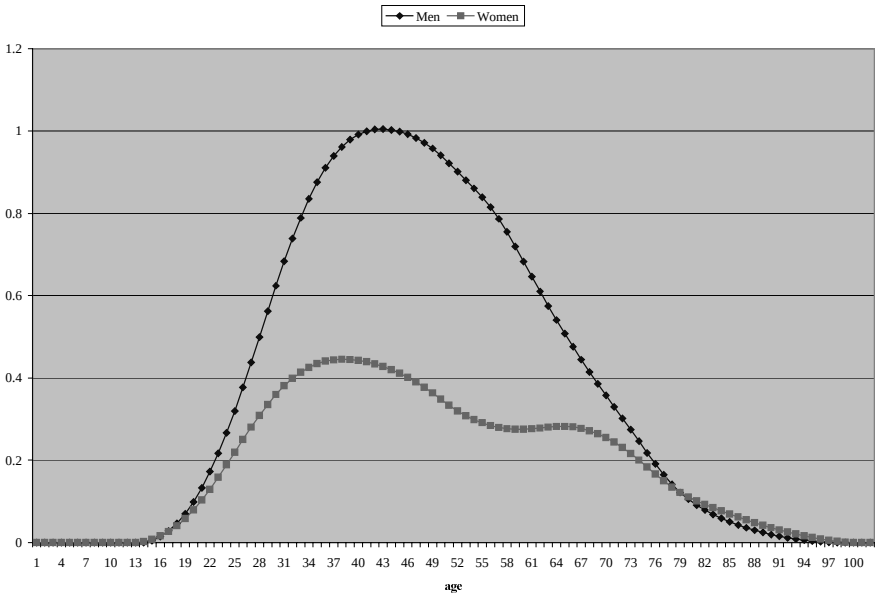


Chart 9. Indirect taxes



Charts 1 and 2 show that the expenditure on health and pensions is strongly and positively related to the age of the beneficiary[14]. As for health, the average benefit for a 60-year old is more than twice the one for a 40-year old (2.8 for men and 2.3 for women). This ratio jumps at 6 for a 90-year old (for both men and women). The chart shows also high relative benefits for the first three years of life, and a hump around the age of 30 for women reflecting the larger use of hospital structures during the fertility period.

As for pensions, from the age of 65 the average level of this transfer is much smaller for a woman than for a man. Before that age the average amounts are larger for women due to the predominant weight of survivals pensions, but from the age of 65 onward this effect can no longer offset the higher average amounts of old-age, seniority and

[14] These profiles are obtained as weighted averages of the profiles for the single tax and transfer items reported in Table 1 (using as weights their share of the aggregate expenditures or revenues).

disability pensions for men (due to their more active participation to the labour market).

As for education, the relative profile has an unimodal shape, and declines to zero above the age of 30. The very steep decline of this curve after the age of 15 reflects the drop in the enrolment rates once mandatory education is over. The male profile for the "labour market and family" benefits shows a double peak[15]. The first one, around the age of 35, mainly reflects the transfers to the family and the unemployed. The second one, around the age of 55, reflect social mainly severance pay and disability and work injury transfers. As for women, there is a single peak around the age of 30 as at that age they receive most of the transfers targeted to the family and the unemployed. Finally, the profile for social assistance (social pensions, war pensions and invalidity pensions) is increasing with age both for men and women (who receive a larger share of these transfers, especially invalidity pensions).

As far as the burden of taxation is concerned, the age profile of taxes on labour (direct taxes and social contribution) is hump-shaped, reflecting the age profile of labour earnings (that reach a peak around the age of 45). Particularly strong is the link between the age profiles of labour income and social contributions; as the latter are proportional to the payroll, the relative amount of contributions paid above the age of 60 is negligible. The profile for taxes on capital is more tilted toward old age, both for women and men, something that is consistent with the continuation of savings and capital accumulation during this age (wealth decumulation start only from the age of 65). As for indirect taxes, the profiles reflect the link between age and both the level and the composition of consumption[16]. As the rate varies with different goods and services, a change in the composition of consumption (for the same level) would determine a different allocation of the tax burden. An example is taxation on petrol, with a very high rate and whose consumption appears to strongly decline with age.

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[15] See Table 1 for the list of these benefits.

[16] The profile for indirect taxes has been obtained using the Survey on Household Consumption of ISTAT. The expenditure per household is distributed among its components as a proportion to their relative participation to the household income.

Demographic projections

Generational accounting aims at quantifying the tensions that, given the existing fiscal system, will arise from future changes in the population structure. In order to build future demographic scenarios the first step is to consider the most recent trends in both mortality and fertility rates. Life expectancy at birth has risen steadily in Italy over the last 60 years (from 53.8 in 1930 to 74.1 in 1993 for men, and from 56 to 80.5 for women), but the most important change has involved fertility. While most of the European countries show a declining trend in their fertility rates, Italy stands out for having the second lowest value of this rate (only Spain has a lower one), from 1997 below the replacement value (see Table 2). The fertility rates for cohorts confirm the rapid decline in the Italian fertility, as the rate declines from 2.1 for the cohorts born in 1944 to an estimate of 1.77 for the generation born in 1957 and 1.59 for the one born in 1963 (see Table 3). Generally speaking, Italy is characterised by the following trends: a rise in the number of women with no children, a drastic reduction in the number of families with more than three children, and an increase of the age at which the first child is born. Behind these general trends, however, there are significant regional differences, as the "single child model" predominant in the Northern areas coexists with the model prevailing in the Southern regions and characterised by a relatively larger (even if declining) number of dependants.

Table 2. Fertility rates

	1970	1975	1980	1985	1990	1993	1994	1995	1996	1997
Germany	-	-	-	-	-	1.28	1.24	1.25	1.32	-
France	2.47	1.93	1.94	1.81	1.78	1.65	1.65	1.70	1.72	1.71
UK	2.45	1.81	1.89	1.8	1.83	1.76	1.74	1.71	1.72	1.71
Italy	2.43	2.21	1.68	1.45	1.36	1.26	1.22	1.18	1.21	1.22
Spain	2.86	2.8	2.21	1.64	1.36	1.27	1.21	1.17	1.15	1.15
Sweden	1.94	1.78	1.68	1.73	2.14	2	1.89	1.74	1.61	1.53
Norway	-	1.98	1.72	1.68	1.93	1.86	1.87	1.87	1.89	1.86
Turkey	5.68	5.09	4.36	3.59	2.99	2.76	2.69	2.62	2.55	2.48

Source: Recent demographic developments in Europe 1998, Council of Europe, September 1998.

Table 3. Cohort fertility rates

Year of birth of women	Germany	France	UK	Italy	Spain	Sweden	Norway	Turkey
1944	1.8	2.26	2.21	2.1	-	2	2.25	4.56
1945	1.8	2.22	2.19	2.09	-	1.97	2.21	4.48
1946	1.79	2.17	2.19	2.07	2.35	1.99	2.18	4.38
1947	1.77	2.13	2.08	2.01	2.33	2.01	2.16	4.28
1948	1.75	2.12	2.11	1.97	2.35	1.99	2.13	4.18
1949	1.74	2.1	2.08	1.92	2.25	1.99	2.11	4.08
1950	1.72	2.11	2.07	1.91	2.15	2	2.09	3.98
1951	1.7	2.11	2.04	1.88	2.12	2	2.08	3.98
1952	1.68	2.12	2.05	1.85	2.14	1.99	2.07	3.98
1953	1.67	2.12	2.04	1.86	2.05	2.02	2.04	3.97
1954	1.67	2.12	2.02	1.85	1.95	2.03	2.04	3.97
1955	1.67	2.13	2.02	1.83	1.92	2.02	2.05	3.97
1956	1.67	2.13	2.01	1.8	1.88	2.04	2.05	3.93
1957	1.66	2.12	2.01	1.77	1.89	2.03	2.04	3.89
1958	1.65	2.11	1.99	1.74	1.83	2.05	2.05	3.84
1959	1.65	2.09	1.97	1.71	1.77	2.05	2.05	3.8
1960	1.65	2.07	1.97	1.69	1.75	2.04	2.05	3.76
1961	1.64	-	1.94	1.65	1.65	2.02	2.03	-
1962	-	-	1.91	1.61	1.6	1.99	2.02	-
1963	-	-	1.9	1.59	1.56	1.98	2.01	-
1964	-	-	1.87	-	1.55	1.95	1.98	-
1965	-	-	1.86	-	1.47	1.94	1.97	-

Source: Recent demographic developments in Europe 1998, Council of Europe, September 1998.

In order to quantify the potential long-term imbalance of budgetary policies we use the demographic projections produced by ISTAT, that cover different possible scenarios. The baseline case in our model adopts the "central" assumptions of this Institute, describing the most likely future demographic scenario. In this scenario, the total fertility rate rises slightly, from 1.2 children per women to 1.45 by 2020 and remains constant thereafter. A further decline in the mortality rates is assumed, as life expectancy at birth increases to 78.3 for men and to 84.7 for women by 2020. Finally, the flow of immigrants is assumed to remain constant at the average level of the 90's (56,000 immigrants per annum).

As a result of these assumptions, total population begins a slow but steady decline from the current 57 millions to 50 millions in 2040 and 24 millions in 2115 (Chart 11). The old age dependency ratio (the ratio between the number of those aged 65 or more and those aged 18-64) jumps from the current 26.9 percent to 38.2 percent in 2020, and reaches around 60 percent in 2045 before settling at around 55 percent thereafter

Chart 10. Old age dependency ratio

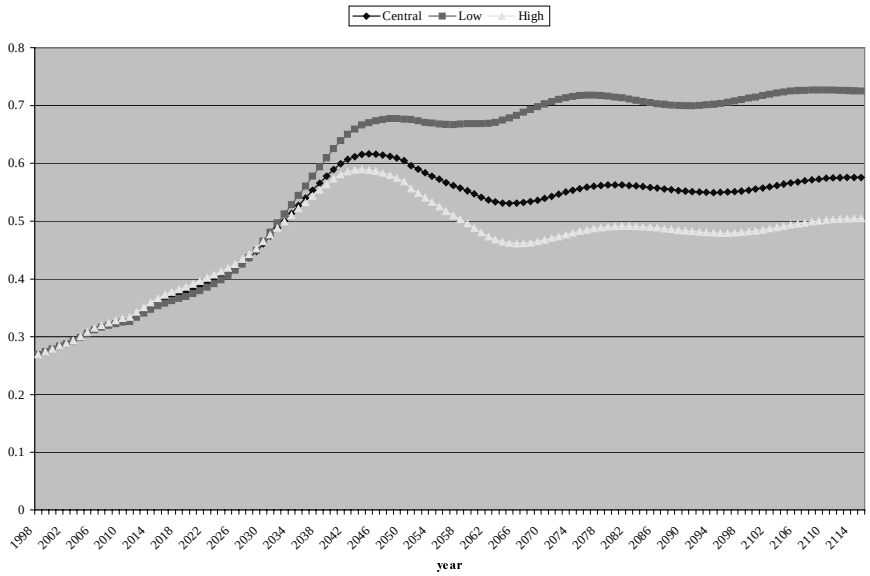


Chart 11. Population

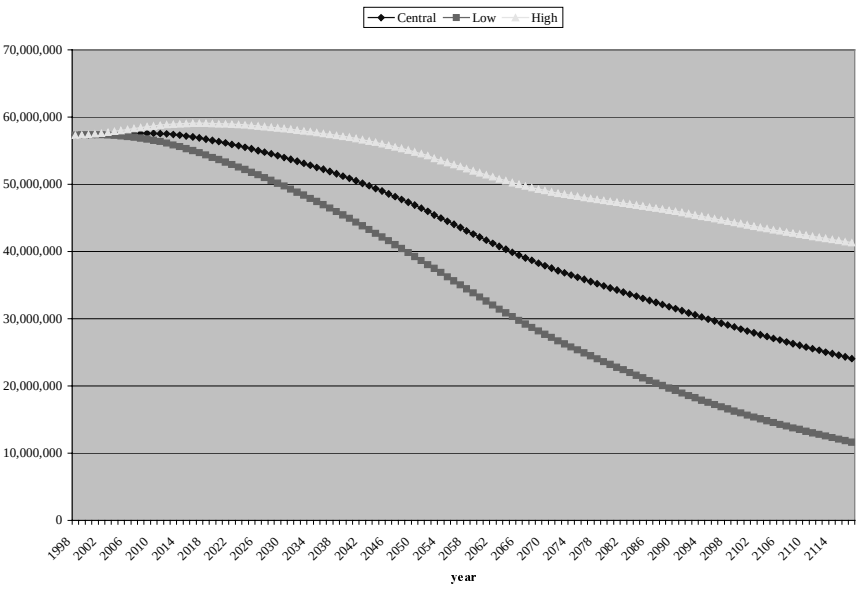
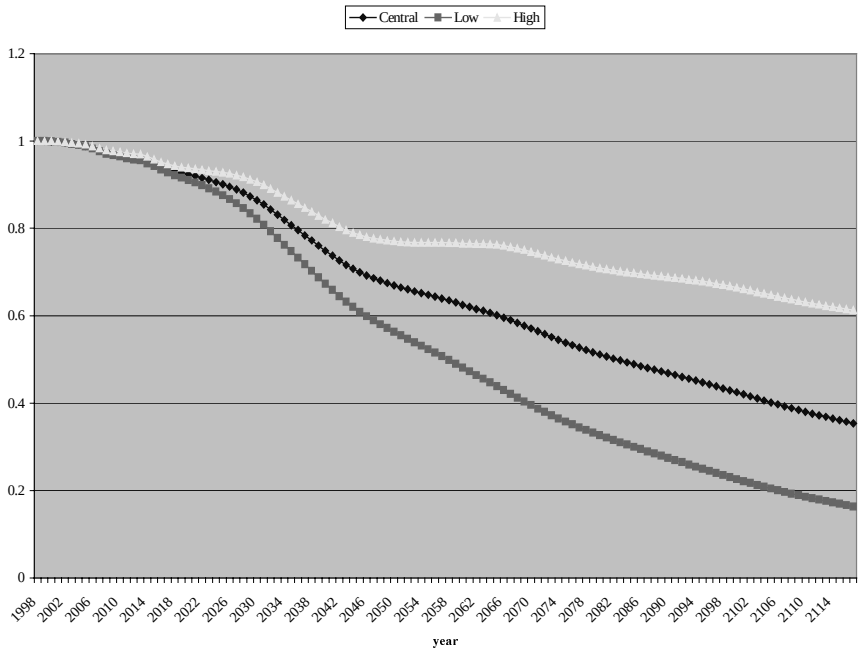


Chart 12. Labour force



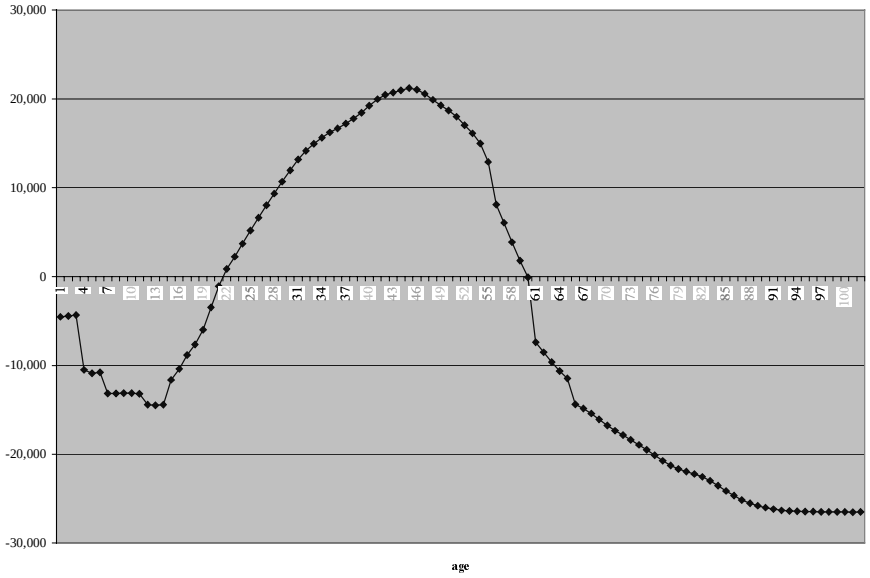
(Chart 10). Hence, if today there are 100 potential workers, in 50 years time they will be 66, and in 100 years they will be just above 40 (Chart 12). The implications for pay-as-you-go pension systems are immediate: if today the pension received by a single retiree is paid by the potential work of four individuals, in 50 years the same pension will have to be paid by the potential work of less than two workers. For given labour market participation and unemployment rates, population aging is bound to introduce redistributive tensions between generations.

ISTAT also presents a more optimistic ("high-assumption") scenario, based on a higher life expectancy at birth (80.1 years for men and 86.3 for women by 2020), a more relevant increase in the total fertility rates (up to 1.76 per women), and a larger net immigration flow (equal to 76,000 units in 2020 and thereafter). Under these assumptions the old age dependency ratio would still rise, even if less rapidly than

before; after reaching a peak of 59 percent in 2044, it will settle around 49 percent by 2100[17].

While ISTATs build its projections until 2050 we extrapolate further until 2200. using the assumptions on fertility, life expectancy and immigration that are implicit in the 2050 population figures for both scenarios[18].

Chart 13. Net taxes for age groups in 1998
(in thousands of lire)



[17] ISTAT presents also a less favourable ("low-assumptions") scenario, in which fertility rates do not increase at all, but decline further to 1.12 children per women. The consequences of this and other assumptions would be a dramatic reduction in birth rates and then of population and labour force (that would decline by 82 percent in 2100), while the old age dependency ratio would more than double in 40 years (see Charts 10, 11 and 12).

[18] The assumption that demographic processes reach a steady state by 2020 is only one of the many that could inspire demographic projections. One could assume, for example, that fertility follows a cycle, or that demographic changes are endogenous to some of the changes in social and economic factors. The existence of a cycle behind the fertility dynamics would clearly imply much more optimistic demographic scenarios than the ones used in this study (see F. Padoa Schioppa, 1993).

Generational accounts of currently living generations

Given the age and gender tax and transfer profiles showed in charts 1-9, it is possible to anticipate the fiscal pressures arising from the increase of the average age of citizens, especially through a surge in the aggregate social and health expenditure.

Chart 13 shows what happens if we divide the 1998 tax and transfer aggregates among the age groups using the relative profiles of charts 1-9. In 1998, the young (aged 0-17) and the old (60-year old and more) receive on average a net transfer from the State, funded with the net taxes paid by those who belong to the working-age groups. The largest net taxes are paid by those aged 45 (see Table 4).

The present value of the total net taxes that currently living individuals can expect to pay or receive (if negative) to the State during their remaining lifetime is showed in Tables 5M and 5F (for men and women, respectively). To obtain these amounts we take back to 1998 a series of financial transactions that will take place in the future. Hence, we need assumptions on both the growth of monetary aggregates and the discount rate. Table 5 is obtained assuming a real productivity growth rate of 1.5 percent per annum, and a 5 percent real discount rate. Hence, Table 5M and 5F indicate the net taxes that currently living individuals of different age are expected to pay over their remaining lifetimes under the hypothesis that their lifetime income will grow at 1.5 percent per annum.

Those born in 1998 will pay to the government 35,3 millions of lire (in 1998 prices) if men, and receive around 81 millions of lire if women. This difference is mainly due to the smaller amount of taxes and contributions paid by women (who participate less to the labour market). The most relevant transfers are represented by education and then pensions, while social contribution are the most important tax. As individuals grow older and start working, the present value of net taxes increases (become positive for women). This is because the transfers to the young are now gone, and the taxes and contributions that will be paid in the working age are discounted less heavily. The peak in net taxes is reached between the ages 25 and 30, for both men and women. Once they got even older, individuals start receiving a net transfer from the State, as they will pay less taxes and receive transfers targeted to the old ages (such as pensions and health care services). The break even point is

Table 4. Average taxes and transfers per capita, 1998

(in thousands of lire)

Age	Total	Taxes on labour	Taxes on capital	Taxes on real estate	Indirect Taxes	Social ontributions	Other Revenues	Health	Education	Pensions	Labour Market and Family	Other Social Security	Assistance	Other Expenditure
0	-4,547	0	0	0	842	0	1,436	-1,831	0	-194	0	-7	-19	-4,775
5	-10,783	0	0	0	842	0	1,417	-838	-6,679	-652	0	-22	-76	-4,775
10	-13,193	0	0	0	842	0	1,417	-536	-9,146	-841	-3	-29	-124	-4,775
15	-10,392	35	0	6	930	1,218	1,418	-623	-7,525	-847	-37	-30	-157	-4,780
20	-1,083	993	20	34	1,645	4,230	1,429	-821	-2,547	-857	-181	-37	-202	-4,789
25	6,609	3,637	290	154	3,081	6,376	1,474	-1,010	-811	-887	-582	-58	-241	-4,814
30	13,193	6,168	924	336	4,736	7,996	1,530	-1,146	-109	-942	-1,074	-83	-260	-4,882
35	16,688	7,242	1,090	472	5,927	9,218	1,581	-1,160	0	-1,018	-1,379	-106	-268	-4,912
40	19,957	8,275	1,937	618	6,453	10,057	1,615	-1,142	0	-1,138	-1,340	-122	-265	-4,990
45	21,025	8,904	3,041	752	6,491	10,046	1,633	-1,272	0	-1,895	-1,191	-137	-254	-5,095
50	18,007	7,758	3,233	797	6,222	9,650	1,642	-1,612	0	-2,892	-1,230	-176	-253	-5,132
55	8,113	5,817	4,666	850	5,842	5,797	1,645	-2,065	0	-7,589	-1,079	-290	-287	-5,193
60	-7,402	2,973	4,181	732	5,352	956	1,648	-2,723	0	-14,078	-589	-338	-430	-5,088
65	-14,386	1,129	4,460	681	4,810	0	1,659	-3,554	0	-16,633	-467	-336	-1,081	-5,054
70	-17,345	340	4,273	605	4,264	0	1,667	-4,462	0	-16,484	-626	-336	-1,566	-5,020
75	-20,098	106	3,304	387	3,822	0	1,676	-5,363	0	-16,315	-763	-336	-1,739	-4,877
80	-22,227	44	2,295	315	3,413	0	1,715	-5,902	0	-16,197	-736	-336	-1,936	-4,901
85	-24,685	22	767	160	3,297	0	1,822	-6,478	0	-16,114	-645	-334	-2,352	-4,831
90	-26,202	16	104	44	3,510	0	2,003	-6,890	0	-16,038	-617	-333	-3,220	-4,781
95	-26,470	11	112	4	3,373	0	2,291	-6,701	0	-15,961	-606	-334	-3,882	-4,777

Table 5M. Generational accounts, male

(in thousands of lire)

Age	Total	Taxes on labour	Taxes on capital	Taxes on real estate	Indirect Taxes	Social Contributions	Other Revenues	Health	Education	Pensions	Labour Marke and Family	Other Social Security	Assistence	Other Expenditure
0	35,383	89,153	35,974	7,590	94,993	133,172	44,910	-39,155	-101,235	-59,655	-16,288	-2,703	-6,416	-144,958
5	77,296	104,443	42,090	8,885	106,593	154,320	44,718	-37,738	-105,413	-67,832	-19,077	-3,092	-7,286	-143,315
10	160,959	123,862	49,968	10,542	121,564	180,731	44,849	-40,508	-76,809	-76,663	-22,629	-3,528	-8,034	-142,388
15	262,664	144,504	58,171	12,285	137,090	208,281	44,443	-43,665	-36,786	-83,240	-26,350	-3,954	-8,534	-139,581
20	343,181	166,886	67,587	14,270	153,458	224,318	43,889	-46,531	-9,927	-91,168	-30,255	-4,424	-8,874	-136,046
25	367,220	183,440	77,607	16,087	165,392	223,609	42,735	-49,033	-2,569	-111,801	-33,675	-4,890	-8,920	-130,758
30	363,904	187,425	87,119	17,351	170,155	212,017	41,392	-52,270	-190	-124,143	-35,371	-5,348	-8,876	-125,358
35	323,224	177,555	94,579	17,712	165,956	190,947	39,796	-56,246	0	-138,660	-34,049	-5,748	-8,859	-119,759
40	284,234	158,161	103,193	17,375	154,209	165,959	37,717	-60,700	0	-132,557	-30,560	-6,087	-8,928	-113,547
45	138,221	128,707	102,368	16,181	137,736	133,525	35,217	-65,494	0	-201,466	-26,819	-6,403	-9,207	-106,124
50	-18,061	90,447	94,320	14,074	117,810	91,392	32,186	-69,792	0	-252,293	-22,866	-6,675	-9,754	-96,911
55	-164,464	51,930	83,030	11,356	96,505	42,337	28,911	-73,141	0	-284,122	-17,398	-6,579	-10,682	-86,610
60	-268,771	22,846	67,564	8,191	75,421	6,505	25,423	-74,439	0	-294,547	-12,751	-5,964	-11,889	-75,131
65	-289,945	7,838	53,209	5,586	57,357	0	21,944	-72,700	0	-269,420	-11,703	-5,144	-12,922	-63,990
70	-273,257	1,789	31,766	3,364	42,907	0	18,487	-67,205	0	-223,560	-10,986	-4,287	-12,676	-52,855
75	-238,218	634	15,511	1,908	31,209	0	15,128	-57,747	0	-178,217	-9,024	-3,426	-11,979	-42,215
80	-191,098	210	6,700	1,242	22,055	0	12,021	-45,806	0	-135,315	-6,341	-2,600	-10,876	-32,387
85	-147,382	96	1,598	309	16,000	0	9,529	-35,238	0	-100,109	-4,209	-1,918	-9,935	-23,505
90	-111,319	48	353	54	11,769	0	7,715	-25,984	0	-74,229	-2,910	-1,424	-9,301	-17,409
95	-83,389	15	393	3	7,734	0	6,467	-17,958	0	-55,820	-2,114	-1,075	-7,896	-13,138

Table 5F. Generational accounts, female

(in thousands of lire)

Age	Total	Taxes on labour	Taxes on capital	Taxes on real estate	Indirect Taxes	Social Contributions	Other Revenues	Health	Education	Pensions	Labour Marke and Family	Other Social Security	Assistence	Other Expenditure
0	-80,790	51,891	13,244	4,091	65,339	83,796	41,714	-35,432	-99,547	-48,498	-9,567	-2,095	-9,198	-136,528
5	-60,231	61,002	15,542	4,803	72,335	97,635	41,523	-34,530	-104,273	-54,768	-11,248	-2,392	-10,600	-135,261
10	-3,084	72,285	18,440	5,696	81,178	114,502	41,538	-37,653	-76,017	-60,482	-13,327	-2,694	-12,099	-134,451
15	70,123	84,666	21,532	6,658	90,492	132,337	41,132	-41,590	-36,055	-64,805	-15,611	-2,989	-13,486	-132,158
20	124,204	97,846	25,104	7,744	99,640	143,663	40,610	-45,247	-9,476	-70,292	-17,838	-3,315	-14,914	-129,321
25	127,890	103,077	28,790	8,678	104,828	143,650	39,637	-47,602	-2,274	-87,098	-18,752	-3,600	-16,284	-125,159
30	107,225	97,293	32,260	9,415	105,021	134,411	38,588	-49,036	-117	-100,526	-17,301	-3,835	-17,887	-121,060
35	59,670	85,792	35,109	9,814	100,725	115,205	37,446	-50,461	0	-118,398	-14,814	-4,079	-19,810	-116,858
40	1,633	70,847	37,484	9,912	93,246	88,644	36,066	-52,961	0	-131,000	-12,116	-4,321	-22,064	-112,104
45	-92,034	49,615	39,988	9,512	84,224	61,741	34,400	-56,326	0	-170,291	-9,647	-4,537	-24,646	-106,068
50	-165,103	29,208	42,261	8,777	75,269	32,443	32,374	-59,303	0	-188,005	-7,415	-4,719	-27,495	-98,498
55	-224,699	12,626	43,005	7,998	67,563	6,669	30,140	-61,599	0	-199,703	-5,650	-4,759	-30,813	-90,175
60	-240,186	4,158	35,899	7,059	59,842	596	27,407	-62,310	0	-188,694	-5,309	-4,352	-34,038	-80,445
65	-224,769	1,609	31,504	6,033	51,157	0	24,239	-60,971	0	-164,040	-5,023	-3,802	-35,563	-69,912
70	-198,174	881	27,559	4,464	41,841	0	20,734	-57,297	0	-137,533	-4,448	-3,215	-32,741	-58,420
75	-171,217	340	18,822	2,584	33,002	0	17,140	-51,113	0	-110,974	-3,653	-2,614	-28,142	-46,609
80	-142,168	159	9,809	1,365	25,350	0	13,693	-42,680	0	-85,353	-2,763	-2,021	-23,916	-35,811
85	-112,552	91	1,825	568	19,007	0	10,503	-33,365	0	-61,495	-2,050	-1,463	-20,335	-25,838
90	-80,033	53	291	136	13,636	0	7,812	-23,785	0	-41,513	-1,514	-996	-16,695	-17,459
95	-57,643	43	55	6	9,089	0	6,305	-16,887	0	-29,103	-1,112	-704	-13,060	-12,275

around 45 and 50 years for men and 35 and 40 for women[19]. Beyond that age individuals will be net creditor to the State: in the remaining years of their life they will receive a net transfer as their payments will come to an end while other transfers (pensions) and services (health) will become increasingly important.

4 The results

In order to assess the long-term imbalance of current fiscal policy we have run a series of simulations based on the demographic scenarios described above, and on some assumptions regarding the economic environment. The sustainability condition closely depends on the economic scenario that will prevail in the future. As we cannot predict the future, simulations are run on the basis of different values for the labour productivity growth and the real interest rate. In particular, we consider cases in which labour productivity grows in real terms at 1, 1.5 and 2 percent per annum, and values of 3, 5 and 7 percent for the real interest rate. The baseline scenario is thus characterized by a 1.5 percent labour productivity growth and a discount rate of 5 percent[20].

It is worth stressing here that we ignore any other change in the economic structure and in the immigrants flows. Given the length of the time horizon adopted it is realistic to expect some endogenous (or policy-induced) change of the economic and social framework. However, predicting the extent, or even only the direction, of these changes is

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[19] Women pay less taxes and contributions because of their smaller participation to the labour market, and receive a only slightly smaller amount of transfers because of their higher longevity and the generosity of some social security program, such as survival pensions. However, the difference in accounts between men and women should not be over-emphasised, both because we ignore any redistribution within the family and because the current differences in the participation rates are likely to decline in the future.

[20] These values define the baseline scenario in the book containing a multi-country application of generational accounting and edited by Auerbach, Kotlikoff and Liebfritz (1999). As we have noted above, the choice of the appropriate discount rate is not easy and the quite broad range of values adopted in this work reflects this uncertainty. The choice of the labour productivity growth rate of 1.5 percent reflects the average of the growth rates of labour productivity in the OECD countries in the 80's (1.8 percent) and 90's (1 percent).

impossible[21]. Further, it must be stressed that the main objective of generational accounting is not to predict futures economic scenarios, but to highlight the potential tensions implied by the continuation of current policies into the future, something that traditional accounting measures (such as deficit and debt) are not able to perceive.

Baseline case

According to our estimates, in the baseline scenario (Table 6) current fiscal policy in Italy is far from equitable as it requires a considerable increase in the net taxes paid by future generations. While the generation born in 1998 receives, on average, 22 millions of lire of net transfers from the State, future generations will have to pay 77 millions of lire-1998. The difference between the accounts of the newborns and future generations (calculated according to the traditional method, that is, assuming that only future generations will bear the burden of the adjustment) is thus around 100 millions of lire. This is equivalent to having future generations pay 30 percent more in taxes and contribution than current newborns.

In the baseline scenario the Intertemporal Balance Gap represents around 58 percent of net current financial liabilities. In order to close this gap there are two possibilities. The first one is to have a 5 percent immediate and permanent increase of the taxes and contributions paid by all generations. This is equivalent to an increase of fiscal pressure in 1998 of more than 2 percentage points (from 44 to 46 percent), or to approximately 40 thousand billion of lire of larger fiscal revenues in 1998. The second possibility is to have a 5,1 percent proportional cut in public expenditures and transfers for all generations (or a cut of 13.5 percent in government intermediate consumption and compensation of employees, or a 13.8 percent reduction in pension transfers).

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[21] The same decrease of the labour force should affect labour productivity. These effects are, however, ambiguous; productivity should go up because of the higher capital per worker, but the reduced dynamism of markets in an aged society could hinder incentives to innovation (see Cutler et.al, 1990). Traditional generational accounting does not take into accounts any of these effects, but there have been attempts to introduce generational accounting within a general equilibrium model where all these feedback and endogenous reactions can be considered (see Kotlikoff and Fehr, 1997).

Table 6. Generational accounts: the baseline case (r = 5%, π = 1.5%)

	Average	Men	Women
Newborns (thousand of lire)	-22,704	-80,790	35,383
Future generations (thousand of lire)	77,183	19,096	135,269
Difference (newborn-future generations)	99,886		
Increase of taxes only for future generations	30.0%		
Intertemporal balance gap (% of debt)	58.3%		
Increase of taxes for all generations	4.96%		
Decrease of expenditure for all generations	5.14%		

Table 7 shows the accounts of generations that will be born in 10, 20, 30, 40 and 50 years, assuming that current fiscal policies apply to future generations as well as the currently living ones. The accounts increase for men (the generation born in 2048 will be paying 8 millions of lire more than the one born in 1998) and decrease for women (if born in 2030 they will be receiving 3 millions less than if born in 1998). Looking at the composition of the accounts reveals that this is due to both the cut in pension transfers and the increase in social security contributions caused by the pension reforms going to maturity.

As indicated above, if the continuation of current fiscal policies into the future means that the net-lifetime taxes paid by future generations are higher than those paid by newborns, the intergenerational balance gap would be higher than the intertemporal balance gap. Hence, given Table 8, it does not come as a surprise that in the baseline scenario the intergenerational gap is 60 percent of the debt, slightly above the

intertemporal gap, and that this imbalance could be absorbed by a once and for all decrease in all taxes by 5.1 percent (against the 5 percent needed to absorbe the intertemporal gap).

Table 8 highlights the importance of an immediate implementation of the fiscal adjustments, as it shows the cost of delaying it by 3, 8 or 12 years. For example, even a minor delay of the adjustment (to 2001) would require a larger permanent increase in all taxes of more than 50 basis points (from 5 to 5.6 percent). This is because postponing the intervention amounts to allow each generations born in the meantime to benefit from the status quo (that is, to pay the same net taxes paid by the generation born in 1998) thereby imposing a even higher burden to future generations.

Table 7. Net taxes paid by generations born after 1998
(in thousands of lire)

	Baseline case	
	Men	Women
born in 1998	35,383	-80,790
born in 2008	36,716	-78,763
born in 2018	41,937	-77,661
born in 2028	42,948	-77,481
born in 2038	43,163	-77,514
born in 2048	43,373	-77,636

Table 8. The cost of delaying

	Increase taxes	**Decrease transfers**
immediate	4.96%	5.14%
in 2001	5.56%	5.71%
in 2005	7.28%	6.61%
in 2010	8.90%	7.96%

Sensitivity Analysis

Table 9 shows the results of sensitivity analysis with respect to different values of the productivity growth and discount rate. As we would have expected, the fiscal imbalance becomes less severe if one chooses higher values of real productivity growth and/or lower discount rates. In the best possible economic scenario (the one with only 1 percentage point of difference between interest and productivity growth rates) the difference in the accounts of newborns and future generational is reduced to 44 millions of lire (equivalent to an increase of 5 percent of all taxes and contributions for future generations). Moreover, the intertemporal balance gap (56 percent of the stock of public debt) would be closed by a once and for all 2.21 percent increase in taxes or a 2.24 percent cut in transfers for all generations. In the worst possible scenario (with a difference of 6 percentage points between interest and productivity growth rates) the difference in accounts would increase to

Table 9. Sensitivity analysis of imbalance indicators with respect to the discount rate (r) and productivity growth (π)

		Difference in accounts of newborns and future generations (thousands of lire)	Increase of taxes only for future generations	Intertemporal balance gap (% of debt)	Increase in taxes for all generations that closes the gap	Decrease in transfers for all generations that closes the gap
π	r					
1.0	3	81,090	14.0%	66.9%	3.83%	-3.10%
	5	112,426	40.3%	59.5%	5.65%	-5.87%
	7	156,522	104.7%	60.5%	8.07%	-8.52%
1.5	3	65,469	9.3%	63.9%	3.08%	-3.12%
	5	99,886	30.0%	58.3%	4.96%	-5.14%
	7	143,909	81.9%	59.5%	7.33%	-7.71%
2	3	43,743	5.0%	55.8%	2.21%	-2.24%
	5	86,754	21.7%	56.3%	4.24%	-4.38%
	7	129,511	63.3%	58.3%	6.61%	-6.93%

156 millions of lire, and the intertemporal balance gap (now 61 percent of the stock of public debt) would be absorbed by a 8 percent increase of all taxes.

Another simulation aims at assessing the relative contribution of demography and the initial stock of public debt in determining the imbalance of the baseline scenario. The result is that population ageing is more relevant than the initial level of debt, as the indicators of fiscal imbalance improve more if we impose constant population structure than if we assume away public debt. Table 10 shows that with zero public debt future generations would receive an average net transfer from the State equal to 89 millions of lire, around 66 millions more than generations born in 1998. The intertemporal gap would be negative, that is, fiscal policies would be sustainable even if taxes would be permanently cut by 3.6 percent or transfers increased by 3.7 percent. On the other side, if population was constant, the balance gap would be absorbed by a larger cut in taxes (5 percent) or by a larger increase in transfers (5.7 percent).

Further, if we adopted the more optimistic demographic scenario of the ISTAT the improvement with respect to the baseline scenario would be only minor. The difference in accounts would be 98 millions of lire, while the increase in taxes for all generations that eliminates the intertemporal balance gap would be 4.8 percent. More relevant is the case in which labour force remained at the 1998 levels (for example, thanks to stronger immigration and female labour market participation)22. In this case, if only future generations would be called to restore the long term equilibrium of public finances they would pay only 9 millions of lire more than the generation born in 1998. If current fiscal policies was applied to future generations as well, the gap would be negative (-24 percent of debt), and would be eliminated by a 1.8 percent reduction in taxes and contributions or a 2 percent increase in expenditure and transfers for all generations.

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[22] According to Franco and Sartor (1999) in order to keep the labor force at its 1995 levels the flow of immigrants should increase from 50,000 units in 2001 to a peak of 625,000 in 2033.

The impact of the pension reforms

The results shown so far take into account the reforms of the pension system carried out in 1992 and 1995, under the Amato and Dini governments, respectively. The impact of these reforms is estimated through the methodology described in the Appendix. Charts 14 and 15 show the effects of the reforms on the relative age and gender profiles for pension transfers[23].

As for the employees, Chart 14 shows the reduction in the average pension due to the less generous method of calculation and (for the older pensioners) the switch from wage to price indexation. Because of the change in the indexation mechanism the pension profile, which was quite flat under the old regime, is strongly decreasing with the age of the beneficiary in the new regime. As for the self employed, Chart 15 shows that, in the new regime, on average only women retire with smaller pensions than in the old regime, while for both genders pension amounts sensibly decline with age. While the latter phenomenon is due to the change in the indexation mechanism, the first one is explained by the fact that the old regime was characterized by the prevalence of "minimum pensions", while in the new regime pensions have been linked to the contributions paid. This change advantages only men, who have higher salaries than women (both in levels and rate of growth terms), according to the Bank of Italy survey.

Table 11 presents an evaluation of the aggregate impact of the reforms. First, it shows how the aggregate pension expenditure and social contribution revenues would change if the reforms were at full maturity in 1998. In the baseline scenario (with productivity growing at 1.5 percent per annum and workers retiring as soon as they can, after 40 years of contribution or at the age of 57, whichever is the earliest) the reforms would reduce the expenditure on pensions for employees by 41.6 percent and increase their contributions by 6.3 percent, while pension expenditure for self-employed would increase by 30.4 percent and their contributions by 39.9 percent. The increase in the pension expenditure for self-employed is partly due to the larger average pension and partly to the

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[23] The average pension amount for each age groups is normalized with respect to the one received by a 60-year old men for the employees and a 65-year old man for the self employed.

Table 10. Imbalance indicators with alternative economic and policy scenarios

	Difference in accounts of newborns and future generations (thousands of lire)	Increase of taxes only for future generations	Intertemporal balance gap (%of debt)	Increase in taxes for all generations that closes the gap	Decrease in transfers for all generations that closes the gap
No Debt	-66,313	-19.90%	-	-3.55%	+3.68%
Constant population	-85,370	-18.90%	-64.30%	-4.95%	+5.66%
Demographic projections: high scenario	98,250	30.20%	56.80%	4.80%	-5.06%
Constant Labour Force	9,309	2.10%	-24.00%	-1.81%	+2.00%
No reform of pensions	178,657	54.90%	106.30%	9.14%	-9.01%
Reforms fully mature in 1998	-73,312	-22.00%	-45.50%	-3.40%	+4.33%
Minimum retirement age at 60	32,753	9.70%	17.80%	1.50%	-1.61%
Minimum retirement age at 65	11,847	3.50%	5.30%	0.44%	-0.47%
Upgrading of replacement rates	94,392	28.40%	55.00%	4.68%	-4.86%
Pro rata for all employees	15,495	4,7%	0,1%	0.70%	+0.8%

smaller impact of the change in the indexation mechanism (as the amount of the "minimum pensions" was not automatically linked to wages).

Table 11 also shows how these estimates change with (a) the rate of productivity growth and (b) the retirement age. As a higher productivity growth amplifies the effect of the change in the indexation mechanism, the reduction of pension expenditure for the employees is larger and the increase for the self-employed smaller than in the baseline scenario. For a given interest rate, these effects on pension expenditure contribute to the improvement in the long-term imbalance indicators shown in Table 9. Moreover, if the minimum retirement age is increased to either 60 or 65 years, the reduction of pension expenditure for the employees is slightly smaller and the increase for the self-employed larger than in the baseline scenario. This is due to the increase in the average pension amounts caused by the longer permanence of workers in the labour market (and thus the larger amount of contributions paid).

To assess the impact of the pension reforms on the Italian generational accounts we have run a series of simulations, whose results are reported in Table 10. The contribution of the two reforms is estimated by simulating the case in which no reform had been introduced at all. The result is a clear deterioration on the long-term imbalance; the difference between the accounts of the newborns and those of future generations would be over 178 millions of lire (against the 77 of the baseline scenario) and the increase in all taxes and contributions required to future generations would be around 55 percent. The intertemporal balance gap would be 106 percent of the stock of public debt in 1998 and would be closed by a larger immediate and permanent increase in all taxes and contributions for all generations (9.1 percent).

We then considered the case in which the reforms had been introduced several years ago, so that they would be at full maturity in 1998. In this case, future generations would be receiving net transfers of around 93 millions of lire and the intertemporal balance gap would be negative, so that the long-term equilibrium would be guaranteed by a immediate and permanent reduction of taxes and contributions by 1.5 percent (equivalent to 30 billion of lire in 1998) or by an increase in expenditure and transfers by 4.3 percent.

Table 11. Difference between old and new pension regime (with new regime fully mature in 1998)

	Employees			Self employed		
π	**1.0%**	**1.5%**	**2.0%**	**1.0%**	**1.5%**	**2.0%**
Old age and seniority pension (age=57)	-39.0%	-41.6%	-44.0%	38.2%	30.4%	23.4%
age	**57**	**60**	**65**	**57**	**60**	**65**
Old age and seniority pension (π = 1.5%)	-41.6%	-39.9%	-38.2%	30.4%	32.9%	36.3%
Contributions (π = 1.5%)	6.3%	12.4%	19.1%	39.9%	49.0%	58.5%

Chart 14. Old age and seniority pensions, employees

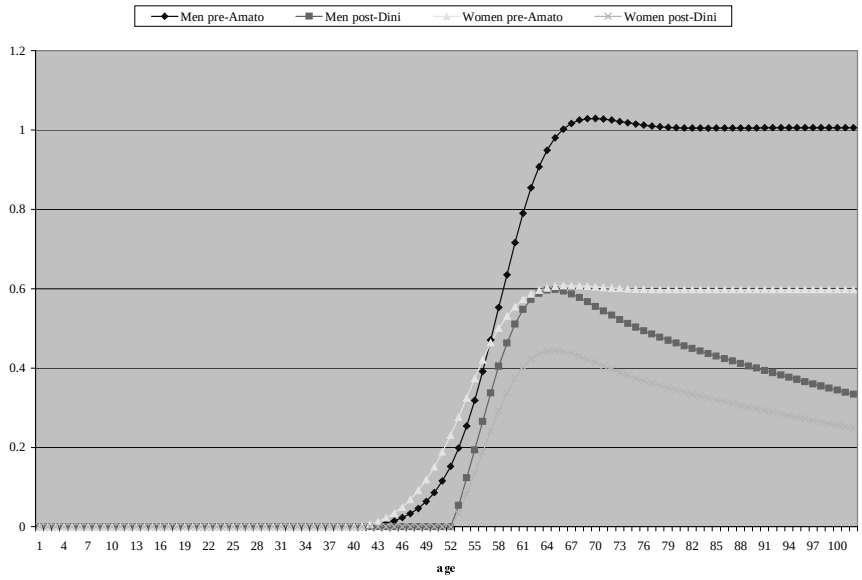
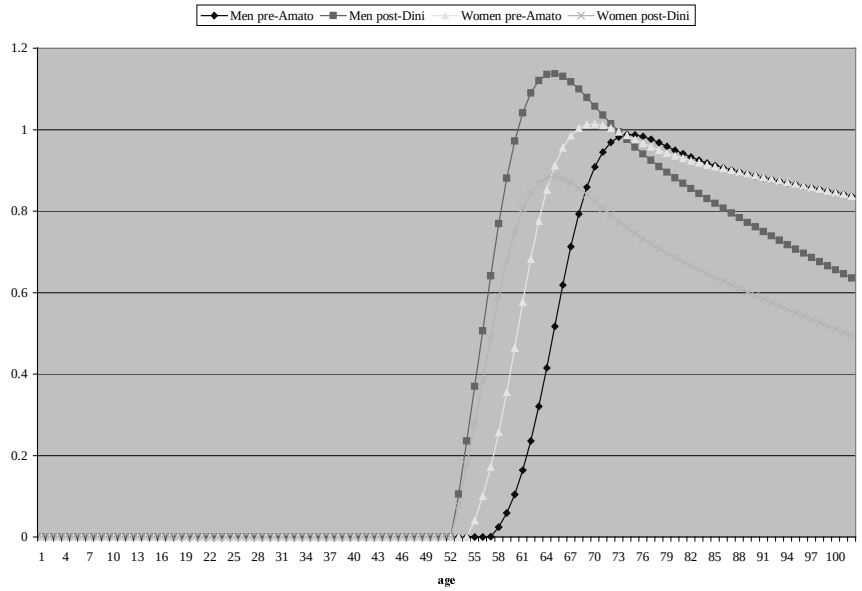


Chart 15. Old age and seniority pensions, self-employed



While this scenario represents a mere counterfactual exercise, a more feasible policy measure is to extend the "pro rata" method to all workers, even those with more than 18 years of contribution at the end of 1995[24]. Considering only the pension expenditure for the employees, the extension of the "pro rata" method would basically eliminate the long-term fiscal imbalance, as sustainability would be restored through a very small increase in taxes and contributions (0.7 percent) or a minor reduction of expenditure and transfers (0.8 percent).

The same result would be achieved by increasing the minimum retirement age to 60 or 65 year (from the current age range of 57-65). In the first case the intertemporal balance gap would be 18 percent of the debt and would be absorbed by an increase of 1.5 percent in taxes and contributions or by a 1.6 percent reduction in expenditure and transfers. With the retirement age at 65, the long-term equilibrium would be basically achieved, with only a minor, further adjustment required (a 0.44 percent increase in taxes and contributions or 0.47 percent reduction in expenditure and transfers, equivalent to 3,800 billion of lire in 1998).

A final simulation on the impact of pension reforms concerns the adjustment of the replacement rates (see Appendix). Under the new regime these rates should be periodically adjusted so as to take into account changes in life expectancy (to which they are negatively linked). As ISTAT projects a slow increase in the average residual life up to the year 2020, we calculated the replacement rates using these projections and re-estimated pension expenditure accordingly. The reduction in pension expenditure for the employees is larger than in the baseline case (-43.8 percent against –41.6 percent, as showed in Table 11), while the increase in pension expenditure for self-employed is now less relevant (25.7 percent against 30.4 percent). In terms of generational accounts, the adjustment of the coefficients only slightly improves the intertemporal gap and the extent of the adjustment required (taxes and contributions should be increased by 4.7 rather than by 5 percent as in the baseline case).

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[24] As showed in the Appendix, with the "pro rata" method those who have less than 18 years of contributions at the end of 1995 have their pension calculated on the base of the new and old formulas according to the proportion of their entire seniority spent, respectively, before and after 1995.

Table 12. Alternative measures to close the gap: an international comparison

Country	Decrease of transfers (%)	Increase in taxes (%)
Italy	5.14	4.96
UK	9.5	2.7
Usa	20.3	10.8
Japan	25.3	15.5
Germany	14.1	9.5
Canada	0.1	0.1
Thailand	-114.2	-25
Australia	9.1	4.8
Denmark	4.5	4
Netherlands	22.3	8.9
New Zealand	-0.6	-0.4
France	9.8	6.9
Noway	8.1	6.3
Portugal	7.5	4.2
Argentina	11	8.4
Belgium	4.6	3.1
Brasil	17.9	11.7

Source: Kotlikoff and Leibfritz (1999) and Raffelheuschen (1998)

The redistributive effects of the Maastricht Treaty

Before concluding, it is worth stressing here the peculiar nature of the policy adjustment considered so far. Only a specific path of taxes and transfers (among the infinite paths consistent with the adjustment required) has been considered, the one implied by an immediate and permanent change in taxes or transfers[25].

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[25] Barro (1979) shows that under a set of relatively weak assumptions such a policy is optimal, as it minimizes the distortions in the labour supply and the administrative costs associated with the implementation of fiscal policies.

However, it is well-known that Maastricht Treaty considers as too high a ratio debt/GDP larger than 60 percent, and impose a convergence to this threshold. In our model, this amounts to choose a different time path for the sequence of primary surpluses needed to restore the intergenerational balance. Assume, for example, that the threshold of 60 percent is to be reached in 10 years. In the baseline scenario we estimate that in order to reach the 60 percent debt/GDP ratio in 2008 all taxes and contributions should be increased by 7.9 percent in the next ten years, and by 3.2 percent thereafter. Alternatively, the same result could be obtained through a cut in expenditures and transfers of 8.6 percent in the first ten years and 3.2 percent after 2008.

The difference with respect to the baseline scenario (in which all taxes and contributions need to be permanently increased by 5 percent) is that the more restrictive fiscal policies imposed to current generations determine a strong reduction of public debt in the first ten years. The decrease in the amount of interests that must be paid to service this stock of debt thereafter implies that future generations will have to pay smaller net taxes in order to meet the solvency constraint. Note that the total present value of the primary surpluses does not change, as this is fixed by the initial stock of public debt. Hence, every attempt to fix the debt/GDP ratio to a specific level within a specific period of time is bound to have redistributive effects, as it changes the way in which the burden associated with the solvency constraint is allocated across generations[26].

5 Conclusions

Italy is characterized by a fertility rate that is among the lowest in the world, and is likely to experience a sharp increase in the old age dependency ratio. Generational accounting, a method of long-term fiscal analysis studying the sustainability and degree of intergenerational equity of current fiscal policies, allows to assess the impact of ageing on Italy's

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[26] As an example, trying to hit the target by the year 2013 would require an increase in all taxes and contributions by 5.3 percent for the next 15 years and 4.6 thereafter, and therefore a smaller burden for current generations.

public finances, taking into account Italy's other two fiscal anomalies, namely, its high stock of public debt and the large proportion of its social expenditure that is targeted to the elderly.

In the first application of generational accounting to Italy (Franco et al., 1992) the long term imbalance in 1990 was measured by future generations paying to the State 198 millions (of lire-1998) more than current newborns. The intertemporal balance gap was absorbed by a 60 percent increase in all taxes and contributions paid by current and future generations. A subsequent study (Franco and Sartor, 1998), with 1995 as the base year and with the pension reforms included, showed a difference in net taxes equal to 149 millions of lire-1998. The same study pointed out that, in order to close the intertemporal imbalance, taxes and contributions paid by all generations should increase by 9.7 percent (which should be compared to 5 percent obtained in this study), while all expenditures and transfers should be cut by 19.8 percent (here is 13.8)[27].

These figures highlight the considerable improvement in the state of Italian public finance achieved over the recent past, and in particular over the last three years. The process of fiscal consolidation achieved in the last eight years has reduced by more than 60 percent the imbalance estimated in 1990. The relevant primary surplus obtained in 1998 (around 4.5 percent of GDP) and the two reforms of the pension system have managed to place Italy in a better position relatively to other European countries, such as Germany and France (Table 15).

It would be a mistake, however, to think that the process of fiscal adjustment is now completed. We show that to get such a result, in the baseline scenario fiscal pressure should increase by more than 2 percentage points in 1998, or expenditures and transfers should be reduced in the amount of 40 thousand billion of lire. Postponing to the future this further effort amounts to go through a more painful adjustment. Further, the Maastricht Treaty requires Italy to insist in the process of fiscal consolidation.

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[27] These results were obtained assuming an economic scenario equivalent to our baseline case, and a fertility rate that would increase up to 1.6.

This paper outlines some measures that may be taken in order to reduce the burden left to the future generations. In particular, given the significance of pension transfers in Italy, we identify two changes in the pension system which could restore the intertemporal balance. The first one is represented by an accelerated transition to the new pension regime with the extension of the "pro rata" method for all workers, while the second one is based on the increase of the minimum retirement age to 60 or 65 years.

However, studying the interaction between population ageing and public finances leads us to appreciate all that policies which are potentially able to improve the ratio between active and non active individuals. In particular, extremely relevant are the measures which contribute to the regular integration of immigrants, an improvement of the female participation in the labour market and a decrease in structural unemployment. This kind of policy already has, and will increasingly have in the future, a crucial role in reducing generational imbalances and in making public finances sustainable.

APPENDIX
THE PENSION SIMULATION MODEL

This Appendix presents the simulation model used to estimate the effects of the recent reforms on Italy's pension system. Before the reforms, the pension scheme for the employees was very different from the (several) ones associated to the self-employed (a key objective of the reforms has actually been to eliminate the main sources of inequality between these schemes) We thus approach differently the two schemes, but the model is substantially the same as the one presented in Sartor (1998).

Table A1. Pension schemes for employees: institutional framework

				Old regime		New regime	
				Private sector	Public sector	Private sector	Public sector
Eligibility requirements for	Old age	age	M	60 years	65 years	57-65 years	
			F	55 years	65 years		
		Minimum contributions		15 years	15 years	5 years	
	Seniority			35 years of contributions	20 years of contributions (15 if with dependants)	40 years	
	Survival			5 years of contributions		5 years of contributions	
Earnings for computing pension benefits				average of last 5 year wages	last year wage	average lifetime earnings	

Employees

Two pension regimes are identified, the one prevailing before the reforms "Amato" and "Dini" (the old regime) and the one emerging from the full application of the two reforms (the new regime). Table 11 summarizes the main features of the pension scheme for employees before and after the reforms, and represents our view of the institutional framework characterizing the two regimes.

Participant in the labour markets are classified into different groups according to sector, education and gender. More in particular, for men we identify four types of employees, working in the public or private sector and with or without a university degree. For women we identify 8 types, working in the public or private sector, with or without a university degree, and with or without dependants. Each of these types is represented by an individual born in the base year. For every type the 1995 Bank of Italy's Survey on Households' Income and Wealth (thereafter IBF) provides the distribution of the age at which they enter the labour market, the initial salary and the rate of growth of wages based on seniority. The latter is estimated by running a regression of the logarithm of wages on the working seniority for each type of employees.

Assuming that type *j* workers start working between the age of 13 and 37, the wage at time *t* of an individual belonging to this group (as the base year is 0 he is aged *t* at *t*) is given by the following expression:

$$w_t^j = \sum_{i=13}^{37} f_i^j \left[w_0^j (1+\alpha_j)^{t-i} (1+g)^t \right] \qquad t < tp \qquad [10]$$

where $f_i^{\ j}$ is the probability that an individual belonging to the group *j* enters the labour market at the age of *i*, $w_0^{\ j}$ is the wage paid in the base year to an individual with zero seniority belonging to group *j*, α_j is the rate of growth of wages per each year of seniority for group *j* workers, *g* is the rate of growth of labour productivity and *tp* is the retirement age.

As for the retirement age, in the old regime it is estimated based on two different hypothesis. According to the first one (the "minimum seniority" hypothesis) everyone retires as soon as the minimum requirement for receiving either a seniority or an old age pension has been reached. According to the second assumption (the "average seniority" hypothesis) everyone retires at the average seniority observed in the IBF[28]. In the new regime everyone is assumed to retire at the age of 57 or after 40 years of contributions, whichever is the earliest. Table A.2 shows that, based on these assumptions, the tightening of the eligibility

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[28] For the employees working in the public sector the average seniority is taken from Pandimiglio (1990).

rules in the new regime is captured via a longer average contributory period than in the old regime[29].

Once we have identified the wage profile for each type of employees, the amount of pension benefit in the old regime (OR) is estimated through the following equations:

$$p_t^{OR,j} = \sum_{i=13}^{37} f_i^j \left[r*(tp-i)\right] \sum_{k=0}^{n^j} \frac{w_{t-k}^{i,j}}{n^j} \qquad t = tp$$

$$p_t^{OR,j} = p_{tp}^{VR,j}(1+g)^{t-tp} \qquad tp < t \le D \qquad [11]$$

where *i* is the age at which one enters the labour market, *r* is the replacement rate per each year of contribution (2 percent for private sector employees, 2.33 percent for the first 15 years of contributions and 1.8 percent for the following years for public sector employees), and finally the earnings considered for computing pension benefits are the average of the last 5 annual wages for the private sector and the last year wage for the public sector. After retirement, the pension amounts grow with productivity (until the maximum age, D).

For the new regime (NR) the amount of the pension benefit is calculated as follows:

$$p_t^{NR,j} = \sum_{i=13}^{37} f_i^j \left\{ \pi^t * 0.33 * \left[\sum_{k=13}^{17} 1.5 * w_k^{i,j}(1+g)^{tp-k} + \sum_{k=18}^{tp} w_k^{i,j}(1+g)^{tp-k} \right] \right\} \qquad t = tp$$

$$p_t^{NR,j} = p_{tp}^{NR,j} \qquad tp < t \le D \qquad [12]$$

where π^t represents the annuity rate, whose magnitude depends on the retirement age (it is 0.0472 if one retires at 57, and rises up to 0.06136 if one retires at 65). After retirement, pensions do no longer grow with wages but are indexed only to inflation (and thus remain constant in real terms).

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[29] The only exception is represented by men without a university degree in the private sector.

Combining the [10] with the [11] or [12] one gets the lifetime wage and pension profile for the individual who represents the cohort born in year *t* and the type *j* of employees. The average profile (for men and women) is obtained as the weighted average of the individual profiles, using as weights the IBF relative frequencies of the different groups of employees. Finally, to get the average pension paid to the cohorts living in the base year we discount back (at the rate *g*) the wage and pension amounts; multiplying these values by the population numbers at 1998 obtains an estimate of the aggregate pension expenditure in the base year. For example, the pension expenditure in the base year under the new regime can be estimated as follows

$$P_{1998}^{NR} = \sum_{t=0}^{D} N_{1998,t}\, p_t^{NR} (1+g)^{-t}$$

Hence, the ratio

$$\frac{P_{1998}^{NR}}{P_{1998}^{OR}}$$

provides an estimate of the change in pension expenditure caused by the reforms. To introduce this change in the generational accounts the relative age and gender profile for pensions is obtained by normalizing the average pension amounts in the new regime with respect to the average pension in the old regime of a 57-year old male

$$p_t^{i,OR} = \frac{p_t^{i,OR}}{p_{57}^{M,OR}}, \qquad p_t^{i,NR} = \frac{p_t^{i,NR}}{p_{57}^{M,OR}} \qquad t = 0....D, \quad i = M, F$$

where M stands for male and F for female.

Transition

Once we have estimated the relative pension profiles for the old and new regimes the transition between the two regimes is modelled as follows.

We assume that all employees start working at the age of 18. Those who have less than 18 years of contributions at 31.12.1995 have their pension calculated according the “pro rata” method, that is, their

pension is calculated on the base of the new and old formulas according to the proportion of the entire seniority spent, respectively, before and after 1995. The first individual who get a "pro rata" pension is thus the 57-year old in 2017 (he is 35-year old in 1995, has 17 years of contributions at that time and will retire when he is 57-year old, that is, in 2016). His pension is calculated as follows:

$$p_{57}^{2017} = (\frac{17}{40} p_{57}^{OR} + \frac{23}{40} p_{57}^{NR})$$

For the year 2018 the pension profile is obtained calculating the pension of the 57-year old as 16/40 of the old regime pension and 24/40 of the new regime one; the pension received by a 58-year old is the amount received the year before by a 57-year old; and, finally, the amounts for those older than 58 are as in the old regime. Continuing along this line, the year 2034 will be the first when the 57-year old has his pension calculated entirely with the new regime formula. As the maximum age D is 101, this individual will leave the scene in 2078; therefore, this is the year when the new regime will reach full maturity, as *all* individuals (from the 57 to the 101-year old) will have their pension calculated according only to the new regime rules.

Contributions

As for the social contributions paid, the reforms have not modified the way they are calculated, but have nonetheless affected their amount by changing the eligibility rules. To capture this change in the relative age and gender profile for social contribution the average amounts are obtained as the ratio between the average wage in the new regime and the wage of a 40-year old male in the old regime

$$c_t^{i,OR} = \frac{w_t^{i,OR}}{w_{40}^{M,OR}}, \qquad c_t^{i,NR} = \frac{w_t^{i,NR}}{w_{40}^{M,OR}} \qquad t = 0....D, \quad i = M, F$$

The difference between the wages in the old and new regime is due only to the different value of tp, the retirement age. The transition is modelled the same way described for pensions. Starting from 2017, the average amount of contributions is obtained as the weighted average of the contributions paid in the old and those paid in the new regime

$$c_t^{i,2017} = (\frac{17}{40} c_t^{i,OR} + \frac{23}{40} c_t^{i,NR}) \qquad t = 13...57, \quad i = M, F$$

The transition is over in 2034, when all employees will be subject to the same eligibility rules.

Self employed

For the self-employed we identify 6 types of workers for both men and women, depending on their education level (with or without a university degree) and the scheme they belong to (craftsmen, traders and farmers have all their own pension scheme) [30]. The main difference with respect to the employees is that for the self-employed we consider as the old-regime the one prevailing before 1990, when the pension scheme for the self-employed was transformed with the objective of making it more similar to the one of employees. As the reform triggered an upsurge of the expenditure, had we considered it as the old regime we would have overestimated the reduction of pension spending caused by the "Amato" and "Dini" reforms.

At the same time, modelling the pre-1990 regime is complicated by the existence of a host of different schemes, each with its own rules. However, it well known that before the reform most of the self-employed were paid a "minimum pension", equal to 8,144 millions of lire per annum in 1995, totally independent on the contributions actually paid (one of the objective of the 1990 reform was indeed to link the pension amount for the self-employed to their labour earnings)[31].

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[30] The wage profiles for the self employed are obtained as for the employees. The only difference is that rather than obtaining the initial wages from the IBF we adopt the minimum wage required by the law for paying contributions (22,352 millions of lire for craftsmen and traders, and 11,510 for farmers).

[31] See Castellino (1996).

Table A2. Contributory seniority of employees in the old and new regimes

Old regime: minimum seniority				Old regime: average seniority				New regime			
Men		Women		Men		Women		Men		Women	
gr. pub	20.0	gr. pub with dep.	15.0	gr. pub	24.0	gr. pub with dep.	23.0	gr. pub	33.6	gr. pub with dep.	33.5
gr. pri	34.6	gr. pub without dep.	20.0	gr. pri	34.6	gr. pub without dep.	23.0	gr. pri	35.4	gr. pub without dep.	33.0
ngr. pub	20.0	gr. pri	32.9	ngr. pub	28.0	gr. pri	32.9	ngr. pub	35.4	gr. pri	35.6
ngr.pri	34.4	ngr. pub with dep.	15.0	ngr.pri	38.1	ngr. pub with dep.	27.0	ngr.pri	36.5	ngr. pub with dep.	34.3
		ngr. pub without dep	20.0			ngr. pub without dep.	27.0			ngr. pub without dep	30.8
		ngr. pri	32.0			ngr. pri	33.0			ngr. pri	35.4
Total	31.7	Total	27.5	Total	35.9	Total	30.8	Total	36.2	Total	34.5

Note: gr stands for graduate, ng for non graduate, pub for public sector and pri for private sector.

Table A3. contributory seniority of self-employed in the old and new regimes

Old regime: minimum seniority				Old regime: average seniority				New regime			
Men		Women		Men		Women		Men		Women	
gr. Tr.	34.6	gr. Tr.	32.0	gr. Tr.	28.4	gr. Tr.	19.9	gr. Tr.	33.4	gr. Tr.	31.8
gr. Cr.	34.7	gr. Cr.	32.6	gr. Cr.	30.0	gr. Cr.	18.1	gr. Cr.	34.1	gr. Cr.	32.8
gr. Fr.	34.7	gr. Fr.	32.9	gr. Fr.	31.4	gr. Fr.	23.3	gr. Fr.	34.2	gr. Fr.	31.3
ngr. Tr.	34.3	ngr. Tr.	30.4	ngr. Tr.	27.0	ngr. Tr.	20.7	ngr. Tr.	33.8	ngr. Tr.	29.8
ngr. Cr.	34.2	ngr. Cr.	31.4	ngr. Cr.	30.5	ngr. Cr.	20.5	ngr. Cr.	34.9	ngr. Cr.	31.8
ngr. Fr.	33.8	ngr. Fr.	33.7	ngr. Fr.	30.4	ngr. Fr.	26.3	ngr. Fr.	32.6	ngr. Fr.	34.8
Total	34.4	Total	31.7	Total	29.2	Total	21.0	Total	34.0	Total	31.5

Note: Tr stands for traders, Cr for craftsmen, and Fr for farmers.

The old regime is thus described by assigning each worker who retires at the age of tp a pension equal to the “minimum pension”. As these amounts were seldom adjusted to reflect wage growth, we assume that the pension amounts for the self employed grow at 1 percent per annum (thus below productivity growth in the baseline scenario).

Under the new regime, pension amounts for the self employed are calculated according to the same formula used for the employees. The average pension is thus estimated according to equation [12], the only difference being the replacement rate at 20 percent, rather than 33 percent.

The old regime is thus described by assigning each worker who retires at the age of tp a pension equal to the “minimum pension”. As On the contrary, in the new regime self-employed are assumed to start contributing as soon as they enter the labour market, and to retire as soon as they can. Table A.3 shows that with this method it is possible to capture the tightening of the eligibility conditions that was one of the main objectives of the reforms. The age and gender relative profile for social contributions, and the transition between the two regimes, are modelled using the same method adopted for the employees.

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