ASSESSING THE IMPLICATIONS OF POPULATION AGEING ON TUSCAN WELLBEING: A MICROSIMULATION APPROACH

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The paper illustrates the main demographic, social and economic changes forecasted in a society with a high level of well being such as Tuscany during the period 2008-2030.
The evolution expected of the population structure has the following features: low growth, population ageing and high immigration; remarkable changes are also expected in the composition of the employed population, by sex, age, nationality and educational level; besides, the ageing Tuscan population will also have a remarkable impact on public finances: in fact the retired population must be provided with pensions and other support from the government.
The analysis is carried out using a dynamic microsimulation model (MirtoDin) developed at IRPET (The Regional Institute for Economic Planning in Tuscany). Unlike static models, it is able to operate prospectively and play an important role in informing social-scientific thinking about the future. The model is divided into the following modules: i) the demographic module, which simulates the lifelong trajectories of the Tuscan population from 2005 to 2030. It starts with mortality and includes fertility, partnership dissolution, marriage, immigration and emigration; ii) the education module, which estimates the rates of enrolment in the different types of secondary schools, the numbers of pupils repeating years and dropping out, pass rates, and numbers going to university, dropping out of further education and obtaining degrees; iii) the labour market and income module, which simulates, for each year and each individual, whether or not the individual works and what they will earn from their work; iv) the social security module, which allows us to assess the long-term effects of the pension system; and v) the disability model, which projects the characteristics of the long-term disabled in Tuscany and the evolution of total public expenditure for long-term care.
The initial population is taken from the 2003 wave of the Eurostat Survey on Income and Living Conditions (EU-SILC). The unit of simulation is the individual, but we keep information on household structure and on its changes in time. Economic and demographic transitions are implemented with the aid of MonteCarlo processes.

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1. Introduction

In the next decades demographic changes will transform the age and employment structure of our societies. In Italian regions, the expected evolution of the population structure has the following features: decline or low growth, population ageing and high immigration; remarkable changes are also expected in the composition of the employed population, by sex, age, nationality and educational level; besides, the ageing Tuscan population will also have a remarkable impact on public finances: in fact the retired population must be provided with pensions and other support from the government.

The paper illustrates the main demographic, social and economic changes forecasted in a society with a high level of wellbeing such as Tuscany during the period 2008-2030.

What can we expect?

As a result of declining fertility and increasing longevity, Tuscany is ageing rapidly: between 2008 to 2030 the share of the population aged 65 years or above will rise from 24% to 30%; population ageing will be partially offset by net migration: in fact the share of foreign population will increase from 7% in 2008 to 19% in 2030. Besides, the number of households will grow, whilst their size will decrease: singles will increase by 36%.

Even if the trend towards higher participation in the educational system ceases in the future, there will be important demographic effects caused by younger cohorts replacing older ones with lower education, and the share of people attaining a university degree is expected to rise to 18% of the population by 2030.

In the labour market, the mismatch between demand and supply will rise: without a significant reduction in working hours or an increase in part-time, the unemployment rate will increase; Furthermore, the number of workers with higher qualifications than the job they do will increase, and as a result, so will their level of dissatisfaction, unless there are significant changes in trade specialisation.

Income inequality will rise in the face of limited growth. Lastly, ageing will lead to significant increases in public expenditure, especially on pensions, health and long-term care.

These projections are made using a dynamic microsimulation model (*Irpetdin*) developed at the Regional Institute for Economic Planning in Tuscany (*IRPET*). The models mainly focus on demography, education and the labour market, earnings, social security and long-term care.

The work is structured as follows. Section 2 describes principles of microsimulation and outlines their general aims and characteristics; section 3 gives a detailed description of the structure of *Irpetdin; section 4* presents the model's results and section 5 draws up a conclusion.

2. What are microsimulation models?

In contrast to macrosimulation models, microsimulation models are concerned with individual units: families, persons, tax units, firms, etc. They may be divided into two main types of models: static and dynamic.

Static models[1] are used to measure the short-term impact of economic policies: they simply compare the income (and/or consumption) that households (and individuals) or firms possess at a particular moment in time, and calculate the variations that they undergo following interventions concerning tax or welfare. Therefore, static models examine the immediate effect of a policy change (so-called first-round effect) usually without any attempt to incorporate how that change might affect subsequent behaviour, or what consequences it might have once the demographic or economic foundations change.

[1] For a summary of static models, see Atkinson and Sutherland 1988 and Sutherland 1995.

Internationally, there have been a great many static microsimulation models[2]. The most well known, also because they are the oldest, are those put together in the Anglo-Saxon countries: *Polimod* [Redmond-Sutherland-Wilson, 1998] and *Taxben* [Giles-McCrae 1993] for the United Kingdom; *Trim* [<http://trim.urban.org/] by the Urban Institute and *Math* [http://www.mathematica-mpr.com] by Mathematica Policy Research for the United States; and *Stinmod* for Australia [Lambert-Percival-Schofield-Paul, 1994]. Almost every country in Europe has a national microsimulation model, from *Espasim* in Spain [Levy et al. 2001] to *Sysiff* in France [Bourguignon et al. 1998], and *SWEtaxben* in Sweden [Ericson et al. 2009]. They are national models which use different programming languages, module structures, procedures for calculating gross incomes and validation criteria. Therefore, in order to have a tool that can make similar simulations for all European citizens, the European Commission has promoted the development of a supranational model: *Euromod* [Sutherland, 2001].

On the other hand, dynamic population models project the sample's socio-demographic variables into the future. They can only project one cohort forward in time so as to simulate that cohort´s entire lifecycle (cohort models), or they can simulate forward life histories for all age groups (population models), making up the entire population and including the reproduction of new individuals.

In fact, they are able to predict the likelihood that each individual, given their current characteristics, will make a given transition, i.e. a change in their current status. Some transitions can be deterministic (e.g. age), but most are stochastic, i.e. they incorporate random processes, and therefore require the application of statistical tools. Some stochastic methods reproduce the observed underlying relationships and features of the population indefinitely into the future; while others instead attempt to update the evolution of social and economic relationships by actually including behavioural responses.

As a result, they allow us to analyse the evolution of the socio-demographic structure of the population and the effects of economic policies in the medium to long term.

Unlike static models, dynamic models are able to operate prospectively and play an important role in informing social-scientific thinking about the future.

Examples of dynamic models include Dinasym [Orcutt, Caldwell Wertheimer II, 1976] in the USA, Demogen in Canada [Wolfson, 1990], LIFEMOD [Falkingham and Lessof, 1992], PENSIM [Ball, 1992] and *SAGE* [Evandrou et al. 2001] in the United Kingdom, Dynamod [Antcliff, 1993] in Australia, Sfb3 in Germany [Galler and Wagner 1986], MOSART [Andreassen, Frederikesen and Ljones, 1993] in Norway and DESTINIE [Blanchet, Crenner, Le Minez] in France.

For an up-to-date list of the main static and dynamic microsimulation models, please see the International Microsimulation Association website (http://www.microsimulation.org/IMA/Population-based.htm).

3. The *Irpetdin* structure

Irpetdin is the dynamic microsimulation model of the Tuscan population developed at IRPET: the Regional Institute for Economic Planning in Tuscany. *Irpetdin's* objective is to analyse the evolution of the socio-demographic structure of the Tuscan population and the effects of economic policies in the medium and long term.

The model simulates the main demographic events in individuals' lifetimes such as death, marriage, divorce, birth, children leaving home, etc.. It imputes to individuals other important characteristics such as education, labour force status, sector of activity, and computes income and the future demand for pensions, social transfers and long-term care.

[2] For an international review, please see Atkinson-Sutherland [1988] and Merz [1993].

Every variable is updated in sequence and the time interval is one year. The initial population is taken from the 2003 wave of the Eurostat Survey on Income and Living Conditions (EU-SILC). The unit of simulation is the individual, but we keep information on household structure and on its changes in time.

Economic and demographic transitions are implemented using MonteCarlo processes. In other words, the model simulates the main life events (birth, death, marriage, separation, etc.) for all the individuals in the sample (period by period), and at the same time compares the probability associated with them (generally estimated by integrating information from various sources and using parameters taken from applying probit and log-linear models[3]) with a random number taken from a uniform distribution over the interval from 0 to 1: if the number extracted is lower than the estimated probability, the individual will be exposed to the event. *Irpetdin* is modelled using SAS.

The model is divided into the following modules: I) the demographic module, which simulates the lifelong trajectories for the Tuscan population. It starts with mortality and includes fertility, partnership dissolution, marriage, immigration and emigration; ii) the disability model, which projects the characteristics of the long-term disabled in Tuscany and the evolution of total public expenditure for long-term care; iii) the education module, which estimates the rates of enrolment in the different types of secondary schools, the numbers of pupils repeating years and dropping out, pass rates, and numbers going to university, dropping out of further education and obtaining degrees; iv) the labour market and income module, which simulates, for each year and each individual, whether or not the individual works and what they will earn from their work; and v) the social security module, which allows us to assess the long-term effects of the pension system.

The order of succession of the simulated events, the description of the contents of each module, the method employed for estimating the transition probabilities and the set of covariates are represented in Table 1.

[3] For example, the probability of marriage can be found by applying - to sample data - a probit model that uses age, region of residence, level of education, etc. as covariants.

Table 1
EVENTS, ESTIMATION METHODS, COVARIATES AND DATA SOURCE FOR THE SIMULATION

Event	Candidates	Estimation	Covariates	Source
		Demographic module		
Mortality	All individuals	Transition matrix	Age, gender, birth year	IRPET forecast
Marriage	Single, divorced, widowed aged 18-48	Transition matrix	Age, gender, educational status, nationality	Marriage findings, ISTAT
Dissolution	Marriage below 70	Transition matrix	Age, gender, educational status, nationality	Marriage findings, ISTAT
Fertility	Married women aged 15-45	Transition matrix	Age, number of children, educational status, nationality	Hospital birth certificates, IRPET forecast
Leaving home	Children 18-34	Transition matrix	Age, gender	Research
Migration flows	All individuals	Transition matrix	Age, gender, educational status, work status, household size	Municipal registry offices, IRPET forecast
		Disability module		
Disability	All individuals	Logit	Age, education, gender	Survey on public health, ISTAT
		Education module		
Choice of upper secondary school	All individuals aged 16 who have completed compulsory education	Multinomial logit	Gender, parents' educational level	Research into schooling and school leavers' work, ISTAT
School drop-out rates	All individuals enrolled at upper secondary school	Transition matrix	Gender, type and year of upper secondary school	Tuscan scholastic observatory , IRPET
Repeating	All individuals enrolled at upper secondary school	Transition matrix	Gender, type and year of upper secondary school	Tuscan scholastic observatory, IRPET
High school certificate	All individuals enrolled at upper secondary school	Logit	Gender, parents' educational level	Research into schooling and school leavers' work, ISTAT
Entry to tertiary school	Individuals with a high school certificate	Logit	Gender, type of high school certificate and mark	Work force study, ISTAT
University career (drop outs, three- and five-year degree, etc)	All individuals enrolled at university	Transition matrix	Gender, type of upper secondary school and year of course	Tuscan scholastic observatory, IRPET
		Labour market module		
Entry in the labour force	individuals leaving or abandoning school (aged 15-39)	Logit	Gender, age, level of education	Work force study, ISTAT
Employment status (employed or not employed)	All individuals belong to the labour force	Matching between labour demand and labour supply	Educational level	IRPET forecast and Excelsior research
Branch of activity (agricultural, manufacturing, finance, public service, etc.)	All individuals employed	Matching between labour demand and labour supply	Educational level	Work force study, ISTAT
Work status (managers, blue collar, white collar, self- employed, etc..)	All individuals employed	Transition matrix	Educational level, branch of activity	Work force study, ISTAT
Career employment	All individuals employed	Transition matrix	Work status	Work histories panel -Whip
Wages and earnings	All individuals employed	OLS	Age, gender, contributory seniority, educational level, work status, number of hours worked, citizenship	EUSILC sruvey, ISTAT
		Social Security module		
Retirement	All non-pensioners accruing retirement requirements		Pensions and contribution rules	INPS- National Institute of Social Insurance
Pension benefits	All pensioners in the three regimes (defined benefit, defined contribution and mixed)		Pensions and contribution rules	INPS-National Institute of Social Insurance
Social pensions entitlement	Individual aged above 65 entitled to assistance benefits		Pensions and contribution rules	INPS-National Institute of Social Insurance
Supplements to minimum and social assistance supplements	Pensioners fulfilling age and economic condition requirements		Pensions and contribution rules	INPS-National Institute of Social Insurance

A series of exogenous variables, drawn from the IRPET's macro model, are used to link the evolution of labour demand and earnings to the macroeconomic scenario.

3.1 The demographic module

This module handles the following events: ageing, mortality, leaving home, marriage and divorce, fertility and migration flows.

At any period, the age of individuals is increased by one year. After the individual has aged one year, the model determines if they will die or not according to the their age and sex.

In the following step the model makes single people meet in order to create a new household: all individuals aged 18-48 who are not living with a partner are eligible to cohabit and matching probability depends on differences in age, education and nationality between potential partners.

Then the model simulates divorce: in this case the transition probabilities are all female dominant; obviously dissolution of the partnership determines the split of the original household unit. For simplicity, on the parents' separation, children are deemed to remain with their mother. Also children between 18 and 34 can leave their household unit of origin.

Finally, the module selects women who are likely to have a child and assign them a probability of giving birth according to the number of children born previously, age, nationality and education. The newborn's gender is assigned randomly and the household size and composition is updated.

The flow of migrants is then evolved according to the IRPET forecast. The model includes reunited households; the imputation of socio-economic characteristics is carried out using the Monte Carlo method. Covariates are: age, household size, work status, gender and position in household. The data sources are the Registry Offices (*Anagrafi Comunali*) of all Tuscany municipalities.

3.2 The disability module

The simulation of disability is based on the ISTAT Survey on Public Health and the use of the national health services. The model selects individuals who are unable to perform a range of basic everyday activities. The probability of being disabled is determined by a logistic regression equation including age, qualifications (used as a proxy of lifestyle) and gender as predictors.

3.3 The education module

There are three levels of education: primary, secondary and tertiary.

All individuals are in basic schooling up until the age of 16; after completing basic schooling all individuals enter upper secondary schooling. Students can choose among four different types of secondary school: *licei*, *istituti tecnici*, *istituti professionali*, or other. This choice depends on gender and the parents' educational level. The educational attainments (numbers repeating the year, drop-out rates, graduate rates) reflect those observed in the population of students and drawn from the Tuscan Longitudinal Scholastic Observatory.

After graduation from secondary school, the individual faces the option of continuing to tertiary studies. The choice to enter university depends on the type of secondary school attended and on the final mark obtained. University careers and final results are estimated using data drawn from the Tuscany Longitudinal University Observatory.

3.4 The labour market module

The labour market module outlines the major processes and outcomes of working life.

To do this, this module matches labour supply with labour demand: the first is obtained directly from *Irpetdin*, whilst the demand is drawn from the IRPET macro model which provides estimates and forecasts of standard labour units differentiated by sector and the levels of schooling requested by the production system.

Every year the labour supply is formed by all those who were already employed the previous year, minus those who have died or retired in the meantime, plus those seeking work. Instead, labour demand is exogenous and depends on economic cycle forecasts.
Labour demand and supply are combined through two distinct phases:
i) Taken into consideration first of all, for every sector *s*, are the workers employed at the time *t-1* ($O_{t-1,\ s}$); who are represented[4] on the labour market at the time *t* ($O_{t-1,\ t,s}$); this is combined with labour demand ($L_{t,s}$) by sector. If the demand exceeds the labour supply in every sector, everyone keeps their job, otherwise the excess supply turns into either new retirements ($P_{t,s}$), for those who meet the requirements, or unemployment ($U_{t,s}$). In formal terms:

$$\text{if } L_{t,s} \geq O_{t-1,t,s} \Rightarrow O_{t-1,t,s} = O_{t-1,s}$$

otherwise

$$\text{if } L_{t,s} \prec O_{t-1,t,s} \Rightarrow O_{t-1,t,s} = (O_{t-1,s} - P_{t,s} - U_{t,s})$$

ii) subsequently, for every sector, the leftover labour demand ($l^*_{t,} = L_t - O_{t-1,\ t,s}$) is then compared with the population flow looking for work. Those looking for work at the time *t* (φ_t) are those who were already looking the previous year[5] (ϕ_{t-1}) plus those looking for work for the first time (σ_t). These are singled out among all those between the ages of 16 and 39 who are not students, using a logistic regression whose covariates are age, gender, educational level, position in the family (i.e. head of family unit or not). It is forecast that after five years of looking for work, women will be discouraged and therefore become inactive. Both the labour demand ($l^*_{g,}\ l^*_{b,}\ l^*_{c}$) and the supply of those looking for work ($\varphi_{g,}\ \varphi_{b},\ \varphi_{c}$) is classified by three levels of education: *g* (graduates), *b* (upper secondary school leavers) and *c* (minimum scholastic requirements); in the work survey, graduates compete with upper secondary school leavers; and upper secondary school leavers with those who have minimum scholastic requirements. At the lowest level of education, male immigrants have priority over other workers in gaining employment.
In formal terms, the probability (π) of becoming employed is:

For graduates seeking employment

$$\text{if } l^*_g >= \varphi_{g,} \Rightarrow \pi_g = 1$$

$$\text{if } l^*_g < \varphi_{g,} \Rightarrow \pi_g = \frac{l^*_g}{\varphi_g} + \frac{l^*_b}{\varphi_b + (\varphi_g - l^*_g)}$$

For upper secondary school leavers seeking employment

$$\text{if } \pi_g < 1 \text{ and } l^*_b >= \varphi_b + (\varphi_g - l^*_g) \Rightarrow \pi_b = 1$$

$$\text{if } \pi_g < 1 \text{ and } \varphi_b <= l^*_b < \varphi_b + (\varphi_g - l^*_g) \Rightarrow \pi_b = \frac{l^*_b}{\varphi_b + (\varphi_g - l^*_b)}$$

[4] Therefore net of people who have died and emigrants.
[5] Net of people who have died or emigrated.

$$\text{if } l^*_b < \varphi_b \quad \Rightarrow \pi_b = \frac{l^*_b}{\varphi_b + (\varphi_g - l^*_b)} + \frac{l^*_c}{\varphi_c + \varphi_b - \left[\frac{l^*_b}{\varphi_b + (\varphi_g - l^*_b)}\right]\varphi_b}$$

For those seeking employment with minimum scholastic requirements only

$$\pi_c = \frac{l^*_c}{\varphi_c + (1 - \pi_b)\varphi_b}$$

Finally, all those who are employed can be further categorised into subgroups on the basis of their level of employment (part-time, full-time), type of employment (employee, self- employed), industry (agriculture, manufacturing, etc.), work status (managers, blue collar, white collar, self-employed, etc).

Lastly, the module simulates yearly labour income for the active population. The income level is calculated separately for employees and self-employed workers. Once the coefficients are estimated, the level of gross income is computed for each individual considering both the evolution of observable characteristics (age, education, etc.) and medium to long-run productivity growth.

3.5 The social security module

The module is modelled according to the current Italian pension system. The model simulates the following pension benefits: old age and seniority pensions, survivors and indirect pensions, social allowances (*pensione sociale*), supplements to the minimum (*integrazioni al minimo*) and social assistance supplements (*maggiorazioni sociali*).

First of all, the model indentifies all individuals accruing retirement requirements, then it computes the substitution rate between pension benefit and last year's earnings and compares it with a threshold level equal to 65%, 40% and 50% respectively for individuals belonging to one of the following benefit regimes: defined benefit[6], defined contribution[7] and mixed[8]. If these thresholds are satisfied, the individuals are allowed to retire. However, old age pensioners belonging to the defined benefit regime retire when the legal retirement age is reached (60 years for women and 65 years for men) and minimum contributory records are respected (20 years).

[6] Workers with a contributory record equal to or exceeding 18 years in 2005.

[7] Workers who entered the labour market after 1995.

[8] Workers with less than 18 years of contributions in 2005.

4 Main findings

Table 2 llustrates the demographic and economic scenario adopted for the *Irpetdin* simulations.

Table 2
STANDARD SCENARIO PARAMETERS

Exogenous variables	
	Demographic variables
Female life expectancy	IRPET forecast: 84.6(2010); 85.7(2020); 86.9(2030)
Male life expectancy	IRPET forecast: 80.8(2010); 82.9(2020); 85.0(2030)
Total fertility rate	IRPET forecast 1.35(2010); 1.45(2020); 1.50(2030)
Migratory rate per 1,000 inhabitants	IRPET forecast 6.8(2010); 4.9(2020); 4.7(2030)
	Macroeconomic variables
Real GDP growth rates	Irpet forecast: 0.5% (2005-2010); 1.2%(2010-2020); 1.1%(2020-2030)
Labour productivity growth rates	Irpet forecast: -0.2% (2005-2010), 0.8% (2010-2020); 0.9% (2020-2030)
Work units growth rates	IRPET forecast: -1.8%(2005-2010), 2.5% (2010-2020); 1.2% (2020-2030)
	Pension variables
Thresholds, pension and contribution ceilings	GDP indexed
Welfare transfers (social allowances, supplements to the minimum, social assistance supplements)	GDP indexed

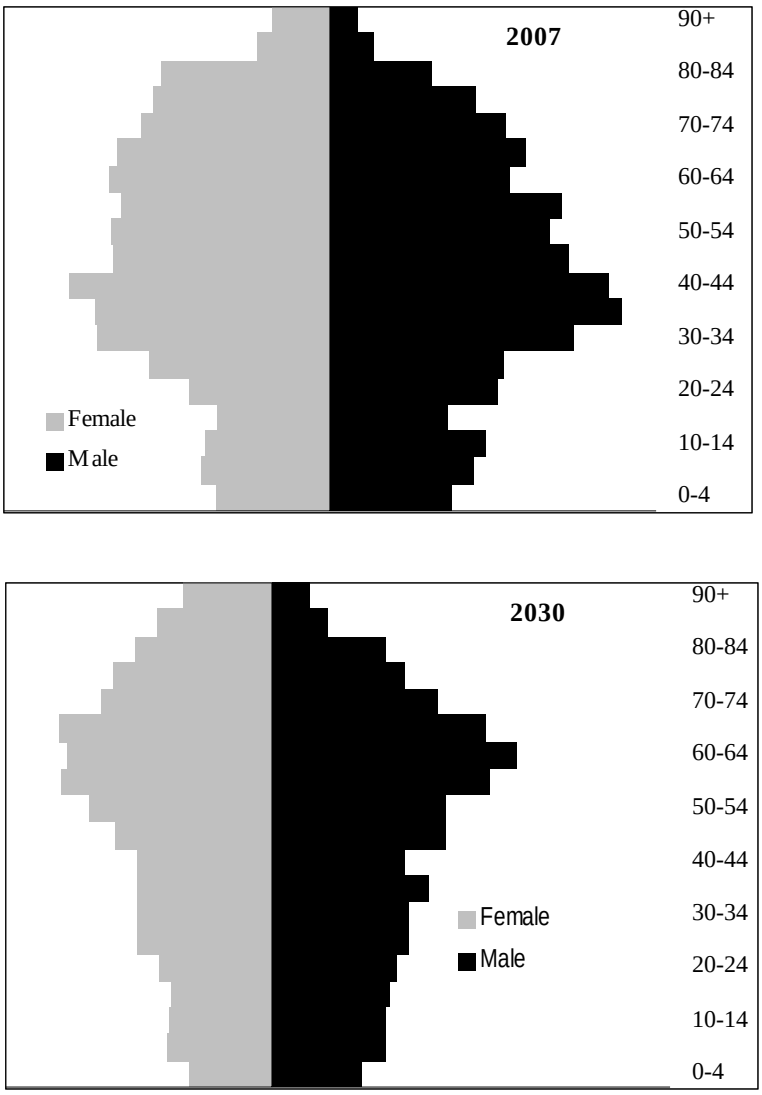
What demographic changes, changes in education levels, the labour market, incomes, and social security and long-term care spending should we expect from now until 2030?

4.1 Demographic change

As a result of declining fertility and increasing longevity, Tuscany will be ageing rapidly. Between 2008 and 2030, the Tuscan population will rise by 4.8% as a result of two different trends: the increase in the population aged over 65 and the decrease in the population under 65. The following graphs show the expected moving age pyramids (Graph 3).

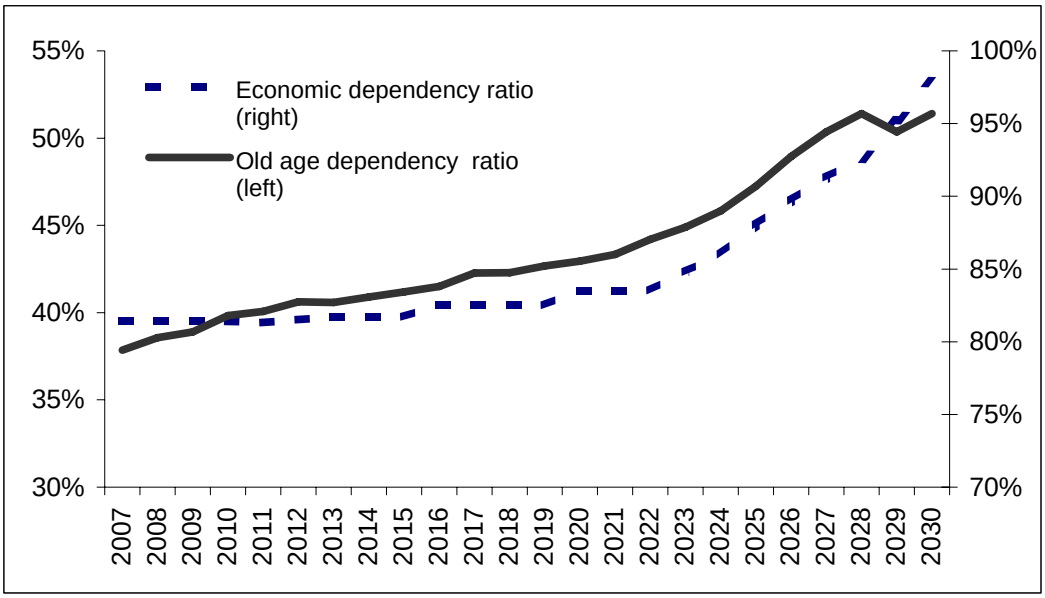
The population will age despite the strong growth in migratory flows from abroad. As a consequence, all the main dependency indexes, both demographic and economic, are expected to rise. For example, the share of over 65s compared to the population aged 15-64 (old age dependency ratio) will go from 36% in 2007 to 48% in 2030, while inactive members of the population aged over 20 out of the total number of workers (economic dependency ratio) will rise from 84% to 98% (Graph 4).

Graph 3
MOVING AGE PYRAMIDS



Source: Irpetdin

Graph 4
OLD AGE DEMOGRAPHIC AND ECONOMIC DEPENDENCY RATES

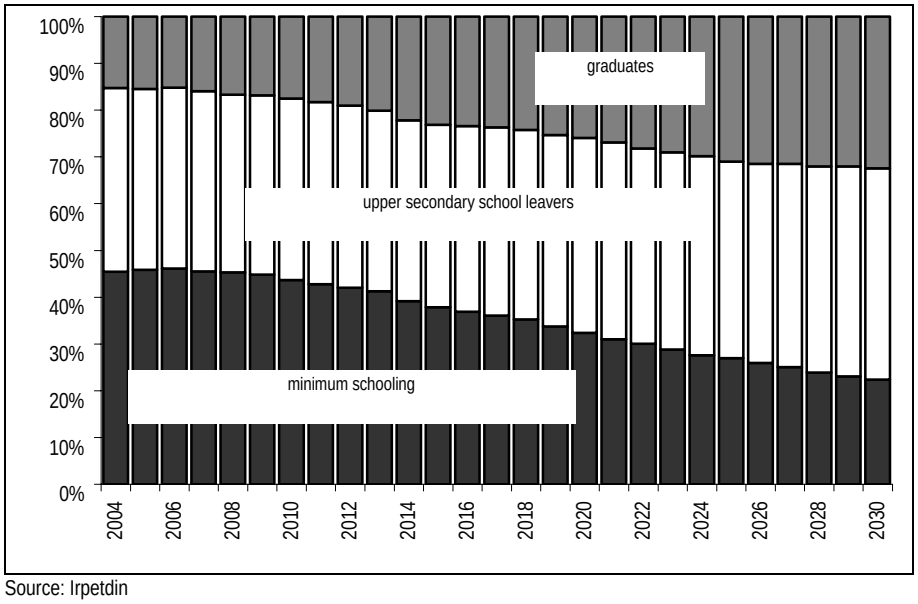


Source: Irpetdin

4.2 Educational change

The following graph shows the evolution of the distribution of educational levels. The share of people attaining a university degree is expected to rise to over 30% of the population aged 25-44 by 2030. Similar trends, though with lesser effects, will also be recorded for the population aged 35-55 and for those over 15 (Graph 5).

Graph 5
EDUCATION OF THE EDUCATIONAL ATTAINMENT DISTRIBUTION, PEOPLE AGED 25-44



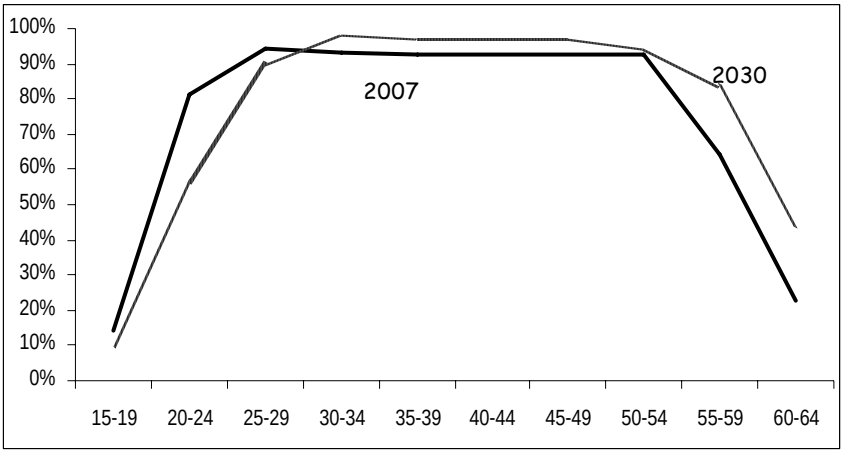
Source: Irpetdin

4.3 Labour market change

Immigration, ageing, schooling and a higher rate of female participation in employment are the main factors destined to change the composition of the labour supply. The forecasts for the future indicate: a strong growth in the rate of female participation and, more in general, of the population aged over 55, while the age of entry in the labour market is destined for a constant rise.

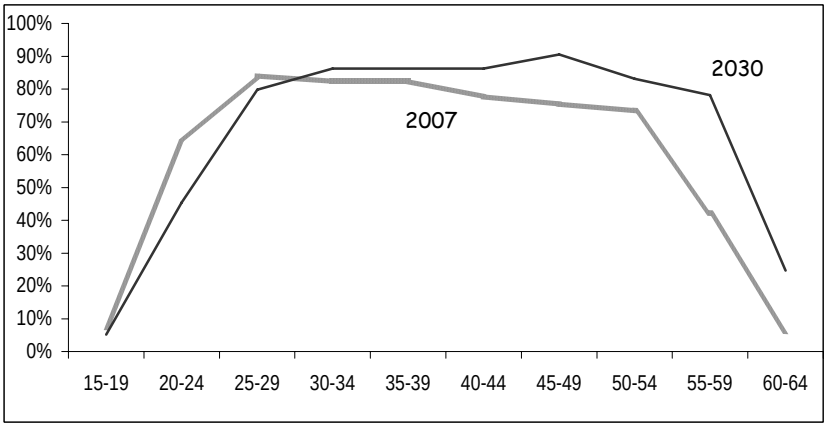
The graph shows the evolution of the age profile of participation rates. The profile for men shifts towards older ages from 2007 to 2030 (Graph 6). The profile for women shows both a shift towards older ages and a significant shift upwards (Graph 7).

Graph 6
PARTICIPATION RATES, AGE PROFILE FOR MEN



Source: Irpetdin

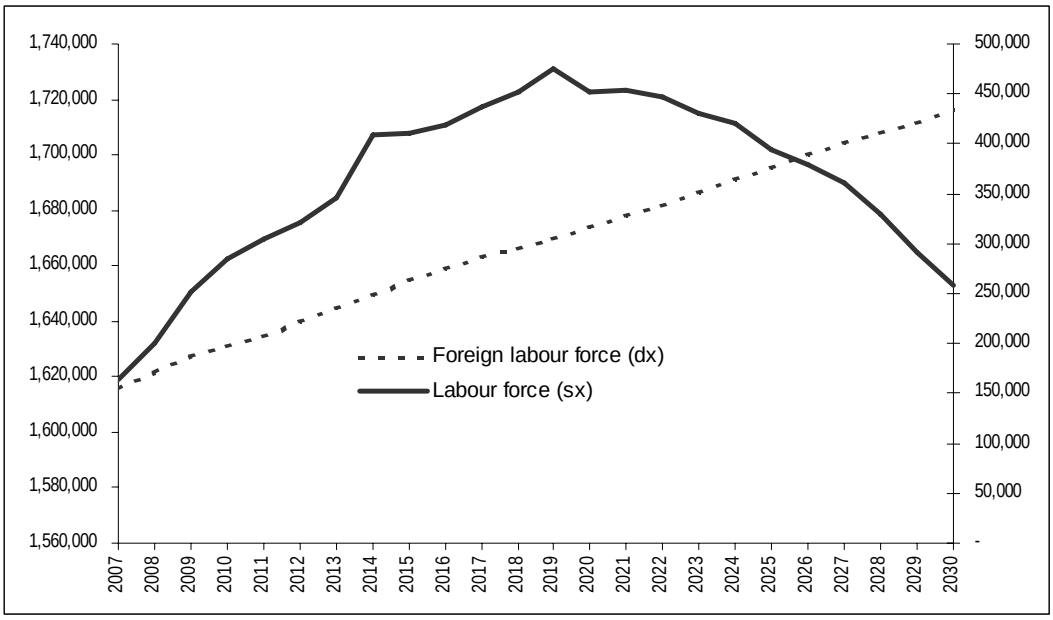
Graph 7
PARTICIPATION RATES, AGE PROFILE FOR WOMEN



Source: Irpetdin

In line with the forecasts given by other models (RGS 2007, Leombruni, Richiardi 2006, Capp, 2005), a bell-shaped trend is expected, first rising, then decreasing (from 2020), in the overall labour supply despite the positive contribution of foreign labour (Graph 8).

Graph 8
EVOLUTION OF THE ITALIAN AND FOREIGN WORKFORCE



Source: Irpetdin

Comparing the labour force with the labour demand we expect a potential quantitative mismatch until to 2020. Unemployment rate is now at 7%, it will go up to 11% at 2020 and only a reduction of working hours (3 hours less a week) could drive the unemployment rate at the level foregoing the current economic crisis.
After 2020, the decreasing of labour force will drive unemployment rate to the level of 5% without any reduction of working hours.So simulation period can be divided in a first interval when unemployment growth, followed by a period (2020-2030) when unemployment decrease but also labour force decrease
In addition to the potential quantitative mismatch, we get a qualitative one too, connected to our production system's low demand for qualified labour. If we consider potential dissatisfaction among the flow of workers who will be hired to carry out jobs requiring lower qualifications to theirs, this number is destined to grow significantly over the next few years.

Table 9
THE MISMATCH BETWEEN LABOUR DEMAND AND SUPPLY

	2009	2020	2030
Labour demand	1,536,631	1,584,951	1623932
Labour supply	1,619,223	1,789,248	1711104
Unemployed	69,592	205,888	86080
Unemployment rate	7%	11%	5%
Share of unsatisfied employees	20%	27.00%	31%

Source: Irpetdin

The evolution in the composition (stock) of the employed population confirms the trends observed in employment rates: the increase is greater for the over-50s, graduates and foreigners (Tab. 10). In our simulation the share of workers aged above 50 will reach 41% of the total employed population in 2030; workers with a university degree will reach 27%; finally, with respect to the nationality of workers, the last two columns show that the share of immigrants will increase to 254% in 2030.

Table 10
THE COMPOSITION OF THE SIMULATED EMPLOYED POPULATION

	GENDER		AGE			QUALIFICATIONS			NATIONALITY	
	M	F	<30	30-50	>50	Minimum schooling requirement	Upper secondary school leavers	Graduates	Italian	Foreign
2007	57%	43%	15%	60%	24%	49%	36%	16%	92%	8%
2015	57%	43%	9%	58%	33%	45%	36%	19%	88%	12%
2020	57%	43%	8%	54%	37%	42%	37%	22%	85%	15%
2030	56%	44%	8%	51%	41%	35%	38%	27%	75%	25%

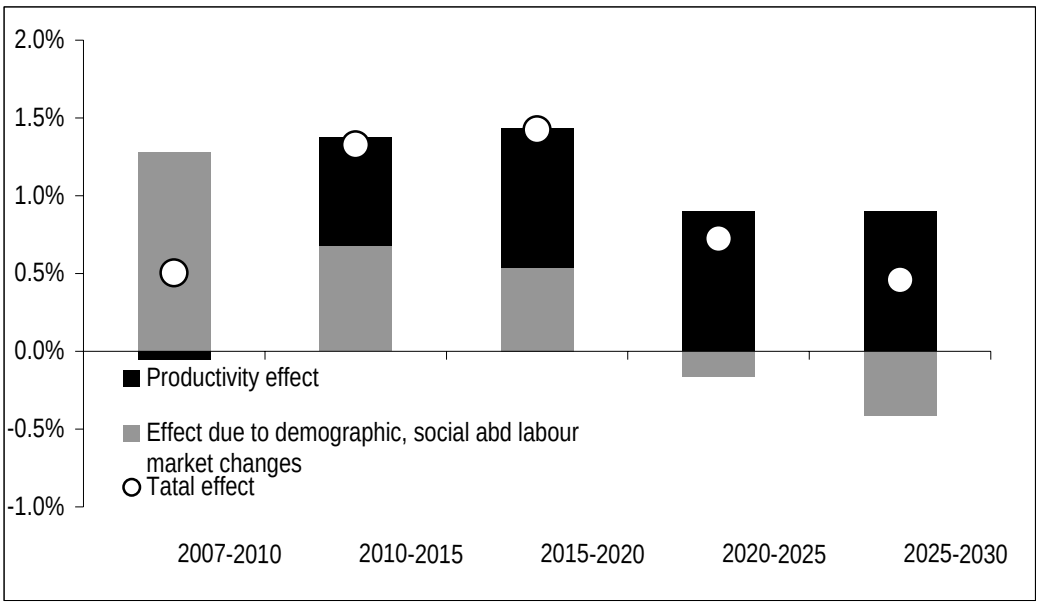
Source: Irpetdin

4.4 Wages and earnings

Salary trends in the next few years will reflect the expected changes in demography, economic growth and the labour market. In particular, they will be the result of two different elements: on one side, the increases in productivity that will happen every year and are distributed between employed people in proportion to salaries received; on the other side, the changes that will take place in the socio-demographic structure of the employed population, as well as the production system structure.

The following graph (Graph 11) illustrates the effects of these two different trends on the rate of growth in gross income from work. It is easy to observe how much the ageing of the employed workforce, as well as the greater presence of immigrants, and the reduction in work hours needed to keep the rate of unemployment unchanged (effect due to demographic, social and labour market changes) contribute - despite the greater increases in workforce productivity and higher levels of schooling[9]- to limiting the future rhythm of growth in pay.

Graph 11
AVERAGE RATES OF YEARLY VARIATION IN GROSS WORK INCOME



Source: Irpetdin

In general the scenario forecast for the next years seems characterised by more iniquity, in the face of low increases in salaries. Anything but a virtuous combination, which is reflected in family income trends (Tab. 12). Indeed, if we also consider pensioners and include both work and pension

[9] The latter in part only, but employed in jobs requiring the right level of qualifications

income at family level, weighted using a suitable scale of equivalence, the Gini index that we obtain increases significantly from 2007 to 2030: from 0.305 to 0.331.

Table 12
EQUIVALENT FAMILY INCOME INEQUALITY (GINI INDEX)

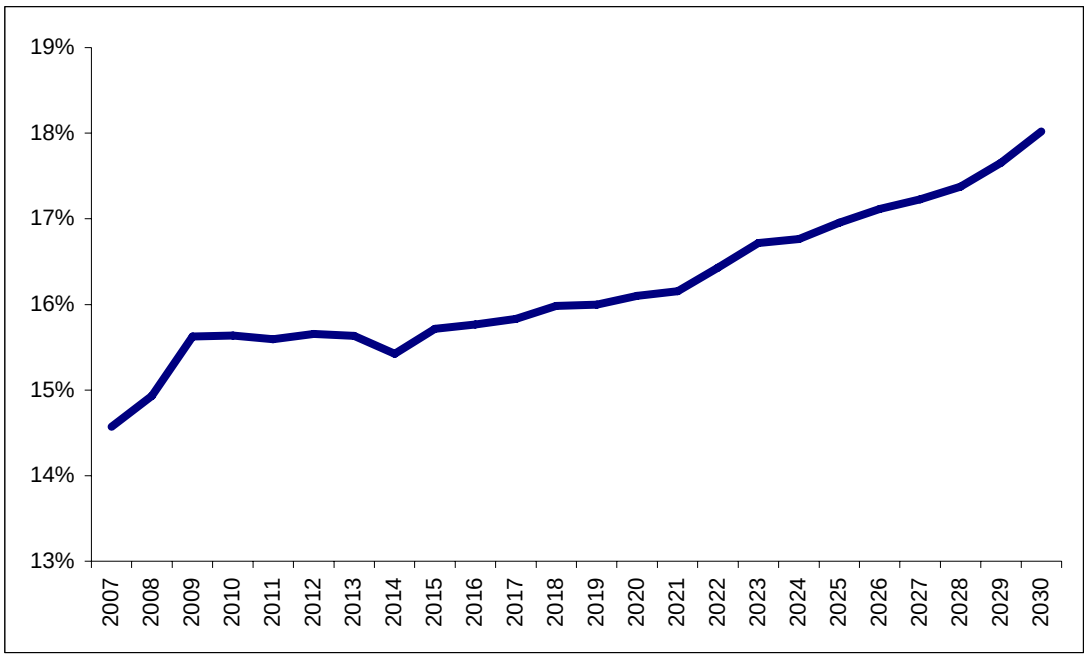
2007	30.5%
2010	31.1%
2015	32.0%
2020	32.6%
2025	33.1%
2030	33.2%

Source: IRPET elaborations

4.5 Social security trends

The forecasted pensions spending against GDP ratio is illustrated in the curve in graph 13. After the increase in the initial three years due to the economic recession underway, the curve goes down slightly following the recovery expected after 2010; subsequently the ratio increases as a result of demographic pressure, which is only compensated in part by the reduction in the average pension following the introduction of the contributions regime. Indeed, mixed regime taxpayers will still have access until 2030. Their pension values are only obtained in part by calculating the contributions they have paid.

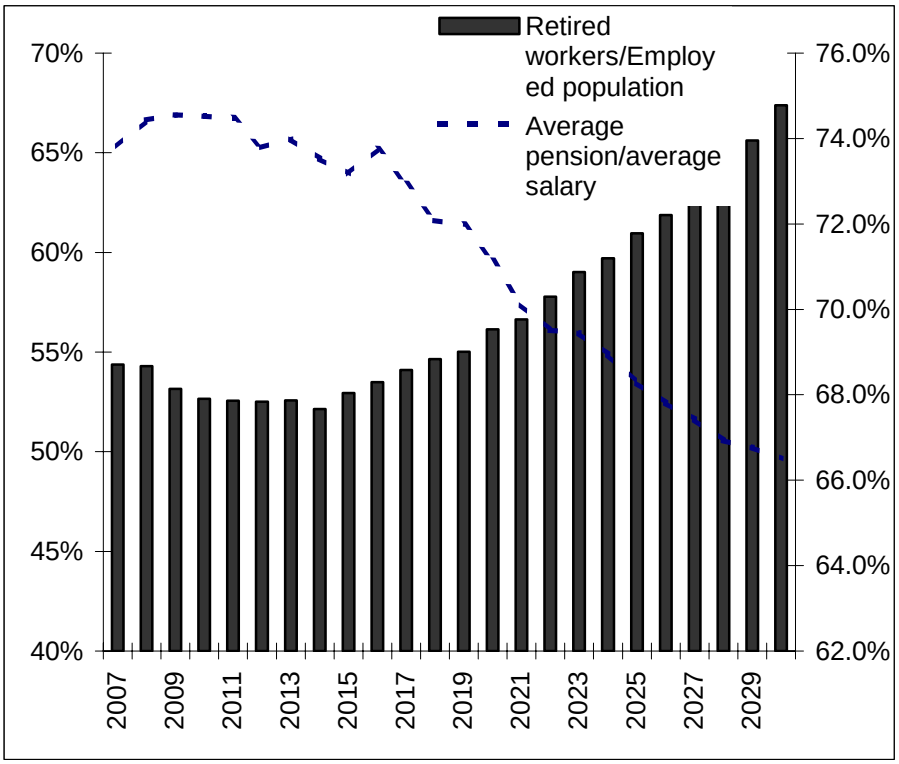
Graph 13
SOCIAL SECURITY SPENDING IN % GDP



Source: IRPET elaborations

In general, the number of pensioners compared to the number of employed will increase, but the growth rate of average pensions will go down. As a result, the ratio between average pension and average salary gross of taxes will go down (Graph 14).

Graph 14
PENSIONERS TO WORKERS AND AVERAGE PENSION TO SALARY



Source: IRPET elaborations

This effect is closely connected to the coming into force of the contribution pension scheme which has significantly lower replacement ratios[10] (Tab. 15). In other words, for the new pensioners, retirement from work will involve downsizing lifestyles more than is the case today for many taxpayers. However, this downsizing will only extend gradually to the whole population of pensioners, because the contribution rule will only take on a decisive importance after 2030: at that date 38% of the stock of pensioners will still be registered in the defined benefit scheme (today 97%), against 52% of those belonging to the mixed regime and 10% to the defined contribution scheme.

Table 15
GROSS REPLACEMENT RATIO AND SHARE OF PENSIONERS PER SCHEME

	Gross replacement rate			Share of pensioners		
	Defined benefit	Mixed	Defined contribution	Defined benefit	Mixed	Defined contribution
2007	70%	47%	0%	97%	3%	0%
2020	77%	58%	37%	78%	18%	4%
2030		57%	42%	38%	52%	10%

Source: IRPET elaborations

Therefore, in future, the social security department will be less concerned by the entity of pension spending rises than its distribution, especially among the generations.

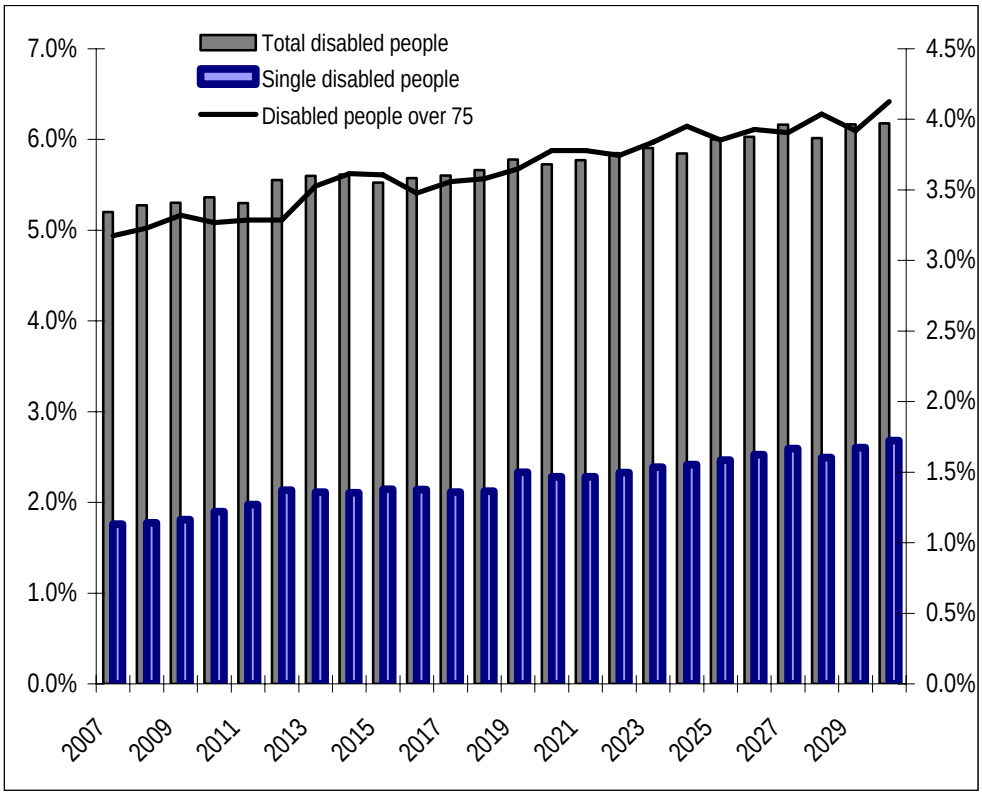
[10] The replacement rate gives the ratio between pension value and the last salary received before retirement. Therefore, it is calculated for new pensioners, while the previous ratio represented in Graph 11.39 is measured for all pensioners.

4.6 Non self-sufficiency trends

One of the main consequences of demographic ageing, in addition to the increase in pensions spending, is the increase in the population requiring benefit because they are incapable, to different degrees, of carrying out the normal functions of everyday life.

In 2030, according to our estimates, the number of non self-sufficient people in Tuscany will increase by 20% compared to current data. The incidence of the phenomenon on the Tuscan population will rise by 1 per cent: from 5.2% to 6.2%. But above all, in the future disabled people will be less able, compared to today, to count on help from the family: while in 2007 the number of single disabled people is estimated at around 32% of the total, by 2030 this share is destined to rise to 42%. Furthermore, the incidence of those over 75 will increase and therefore, associated to age, the number of functions that they will no longer be able to do will grow.

Graph 16
INCIDENCE OF DISABLED PEOPLE OUT OF ALL RESIDENTS



Source: IRPET elaborations

Public spending for long-term care (LTC), which presently amounts to around 1.7% of the GDP is therefore destined to rise by at least another 0.48 per cent, to reach 2.1%: 1.1% for health services, 0.8% for attendance allowance and 0.2% for other care services[11]. Attendance is estimated by bringing the service into line with the real growth of the economy, while for the other two components, the basic parameter used for the forecast is the different pro-capita expenditure depending on age.

[11] Spending for long-term care comprises three items: health costs for long-term care, attendance allowance and expenditure for services provided by local institutions.

Table 17
PUBLIC EXPENDITURE FOR LONG TERM CARE (% GDP)

	2007	2030
Health services	0.89%	1.2%
Attendance allowance	0.66%	0.9%
Other services	0.11%	0.2%
Total	1.66%	2.3%

Source: IRPET elaborations

5. Conclusions

In this paper we have presented Irpetdin: the dynamic microsimulation model constructed by IRPET for the Tuscan Region. The model covers demographic processes, education, the labour market, earnings, pension accumulation and disability. The aim is to further develop our understanding of the life course in order to formulate better policy options and thus to be better placed to assess their impact.

We find that relevant changes are expected both in the level and the composition of the main aspects influencing standards of living.

In the labour market, the demand will no longer be able to cover all the supply. Nevertheless, a balance could be struck between demand and supply through a reduction in the average working week and more part-time work, which is still unusual in our country. But, due to the growing level of schooling of the work-age population, according to our estimations the share of new dissatisfied workers (because they work in low-level jobs), presently 18%, would rise to over 35% in 2030.

Furthermore, except for immigrants (who show low levels of schooling and therefore more concentrated salaries than the autochthonous population), the inequality in pay levels within the single categories of workers (so-called infra-group inequality) will increase to such an extent as to cause an overall increase in salary inequality.

Therefore, the scenario forecast for the next few years seems to be characterised by more iniquity, as a result of low increases in salary profiles. Anything but a virtuous combination, which is reflected in family income trends.

Furthermore, the number of pensioners compared to workers will increase, but the growth rate of the average pension will decrease. The ratio between average pension and average salary gross of taxes is expected to go down. In other words, for new pensioners, retirement from work will result in their having to downsize their living standards more than many taxpayers have to do today. Therefore, in future, the social security department will be less concerned by the entity of pension spending rises than its distribution, especially among the generations.

One of the main consequences of demographic ageing, in addition to the increase in pensions expenditure, will also be the increase in the disabled population.

The above considerations pose two main problems: one pertaining to the growing levels of expenses and the services that have to be guaranteed to a large slice of beneficiaries to maintain current living standards; the other concerning the intensification of aid towards certain categories while for others it is reduced to deal with worsening distributive trends.

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