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### Assessing The Implications of Long Term Care Policies in Italy: a Microsimulation Approach

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# **ASSESSING THE IMPLICATIONS OF LONG TERM CARE POLICIES IN ITALY: A MICROSIMULATION APPROACH**

di Massimo Baldini, Carlo Mazzaferro e Marcello Morciano

*Summary:* This paper projects the characteristics of the long-term disabled in Italy and the evolution of total public expenditure for long-term care (LTC) over the next four decades. The future dynamics of LTC expenditure in Italy is of particular relevance for two reasons: the limited, insufficient level of public spending on the disabled, and the prospect, over the next few decades, of one of the most rapidly ageing populations in the world.

Our analysis is based upon a dynamic microsimulation model (CAPP\_DYN) that estimates the socio-economic evolution of the Italian population over the period 2005-2050. A disability module is built under two different hypotheses concerning the process generating the probability of being disabled: a pure ageing scenario where the probability of becoming disabled is fixed for each age, and an alternative scenario whereby the risk of disability depends on a set of characteristics such as changes in life expectancy, the composition of the household and the level of education. After projecting the future structure of the disabled population, the paper studies the dynamics of public LTC expenditure.

*Keywords:* long term care insurance; dynamic microsimulation; population ageing.

J.E.L. *Classification:* J11; J14; H51.

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## *1. Introduction*

The Italian population is currently undergoing one of the most rapid ageing processes in the world. The percentage of people aged over 65 years of age, which in 2005 stood at 19.5%, is forecast to rise to 27.0% in 2030 and to 33.5% in 2050 according to the central scenario of the last disposable projection of the National Statistics Institute<sup>1</sup>. This process is very likely to have profound implications for the future sustainability and composition of public expenditure in all countries that in the next decades will experience a similar demographic transition. One of the most important consequences of an ageing population will be an increasing number of disabled elderly, and therefore the greater cost of LTC (OCSE 2006; AWG 2006).

The Italian social welfare system presents also features that make the likely evolution more troublesome: resources employed in the provision of LTC services are scarce and misallocated (Gori 2006); there is no national LTC fund of the type introduced over the last few years by a number of different countries, such as Germany and Japan (Antz et al. 2007, Fukui and Iwamoto 2006); the frail elderly, who represent the bulk of the disabled population, are assisted mainly by informal care provided by family members or private providers; the rate of institutionalisation is low when compared to international standards, and has been falling in recent years; in-home care services, provided directly by local authorities or by non-profit organizations, are only commonly found in Northern Italy.

The ageing of the “baby boom generation” is not the only factor that may lead to a future LTC crisis in Italy and other advanced countries. Other substantial demographic changes will probably result in a reduction in the availability of informal care for the future disabled. The significant fall in fertility rates that began in the 1980s means that in following decades the elderly will have fewer children to rely upon. Rising divorce rates will end in an increasing number of elderly people now living alone. Finally, the increasing participation rate of women in the labour market started in the last decade and expected to continue in the future will reduce the number of women willing to provide care for other members of the family, be they elderly or children.

The seriousness of the problem of LTC provision, in terms of public spending, will strongly depend also on future disability rates among the elderly. Over the last few years, there has been a decline in disability rates among Italy’s elderly (Istat 2007a), as well as among the elderly in other developed countries (Manton et al., 2006). If this trend continues, it will reduce future

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<sup>1</sup> See [http://demo.istat.it/altridati/previsioni\\_naz/](http://demo.istat.it/altridati/previsioni_naz/).

LTC costs, *ceteris paribus*. On the other hand, however, not only it is very risky to extrapolate this trend to the future, but the cost of formal care per person will probably rise, due to the increase in such persons' life expectancy and thus in the likelihood that they will spend a long period, towards the end of their lives, confined to bed.

Within the context of this situation, the present study has two principal aims.

The first aim is to project the number of disabled persons in Italy over the next four decades, and to describe their changing demographic characteristics. There are currently numerous studies that forecast LTC spending into the distant future, up to 2050 or even 2100, and for a number of advanced economies (AWG 2006, OECD 2006, Comas-Herrera et al. 2007, Fukui and Iwamoto 2006). Most of these studies, however, are mainly conducted on a macro level, computing cell means of the number of disabled people and LTC spending. They tend to project current disability rates for various age and gender groups into the future. Many then provide some sensitivity analysis of the base results, by changing the level and evolution of one or more of the factors that may contribute towards a rise in LTC spending (disability rates by age categories, unit costs of LTC services, income elasticity of demand for LTC services, etc.). AWG (2006) for example provides projections on the likely evolution of aggregate LTC expenditures in 15 European countries: as far as Italy is concerned, it forecasts an increase of the dependent population ranging from 22% to 93% from 2004 to 2050 according to the different scenarios used in the simulation. In the "reference scenario the projected public spending in LTC would increase from 1.5% of GDP in 2004 to 2.2% in 2050.

Differently from those studies, we present a set of projections computed on the basis of a population based dynamic microsimulation model that simulates the future evolution of the life-cycle events of a sample of microdata regarding individuals deemed representative of the Italian population. The main advantage of this approach is the opportunity it provides of observing future changes in the socio-demographic characteristics of the pool of disabled people, a topic that has yet to be examined by those projection studies focusing on the Italian case (RGS 2006, Comas-Herrera et al. 2007). For example, one potentially worrying factor that a macro model is not able to capture is the likelihood of a marked decline in the average size of those households where disabled people live, with the consequent reduction in informal family support. Using a complete microdata model, we can track the life course of each disabled person and check whether, for example, there will be an increase in the number of disabled elderly living alone, thereby necessitating the provision of more formal care and an increase in LTC spending. Another advantage offered by the microsimulation model is that it enables us to make the probability of being disabled dependent on a set of socio-demographic characteristics

of the population that are expected to change in the future, such as the average length of life, the educational level and the family composition.

The second aim of the present paper is to estimate future public expenditure on LTC in Italy, using the projections of the number of people within each category of disability. In order to achieve this aim, we perform two simulations. The base simulation simply projects current per capita spending into the future, introducing an LTC fund that would ideally replace all forms of cash or in-kind public transfers currently earmarked for the disabled. The alternative simulation assumes a significant increase in LTC spending, reflecting a growing public awareness of the fact that the current LTC provision is far from meeting the needs of the disabled and their families.

The rest of the paper is organized as follows. Section 2 describes the main features of the dynamic microsimulation model used to perform the analysis. Section 3 provides a picture of some of the more important changes due to affect the number and the characteristics of the disabled in the future. Section 4 examines the dynamics of total public spending on LTC, and how an ageing population will increase the burden on the economy.

## *2. The dynamic microsimulation model*

All the simulations presented in this paper are performed using CAPP\_DYN (Morciano, 2007), a dynamic microsimulation model of the Italian population developed at the Centro di Analisi delle Politiche Pubbliche (CAPP), a joint research centre for the analysis of public policies, run by the Universities of Modena and Bologna<sup>2</sup>. The model simulates the main characteristics of the Italian population from 2005 to 2050. Fig. 1 shows the structure of the model: there is an initial base population, a second block which estimates past earnings of the currently active population, a simulation cycle which determines the future evolution of the population, and a final output where all annual cross-sectional data are aggregated into a single panel. Up until now, very few dynamic population models have been applied to the Italian society; the only other two models of this kind are those designed by Vagliasindi et al. (2004) and Ando and Nicoletti Altamari (2004), although neither of them has been applied to the study of disability and long term care.

**Figure 1** The structure of the CAPP\_DYN model

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<sup>2</sup> [www.capp.unimo.it](http://www.capp.unimo.it)

The initial population is taken from the 2002 wave of the Bank of Italy Survey of Households Income and Wealth (SHIW\_02), a dataset comprising 8001 households and 21,400 individuals, which has been resampled and inflated. Any simulation randomly extracts a sample of 107,000 households and 270,000 individuals.

While the unit of simulation is the individual, we nevertheless keep information on family structure and any changes this may be subjected to over the course of time. All individuals in the sample are involved in a considerable number of demographic and economic events, such as birth, education, marriage, work, retirement and death. Economic and demographic transitions among states are simulated using Monte Carlo processes. A set of matrices and econometric models are employed to generate transition probabilities, so as to produce a lifetime pattern of education, work, career, personal and family income, and so on, for each individual in question.

The CAPP\_DYN model has a recursive structure consisting in a set of modules executed in a predetermined order. The structure of these modules is shown in Fig. 2. The simulation starts with a set of demographic modules (mortality, fertility, net migration, household structure, divorce). These are followed by a module for educational choices. The next module deals with job decisions and the estimation of earnings. Each individual may change occupational status (full time, part-time, out of the labour market, unemployed) during his/her lifetime. Finally, each individual, on the basis of the current pension laws, of his/her accrued seniority and of the legal retirement age, moves towards retirement.

Individual income comes from employment or from the social security system. For employed people, an earnings equation is used to estimate lifetime labour income. For retired individuals we compute occupational, survival and social-flat rate benefits, taking into account the rather complex nature of the Italian pension system, as far as possible.

A series of exogenous variables is used to link the evolution of aggregate employment income to the macroeconomic path of GDP defined in the scenario. The final result of the model is a panel aggregating all annual cross-sections from 2005 through to 2050. Individuals and households in the simulated population are heterogeneous over a relatively large set of demographic and economic characteristics, thus enabling the model to deal with a series of important issues (particularly those of a distributive nature) that cannot be dealt with by cell-based or representative agent models.

**Figure 2** The modules of CAPP\_DYN

The primary database for the CAPP\_DYN model is SHIW\_02. The use of a survey as the model's database has both advantages and drawbacks. Compared to those dynamic models based on a random sample from administrative data, our dataset has a fuller set of information on family composition, educational level and economic status for each observation. On the other hand, SHIW\_02 is based on a stratified sample design. This means that each household is weighted according to the inverse of its probability of inclusion in the sample. So we need to adopt a procedure enabling us to treat each observation as though it were a single household. Using a re-sampling procedure, we generated a very large proportional sample of households. In the process of doing so, we made a series of statistical adjustments using Census data, in order to ensure that the distribution of demographic and economic characteristics closely matches the corresponding distribution of the Italian population.

Many other sources of information were employed in building the model. Educational choices and earnings equations are simulated on the 2006 wave of PLUS, a Ministry of Welfare survey analysing the Italian labour market (Mandrone and Radicchia, 2006). Changes in the labour market are given by a multinomial logit estimation on a pooled sample of the 1993-2003 waves from the Quarterly Labour Force Survey carried out by the Italian Institute of Statistics (ISTAT). Survival probabilities, fertility rates and net migration hypotheses, all of which are used to define the demographical evolution of the population, are taken from ISTAT's forecasts of the Italian population for the period 2005-2050 (ISTAT 2001).

The most important exogenous variables used in the simulations are real per capita income growth and real per capita earnings growth. Data are taken from the 2005 Ragioneria Generale dello Stato model (RGS, 2005), which is currently used by the Italian Government to regularly forecast pension, health and LTC expenditure in relation to GDP in the medium/long term. Age-related profiles of employment income are endogenous, and are therefore not necessarily aligned to the RGS model. A special module has been used to calibrate the model's endogenous results in order to bring them in line with the basic economic hypotheses. All monetary variables are in Euros, at constant 2002 prices..

### *2.1 The disability module*

The simulation of the disability condition is based on external information taken from the ISTAT Survey on public health and the use of the national health service, which is carried out every five years on a sample of more than 100,000 individuals of all ages. The most recent survey, which is the one used for the purposes of this paper, was conducted in 2005. The

survey collects information about individuals' ability to perform certain basic daily tasks such as washing, eating and dressing, without the need for the help of others. There are 19 questions of this type, and they may be grouped into four categories, each of which may indicate a different form of disability, namely: being unable to get out of the house; having serious difficulties with movements, everyday activities, or in communicating with others<sup>3</sup>. For each of the four categories, therefore, we end up with a dummy variable which is given the value 1 if the individual is unable to perform that set of activities. This classification has been used to distinguish three levels of disability, each of which depends on how many of these dummy variables takes the value of 1: the lowest disability condition (level 1) is that where the person is disabled in terms of only one of the four groups of variables; medium (level 2) disability corresponds to two dummy variables equal to 1; finally, a person is deemed severely disable (level 3) if three or four areas of disability take a value of 1. Table 1 provides some basic descriptive statistics regarding the survey. Average age increases with the seriousness of the disability condition, as does the proportion of women. The level of education is negatively correlated with the level of disability as does the condition of widowhood.

**Table 1** Descriptive statistics of the Survey on health conditions and use of health services

In order to assign to each individual in the simulation database a disability status, we propose and compare two alternative approaches:

a) *Pure ageing*: the ISTAT Health Survey is used to compute the proportion of disabled people within classes defined by gender and age (Costello and Przywara, 2007). These relative frequencies by gender and age are used to select, following Monte Carlo methods, which sample members are attributed the disability status. Three levels of disability have been identified. Note that under this scenario no cohort effect is taken explicitly into account, nor it is assumed that any future gains in life expectancy will be spent in a state of bad health. As a consequence, these projections are rather mechanical and risk to produce distorted estimations of the number of disabled.

b) *Compression of disability*: the probability of being disabled is not constant within groups of the same age and gender, but depends on a vector of socio-demographic determinants. If these variables change, the probability of suffering from a disability should change accordingly. In

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<sup>3</sup> For example, a person is defined as unable to perform basic everyday activities if he/she indicates a serious difficulty as a reply to at least one of the questions that fall within this category.



order to take account of this endogeneity, we have performed an ordered probit estimation on the 2005 Health survey, where the dependent variable may be classified at four different levels: no disability (95.7% of total sample), low disability (2.1%), average disability (1.3%), severe disability (0.9%). The explanatory variables must be restricted to those socio-demographic characteristics that are common to both the Health Survey and the microsimulation model database, namely: age, gender, educational level, geographic area, widowhood. In addition to these explanatory variables, we have also included the residual life expectancy (in years) of each person, such data (depending on age and gender) being taken from the latest ISTAT estimates. The introduction of residual life expectancy is important, since if overall life expectancy rises, one would not expect the probability of becoming disabled to remain constant for any given age. Indeed, it is now widely recognised that this probability increases rapidly during the last years of one's life. In the presence of an ageing population, the omission of residual life expectancy from the regression would, at the simulation stage, result in an overestimation of the probability of becoming disabled, and therefore also of future LTC costs (Norton and Stearns, 2004). This second hypothesis may be considered to be a variant of the diverse theories asserting that the number of years spent in poor health should decrease as life expectancy increases (Fries 1980, Manton et al. 2006). It is, nevertheless, more accurate and consistent with the data used to build the model than the mere application of a simple ad hoc rule whereby the probability of being disabled increases with life expectancy.

In order to check the results of the application of this rule, we also create a comparison scenario with a very simple rule whereby the probability of becoming disabled changes each year in proportion to the increase in life expectancy. Costello and Przywara (2007) refer to this rule as the “constant health scenario”.

The effect of observable socio-demographic characteristics on the probability to fall under a condition of disability are modelled in terms of an ordered probit model, which takes the following form. Define an ordinal variable  $y$   $\{i: 1 \dots N\}$  indicating the observed level of disability among the sample members and  $y_i^*$  is the associated latent variable. The model has the following general structure:

$$y_i^* = X_i \beta$$

$$y_i = j \quad \text{if} \quad c_{j-1} < y_i^* \leq c_j$$

where  $X_i$  denotes the vector of observable explanatory variables;  $\beta$  is a vector of coefficients, and  $\varepsilon$  is a random variable distributed as a normal. Given the nature of the data available, we ignore the possibility of unobservable personal characteristics which might influence both the level of

disability and some of the explanatory variables. There are four different disability levels, denoted by  $j$ : 0 no disability, 1 low level of disability, 2 intermediate level of disability, 3 serious level of disability. The cut-off parameters  $c$  are estimated as part of the model. (A constant term is not identified in the model).

Table 2 shows the results of the ordered probit estimate on the 2005 Health Survey. The explanatory variables relating to age are introduced using a spline function, and their coefficients show a marked increase in the probability of becoming disabled over the age of 70. Disability status is strongly dependent on the level of education (the omitted variable is the graduate level), and also on being resident in the southern part of Italy (the omitted geographic area). Residual life expectancy has a significant effect: if, in the future, life expectancy increases, this will lead to a reduction in the probability of becoming disabled for each year of age.

**Table 2** Ordered probit estimates of the probability of being disabled

Since CAPP\_DYN projects all the model predictors, we are able to use the estimated coefficients and the cut-off parameters of this regression for predicting, for each year, the probability for an individual with characteristics  $X$  of being in a condition of disability  $j$  as:<sup>4</sup>

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<sup>4</sup> We assume that the gradient of the disability rates (by levels) with respect to the socio-economic characteristics observed in the cross-section (year 2005) will remain constant in the future.

$$\begin{aligned}
pr(y_i^* = 0) &= \int_{c_0}^{c_1} y_i^* dy = Norm[(c_1 - (X_i\beta + \varepsilon_i))] \\
pr(y_i^* = 1) &= \int_{c_1}^{c_2} y_i^* dy = Norm[(c_2 - (X_i\beta + \varepsilon_i))] - pr(y_i^* = 0) \\
pr(y_i^* = 2) &= \int_{c_2}^{c_3} y_i^* dy = Norm[(c_3 - (X_i\beta + \varepsilon_i))] - pr(y_i^* = 1) \\
pr(y_i^* = 3) &= \int_{c_3}^1 y_i^* dy = Norm[(X_i\beta + \varepsilon_i) - c_3]
\end{aligned}$$

In order to identify the disability level for the sample members in each year of the simulation, we use a Monte Carlo process. We assign no disability to sample members who receive a random number  $z$ , drawn from a uniform distribution between 0 and 1 below the conditional probability of having no disabilities  $pr(y_i^* = 0)$ ; we assign low level of disability if the random number are between  $pr(y_i^* = 0)$  and  $[pr(y_i^* = 0) + pr(y_i^* = 1)]$ ; we assign intermediate level if  $[pr(y_i^* = 0) + pr(y_i^* = 1)] \leq z \leq [pr(y_i^* = 0) + pr(y_i^* = 1) + pr(y_i^* = 2)]$ ; finally, if  $z$  is between  $[pr(y_i^* = 0) + pr(y_i^* = 1) + pr(y_i^* = 2)]$  and 1 the individual is assigned the most serious level of disability.

We assume also that if a person is deemed to be disabled in year  $t$ , he/she cannot then return to being classified as non-disabled in future years of his/her life; however, if that person is deemed to be less than seriously disabled, then he/she may be attributed a worse degree of disability in any subsequent year, up until death. We then randomly select (for each of the two alternative imputation approaches described above), from among those classified as being severely disabled, and who had been disabled for more than three years, a subsample of individuals to be taken into nursing homes, this number corresponding to official estimates of the number of people recovered in such homes in Italy (ISTAT, 2007b).

Table 3 shows the association between socio-demographic characteristics of the population and the level of disability predicted by the probit model according to the method used in Ermish and Francesconi (2001). The predicted probabilities are computed at the sample values using estimated parameters (and cut point) from model presented in table 2. The results can be read as follow. The row “baseline probabilities” displays the predicted average probabilities for each of the four levels of disability when all the characteristics are set at their sample values for each person. It can be shown that the overall baseline predicted probability of being in one of the four states is equal to 1, while the sum of the predicted probabilities to have one of the three levels of disability is equal to the rate of disability presented in the text (sum of the baseline probability of having low level of disability=2.1%, intermediate level=1.3%,

serious level=0.9%). The remaining rows of table 3 show predicted probabilities relative to particular values of the explanatory variables. In the case of age, for example, all the characteristics other than age are set at their sample values for each person, and predicted probability values for each person are averaged over the sample.

Women have a disability probability that is always higher than that for males. Individuals with a low level of education present a probability of having a low level of disability of 2.3%, compared with 1.4% for those with a high school diploma, while a higher level of education decreases this probability further. Living in the South of Italy increases the probability of disability compared with the probabilities computed for people who live in the Centre and the North.

**Table 3** Predicted probabilities of being disabled by level of gravity

### *3. Projecting the number and characteristics of the disabled*

The next stage involves the imputation, from the micro-database of the dynamic simulation model, of the probabilities of being disabled, computed according to the two different approaches illustrated above.

Following the first approach (pure ageing), we use the Monte Carlo method to select those persons deemed to be disabled, with the percentage of people belonging to each disability level established exogenously so as to reproduce a distribution of the disability rates in the simulated data, by age and gender classes, which is similar to those observed in the ISTAT survey on health conditions. Thus, in this first scheme the disability rates are fixed for various age groups, and the total disability rate increases simply because the population is ageing.

The second approach makes the total shares of the disabled in the simulated population dependent on a wider set of characteristics of the population, since they depend not only on the ageing of the ‘baby-boom’ generation, but also on the reduction in mortality rates and on other changes in the socio-demographic characteristics of the population that are correlated with the probability of being disabled, such as the rising levels of education.

Table 4 shows - separately for the two alternative simulation schemes - the projected future composition of the total Italian population, subdivided into four classes: those who are not disabled and those who are disabled, classified according to the above-mentioned three levels of disability.

**Table 4** Percentage of persons with disabilities

During the 45 year-period covered by the simulation, the pure ageing scenario forecasts that the total percentage of the population affected by disability will more than double, from an initial value of 4.6% in 2005 to 9.5% by 2050. This increase will be particularly marked among those classified in the two most severe categories of disability. Due to the ageing of the baby-boom generation, the ratio between the number of disabled and the number of people of a working age will also significantly increase: today there are 12 people aged 25 to 64 for each disabled person, whereas by 2050 this number will have fallen to 5. The average age of the disabled will rise significantly, by about 8 years over the period in question. Much of this increase in the average age of the frail population is expected to take place during the first half of the projection period.

The alternative simulation, characterised by endogenous disability rates, shows a significantly lower increase in the total number of the disabled. Higher levels of education and, more importantly, longer life expectancy, lead to a reduction in disability rates for each age. It follows that in this second scenario the disabled are significantly older than under the first one. Although less dramatic, this second scenario confirms the growth in the percentage of disabled citizens, which is projected to move from 4.5% in 2005 to 7.8% in 2050. Fig. 3 shows the different trends in the relative size of the disabled population according to the two alternative hypotheses. Given that in 2005 the number of disabled people (of all ages) in Italy was estimated at around 2.6 million, the naïve pure ageing scenario forecasts that this number will increase to 4.3 million by 2030, and to 5.6 million by the end of the simulation period, in 2050: this latter figure represents an increase of 115%. The scenario characterised by compression of the disability forecasts smaller increases: 3.4 million disabled in 2030 and 4.6 million in 2050, a 77% increase between 2005 and 2050. Comas-Herrera et al. (2007) estimate a percentage increase (for the over-65s only) of 107%. The AWG (2006) study predicts a percentage increase of 93% under the pure ageing scenario. In the constant disability scenario the growth of disabled people goes down to 22%. In our model, the overestimation bias produced by the pure ageing scenario on the change in the number of the disabled is 33% in 2030, going up to 51% in 2050. Fig. 3 shows also the trend in the proportion of disabled citizens according to the “constant health scenario” illustrated above, which foresees a reduction each year in the probability of being disabled, which is in line with the rise in life expectancy. The results are very similar to those produced by our endogenous disability scenario. Our method, however,

does not impose any ad hoc rules. Due to this similarity, the remaining part of the present study will only refer to the two basic scenarios previously described.

**Figure 3** The disabled as a percentage of the total population

Fig. 4 shows the estimated trend in the percentage distribution of the disabled, by age class, over the 45-year period in question. The proportion of the over-80s is forecast to rise significantly over this period, particularly under the compression of disability hypothesis. Since the severity of a person's disability tends to worsen with age, this factor will undoubtedly produce an increase in total LTC spending requirements.

**Figure 4** Shares of the disabled by age class

The number of years a person spends in a disabled condition will increase significantly during the period in question if we assume no changes in the disability rates per age class and gender (Fig. 5). The graph runs from 2020 since the dynamic model does not simulate how many years a person spends as a disabled prior to the beginning of the simulation period, so in the first period of simulation the average numbers of years of disability would rise substantially, starting from 1 in 2006. The scenario characterised by endogenous disability shows a much smaller increase in the aforesaid number of years, due to the shifting of the disability rates according to the increase in life expectancy.

**Figure 5** The average number of years the disabled spend in a disabled condition

The main advantage of a dynamic microsimulation model, when compared with macro models, is the possibility to observe how the distribution of certain characteristics is likely to change among the population of interest. We are now going to focus on some modifications in the characteristics of the disabled population that may influence their chances of receiving care. All

the figures and tables that follow in this section are obtained from the compression of the disability scenario. Tab. 5 shows that the future disabled will be significantly less able to rely on informal care provided by their children than the present-day disabled are, because they will have significantly fewer children than those disabled persons currently requiring care. Today, 56% of all disabled people can get help from at least two children; this percentage will fall to 34% by the end of the period in question. The generation born during the 1950s was the first to be characterised by a significant reduction in fertility compared with previous generations. When a share of persons from that generation become disabled, around the year 2030, many of them will have only one child who could in theory provide assistance.

**Tab. 5** Distribution of the disabled by the number of their children

**Figure 6** Distribution of the children of the disabled by educational level (as a %)

These children, however, will not only be less numerous than today, but will be also much less willing to provide informal care, as they will be increasingly well-educated, and therefore more productive; as a result, the opportunity cost of their providing care will be higher (Fig. 6), and they will also be more involved in formal work outside of the home environment (Fig. 7). The growth in the employment rate among adult women may well lead to a reduction in the aggregate amount of the informal care which, together with home help provided mainly by immigrant workers, is currently standing in for a well-organised (public) insurance system against the risk of disability.

**Figure 7** Employment rate among for the 51-65 age class projected by the model

#### *4. Projecting the costs of long-term care*

In this section we perform two simulations of future public expenditure on LTC in Italy. We have ignored any possible interrelationship between the changing nature of the disabled population in the future and public expenditure, mainly because it is very difficult to imagine how public spending will react to changes in the composition of the said disabled population. In principle, it is even conceivable that there will be no variation in the nature and per capita amount of social expenditure. We have considered this case as our base simulation. More generally speaking, public policies can change in various ways as a reaction to the demographic crisis, and such changes cannot be forecast at present. We have therefore considered a second scenario where the government reacts to the aforesaid increase in disability rates by raising the amount of the resources transferred to the disabled.

Both scenarios may, in principle, be rationalised in the form of the introduction of a specific LTC fund, which in one case would simply incorporate current schemes without changing their structure or level of funding, while in the other case it would mean raising the resources targeted to each disabled individual. This fund could be financed by a tax collected on a base that is some variant of national income<sup>5</sup>.

Over the past decade, many advanced countries have created specific social security programs based on targeted contributions, in order to finance the setting up of special LTC funds. In Italy, current programs aimed at the elderly are financed from general taxation, and the debate over the opportunity or otherwise of establishing a specific, independently financed LTC fund is gaining momentum, although so far nothing has been put into practice.

The first of our two simulations assumes the invariance of current policies towards LTC, and provides an estimate of the rising burden of LTC expenditure on GDP and the public budget. Although there is significant spending on the disabled, the current level of public expenditure is still not enough to guarantee a reasonable coverage of the needs of the disabled (Gori, 2006). We have therefore analysed the implications of a possible new LTC scheme with more generous funding than that currently provided by today's highly fragmented institutions. This new scheme would incorporate current LTC expenditure, but would provide different transfer levels according to the kind of care received (in home or residential). Its structure will be described in the following pages.

The base simulation has been conducted under the assumption that the present institutional setting for LTC will remain unchanged in the future. The starting point is therefore the

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<sup>5</sup> In fact, the distribution of the burden of such a tax is a very important issue. At this stage of our study we decided not to consider any alternative options, which shall nevertheless be the subject of future research.



reconstruction of current expenditure levels. According to official estimates provided by RGS (2006), Italy's public expenditure on the disabled in 2005 amounted to about 22 billion euros (1.6% of GDP). This sum can be divided into three parts: a) "health care costs", amounting to about 12 billion euros, which includes both spending on residential care and the provision of drugs, psychiatric assistance, medical visits, etc.; b) 8 billion euros for a cash transfer entitled "Indennità di accompagnamento" (disability allowance), aimed at dependent people and not means-tested, amounting to nearly 500 euros per month in 2006, irrespective of the level of disability; c) 2 billion euros in transfers in kind, mainly formal housing assistance provided by municipalities, generally means-tested.

In our simulations, our estimated level of LTC spending consists of the entire amounts under points b) and c), together with part of the amount under point a), which is not strictly related to health expenditure, since healthcare costs are a component of social expenditure on health, and will in any case be provided by the public sector irrespective of how the LTC system is organised in the future.

The public LTC expenditure forming the basis for our simulations therefore corresponds to 0.9 % of GDP in 2005; this figure is very close to that computed for the starting period of the simulation by other projection studies (OECD 2006, Comas-Herrera et al. 2007).

After identifying the pool of disabled from among the model's micro-units, we assigned different cash-equivalent amounts to be transferred to each of the three disability levels. Those persons belonging to the least serious disability category are assumed to receive only in-kind housing assistance at the local level. Of course, they can also receive other forms of care from private providers or relatives, although such forms do not generally imply any public contribution. We have therefore attributed to each person in the first disability level a sum of money corresponding to the ratio between total expenditure on housing aid and the numerical entity of the lightly disabled.

Each disabled person belonging to the second and third levels receives the disability allowance. This assumption generates a simulated number of beneficiaries which is very close to the real number of beneficiaries of this cash transfer in 2005 (1.4 million). Finally, the most seriously disabled persons resident in nursing homes receive a much larger amount of money, i.e. 2,000 euros per month, which corresponds to the public contribution to residential care costs.

The second, alternative simulation tries to rationalize an increase in the generosity of public expenditure. In order to temper the inevitable arbitrariness when defining the level of expenditure in this more "generous" case, we took the German LTC fund, established in 1994, as our benchmark. We thus doubled the sum received by those disabled persons at the

second and third disability levels who are not institutionalised, from 500 euros a month to 1,000 euros a month. This amount corresponds to the weighted average of the value of the cash and in-kind transfers provided by the German LTC fund in 2005 (Arntz et al., 2007), and would in general mark a significant increase in the focus of public policies towards the disabled. In both simulations, the per capita expenditure levels are forecast to increase yearly at the same rate as real GDP. We do not model any kind of tax or contribution, but simply estimate the cost of different LTC programmes in terms of GDP.

Fig. 8 shows the dependency ratio, computed as the ratio between the number of disabled on the one hand, and the sum of the numbers of workers and pensioners representing the pool of taxpayers called upon to finance a pay as you go LTC system, on the other<sup>6</sup>. According to the pure ageing scenario, this ratio increases by 75% (from 8% to 14%) over the simulation period, even if we compute the pensioners among future taxpayers. In fact, as the analysis in section 3 shows, this is due to the rapid increase in the number of individuals aged over 80, who are very likely to become disabled. If we assume that the risk of disability falls as life expectancy increases, this compresses the increase in the share of disabled people from 75% to 50% (i.e. from 8% to 12%).

**Figure 8** Number of LTC disabled / (number of employed + pensioners)

Fig. 9 illustrates the dynamics of LTC expenditure in the first of the two scenarios that we have chosen for this section, i.e. the base case where the generosity of public LTC for each disabled person is not going to change in the future. All values are expressed as percentages of GDP.

**Figure 9** Ratio between LTC expenditure and GDP, constant generosity case

Total expenditure on LTC that the government needs to collect in order to finance the fund on a purely pay-as-you-go basis increases constantly from 0.9% of GDP in 2005 to 1.7% in 2050 in the pure ageing scenario, and from 0.9% to 1.5% in the compression of disability case. This is therefore also the implicit tax rate of public LTC spending on GDP that must be

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<sup>6</sup> In this paper we do not consider the consequence of funding the LTC system. In this case, at least in the first part of the simulation period, the burden on taxpayers would be even higher than that estimated in the case of a PAYGO financing mechanism.

applied in order to maintain the equilibrium between fund receipts and transfers. The increase in the ratio between LTC expenditure and GDP that we obtain is lower than that calculated according to official Italian government estimates (RGS 2006), which are based on more prudent assumptions, since they assume that only half of the gains in life expectancy will be spent in good health.

The second, “German-style” scenario (Fig. 10), whereby initial expenditure on each disabled person is set at a higher level than the current one, requires more substantial resources. The dynamic evolution of the implicit tax rates are graphically similar to those presented above. The levels are however always higher, reaching nearly 3.5% of GDP in the pure ageing scenario, and 2.7% in the compression of disability case.

**Figure 10** Ratio between LTC expenditure and GDP: “German” case

## 5. Conclusions

Using a dynamic microsimulation model, the paper tries to shed some light on the future characteristics of Italy’s disabled and on future trends in LTC expenditure.

To do so, we compared two projections. One is made under the assumption that current disability rates for each age will remain constant in the future; this is a rather pessimistic hypothesis (not supported by recent evidence) since it corresponds to the assumption that all gains in life expectancy will be spent in a state of ill health. The other criterion, which appears more realistic, assumes that the disability rate reflects the projected trends in demographic characteristics and in life expectancy of the Italian population.

Demographic changes will produce a substantial increase in the number of the elderly disabled, and a marked reduction in the number of relatives on whom they will be able to rely for assistance. Changes in the educational level of the population and in the labour market, with an increase in women’s involvement, will reinforce these tendencies.

Under the pure ageing scenario, in 2050 there will be 2.5 million more disabled people than there were in 2005. According to the alternative hypothesis, their number will increase by 1.5 million, i.e. 40% less than in the first scenario. It is however wrong to conclude that the increase in future LTC expenditure will be 40% less than that estimated by the pure ageing

scenario, since the average age of the disabled will be higher according to the endogenous disability hypothesis. In other words, in the future the number of disabled people will increase less than many fear, but the disabled of tomorrow will be older and more likely to live alone and without the assistance of close relatives, than today's disabled.

In the second part of the paper we tested the likely evolution of LTC expenditure in the face of the expected ageing process. The results show that even if the current low, insufficient average level of LTC spending were maintained in the future, the share of GDP that must be devoted to finance the LTC fund would increase from 0.9% to 1.7% at the end of the simulation period (2050) in the most pessimistic case, and to 1.5% if increased life expectancy will be accompanied by a fall in disability rates for each age class. In the case of a desirable increase in average LTC expenditure per person from 500 to 1,000 euros a month at 2005 prices, the burden on GDP would obviously increase in both scenarios. Since the total tax revenue as a percentage of GDP has already reached high levels, this result suggest that if Italy wants to finance the increase in LTC expenditure, it will be necessary either to widen the currently used tax bases or to reduce the dynamics of other major components of public expenditure.

The dynamic microsimulation model used for this paper could also be put to good use in analysing the likely evolution of the types of formal and informal care for tomorrow's disabled, given the changes in the demographic conditions of the disabled and in the labour market position of their relatives.

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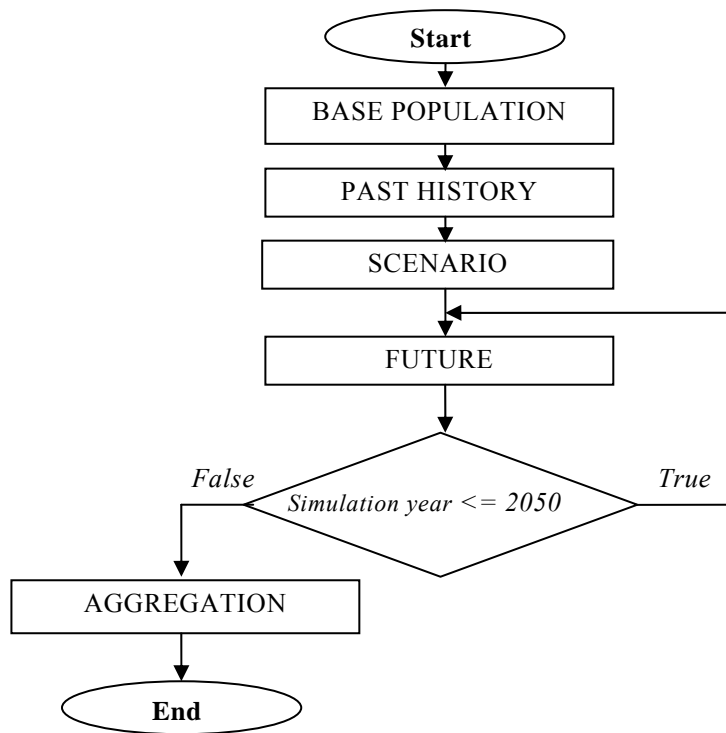


Fig. 1. The structure of the CAPP\_DYN model.

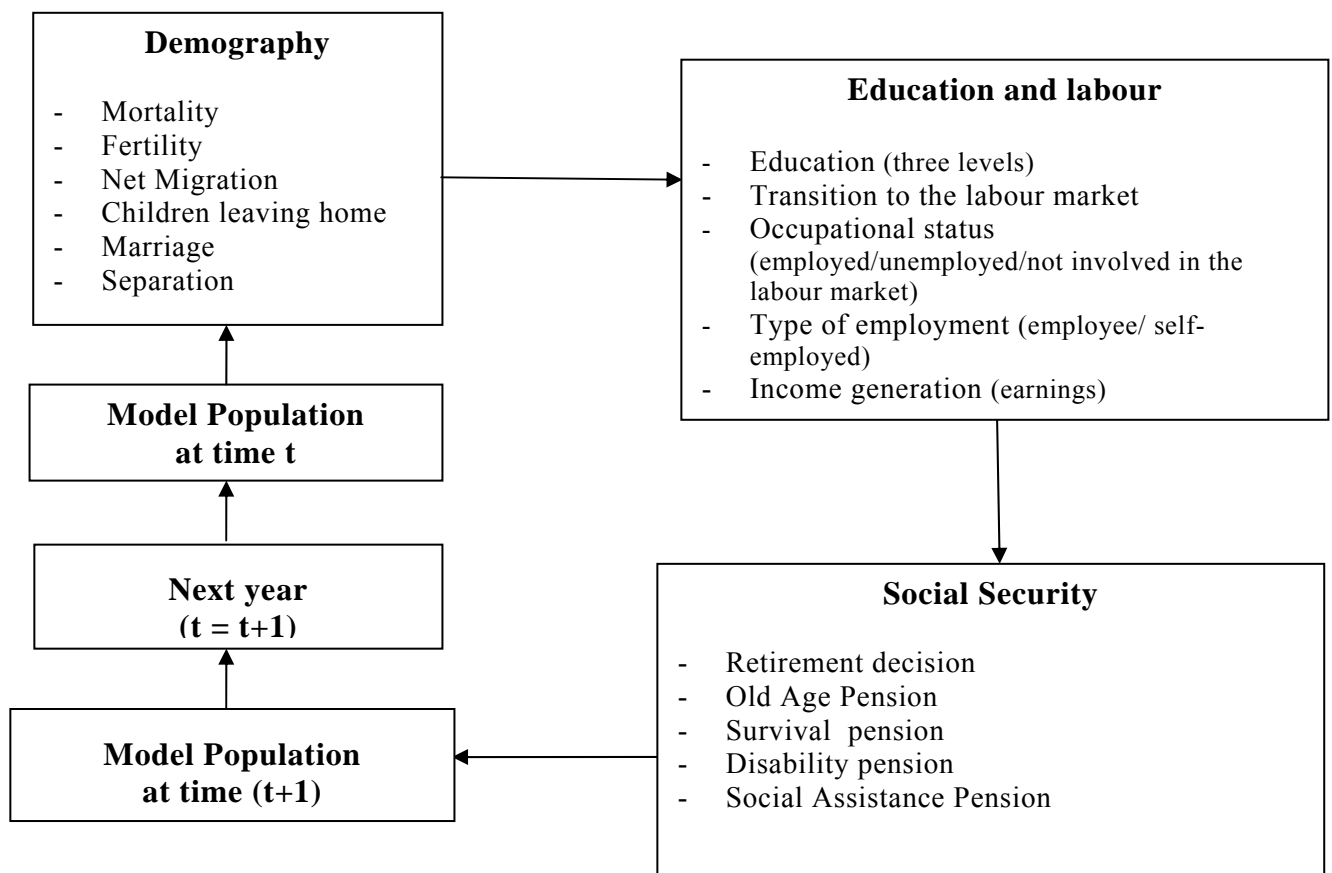


Fig. 2. The modules of CAPP\_DYN.

Tab. 1. Descriptive statistics of the Survey on health conditions and use of health services

	Whole sample	Disabled, level 1	Disabled, level 2	Disabled, level 3
Age	41.8	68.1	75.5	78.8
Woman	51.4%	63.0%	68.4%	70.0%
Compulsory education	59.7%	88.6%	89.5%	93.5%
High-school diploma	26.4%	8.8%	7.7%	4.4%
University degree	8.2%	2.6%	2.7%	2.1%
North	45.2%	41.5%	38.8%	39.2%
Centre	19.2%	18.8%	20.1%	21.8%
South	35.6%	39.6%	41.1%	38.9%
Widow	7.9%	36.9%	45.6%	53.7%
Remaining life expectancy (in years)	40.9	19.2	13.5	11.3
Number of observations	128040	2797	1869	1324



Tab. 2. *Ordered probit estimates of the probability of being disabled*

	Coef.	Robust Std. Err.
<=30 years	-0.0551	0.0100
31-50 years	-0.0400	0.0097
51-60 years	-0.0255	0.0104
61-70 years	-0.0012	0.0089
71-80 years	0.0463	0.0077
>=81 years	0.0604	0.0054
Female (D)	0.3137	0.0424
Compulsory education (D)	0.4726	0.0409
High-school diploma (D)	0.1472	0.0476
Northern Italy (D)	-0.2386	0.0188
Central Italy (D)	-0.1518	0.0234
Widow (D)	0.0997	0.0234
Residual life expectancy (in years)	-0.0541	0.0099
Cut-points:		
C <sub>1</sub>	-1.5867	0.7821
C <sub>2</sub>	-1.1616	0.7821
C <sub>3</sub>	-0.6392	0.7819

*Note:* Number of obs. = 128040; LR  $\chi^2(13) = 15988.04$ ; Prob >  $\chi^2 = 0.0000$ ; Log likelihood = -21515.021; Pseudo  $R^2 = 0.2709$ . (D) indicates dummy variables.

Tab. 3. *Predicted probabilities of being disabled by level of gravity*

	Not disabled	Low level	Intermediate level	Worst level
Baseline probabilities	0.957	0.021	0.013	0.009
55 years	0.970	0.016	0.009	0.004
65 years	0.976	0.013	0.007	0.003
75 years	0.966	0.018	0.011	0.006
85 years	0.925	0.034	0.024	0.017
Female	0.947	0.026	0.016	0.011
Male	0.967	0.017	0.010	0.006
Compulsory education	0.953	0.023	0.014	0.010
High school diploma	0.972	0.014	0.009	0.005
Degree	0.978	0.012	0.007	0.004
North	0.963	0.018	0.011	0.008
Center	0.958	0.020	0.013	0.009
South	0.948	0.025	0.016	0.012
Widow	0.952	0.023	0.015	0.010
Living with spouse	0.959	0.020	0.013	0.008

Tab. 4. *Percentage of persons with disabilities*

1) pure ageing scenario

year	not disabled	disabled low level	disabled intermediate level	disabled worst level	disabled worst level in nursing homes	disabled out of total population	disabled out of population aged 25-64	Average age of the disabled
2005	95.4%	2.1%	1.3%	1.2%	0.3%	4.6%	8.2%	73.7
2010	94.9%	2.3%	1.5%	1.3%	0.3%	5.1%	9.1%	75.9
2020	94.0%	2.6%	1.8%	1.6%	0.3%	6.0%	11.2%	77.2
2030	92.7%	3.1%	2.1%	2.0%	0.4%	7.3%	14.3%	78.7
2040	91.5%	3.5%	2.5%	2.5%	0.5%	8.5%	18.1%	80.1
2050	90.5%	3.8%	2.9%	2.9%	0.5%	9.5%	20.7%	81.6

2) Compression of disability scenario

year	not disabled	disabled low level	disabled intermediate level	disabled worst level	disabled worst level in nursing homes	disabled out of total population	disabled out of population aged 25-64	Average age of the disabled
2005	95.5%	2.1%	1.3%	1.1%	0.3%	4.5%	8.2%	73.9
2010	95.2%	2.1%	1.5%	1.3%	0.3%	4.8%	8.6%	76.5
2020	94.7%	2.2%	1.5%	1.6%	0.3%	5.3%	9.7%	79.8
2030	94.3%	2.3%	1.7%	1.8%	0.3%	5.7%	11.3%	82.2
2040	93.3%	2.6%	2.0%	2.2%	0.4%	6.7%	14.2%	83.5
2050	92.2%	2.9%	2.3%	2.6%	0.4%	7.8%	17.0%	84.9

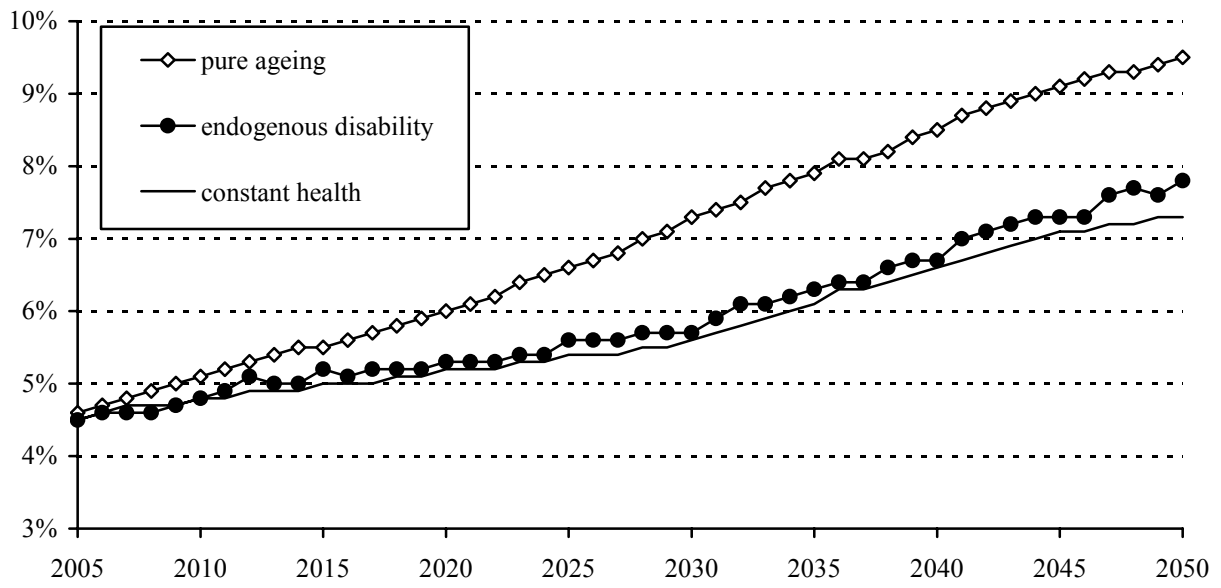
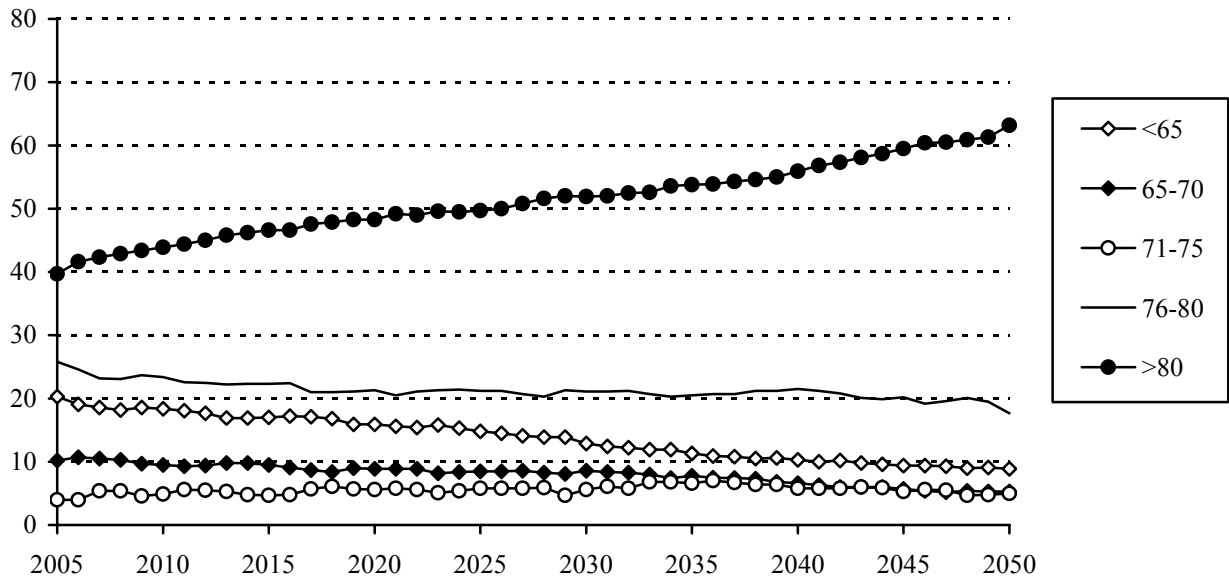


Fig. 3. The disabled as a percentage of the total population.

1) pure ageing scenario



2) compression of disability scenario

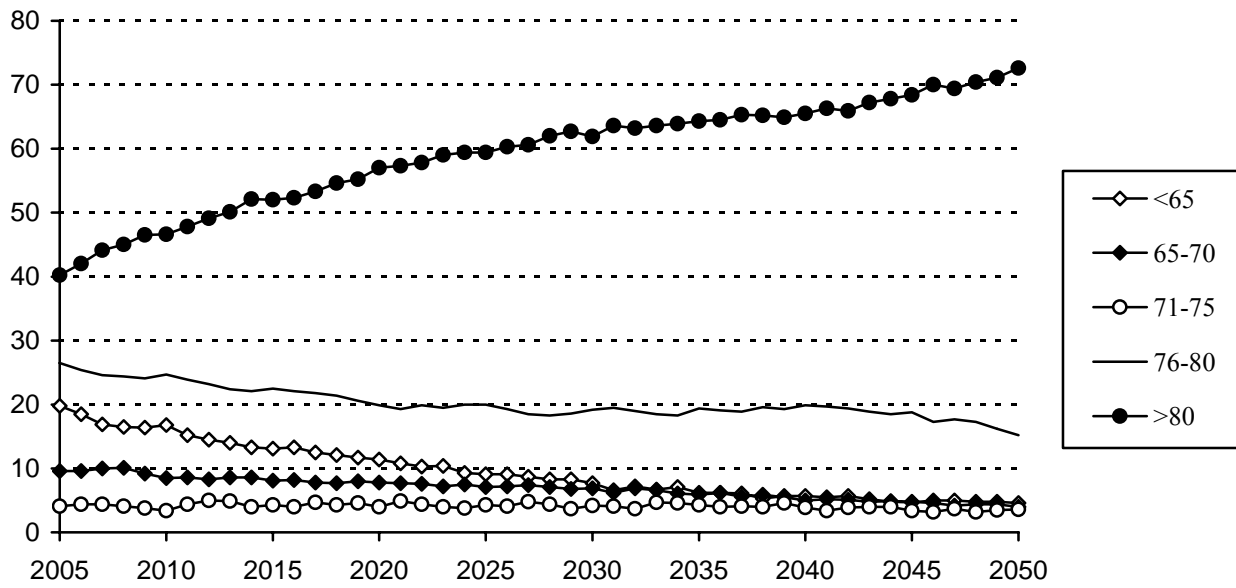


Fig. 4. Shares of the disabled by age class.

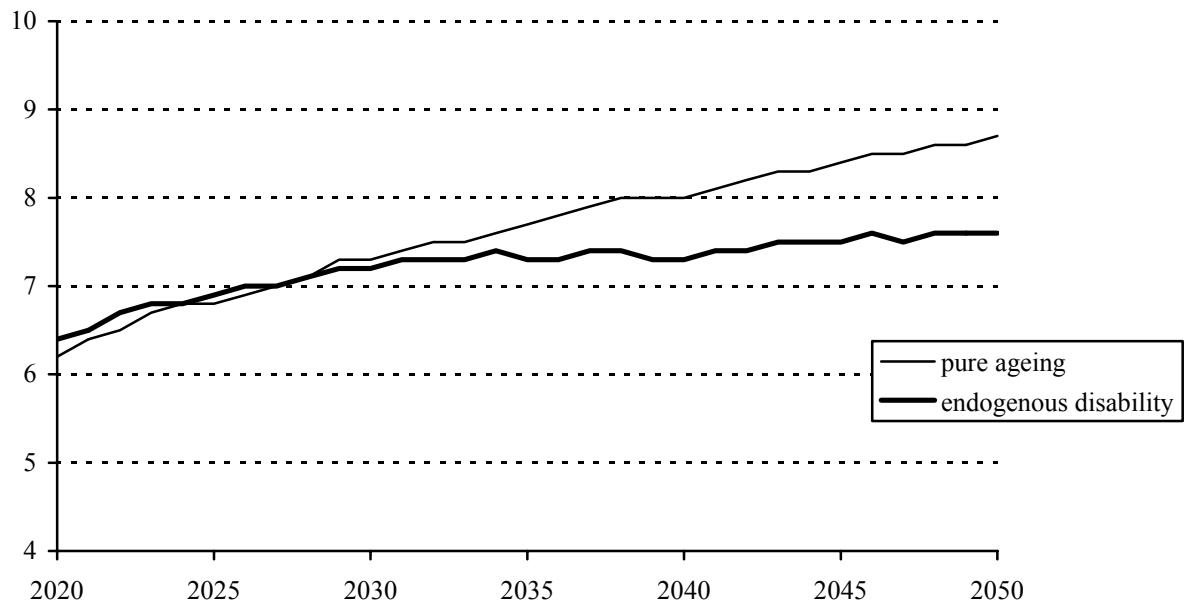
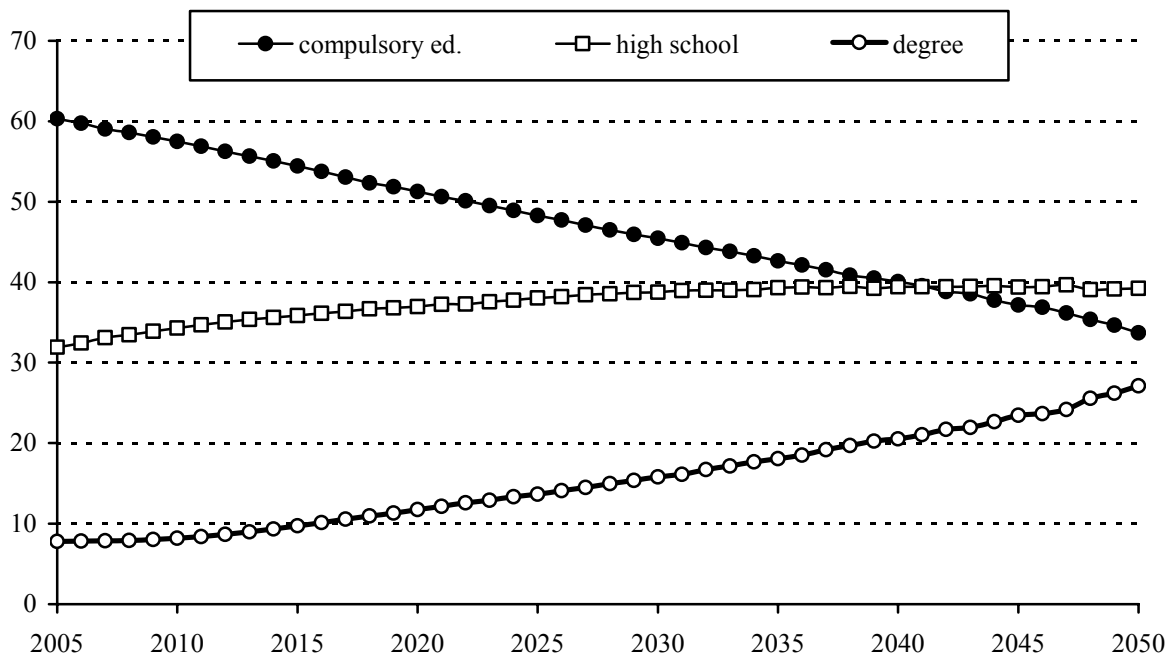


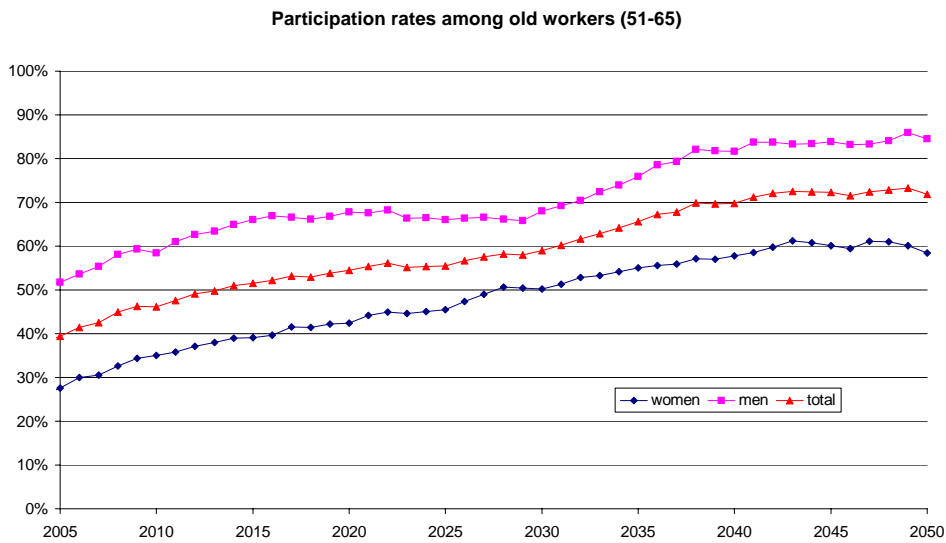
Fig. 5. The average number of years the disabled spend in a disabled condition.

Tab. 5. *Distribution of the disabled by the number of their children*

	0	1	2	3	>=4
2005	23%	21%	29%	14%	14%
2010	24%	20%	28%	15%	13%
2020	26%	20%	29%	14%	11%
2030	32%	19%	28%	13%	8%
2040	43%	16%	27%	10%	5%
2050	54%	12%	25%	6%	3%

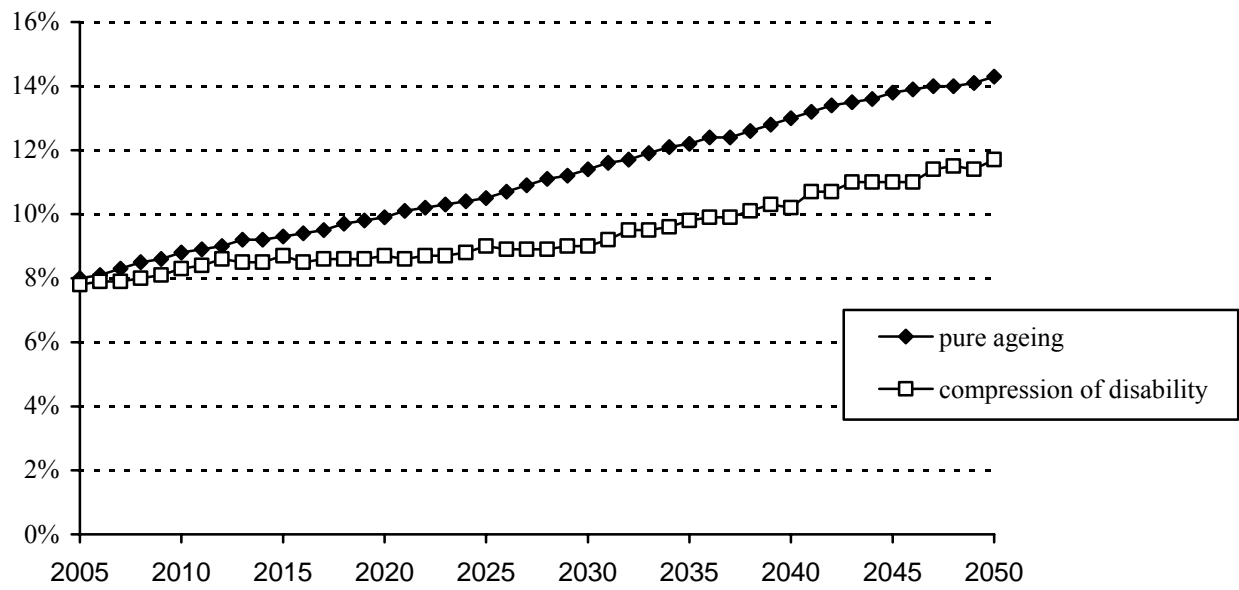


**Fig. 6.** Distribution of the children of the disabled by educational level (as a %).

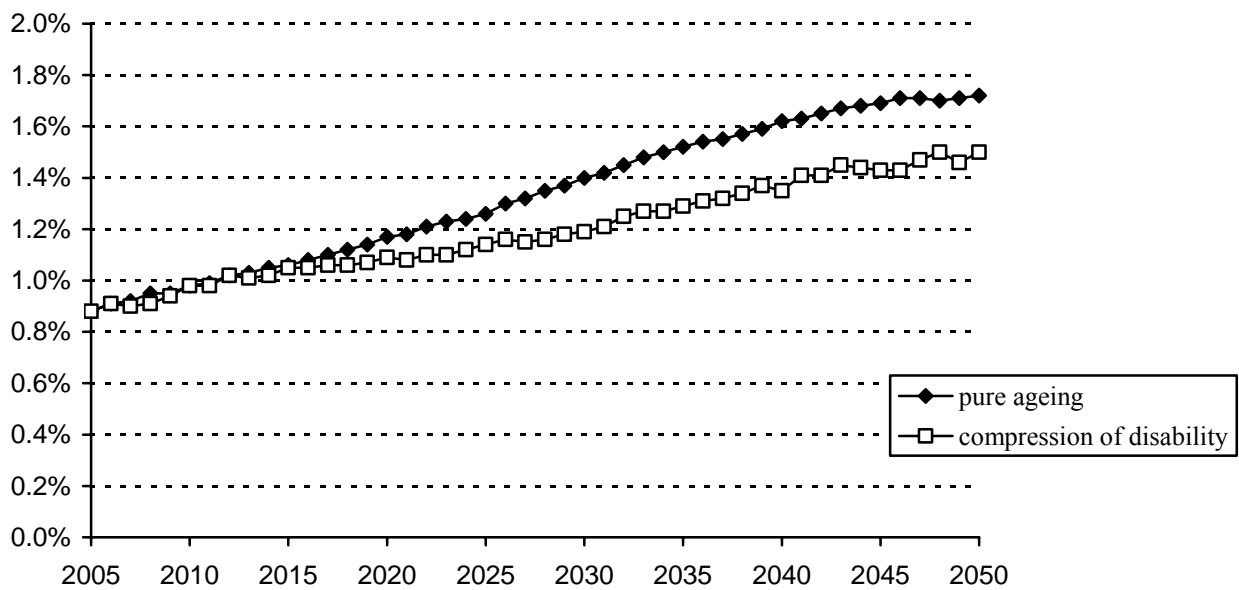


**Fig. 7.** Employment rate among for the 51-65 age class projected by the model.

**Fig. 8** Number of LTC disabled / (number of employed + pensioners)



**Fig. 9** Ratio between LTC expenditure and GDP, constant generosity case





**Fig. 10** Ratio between LTC expenditure and GDP: “German” case

