# THE NEW VERSION OF THE DESTINIE MICROSIMULATION MODEL, INCREASED FLEXIBILITY AND ADAPTATION TO USERS' NEEDS

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**ABSTRACT:** The Destinie model has been developed and maintained at the French national statistical institute (INSEE) since the mid-1990s. A new version is progressively becoming operational and this paper presents the main options that have been retained for this new model. The main goals of this new version have been the improvement of consistency with official demographic projections, the incorporation of more complex labour market trajectories, and increasing portability and facility to use. The new model makes a complete separation between two components. The first component is a generator of demographic and employment biographies, whose results are then stored in two intermediate output files. The second component is a library of subroutines allowing an easy programming of pension projections based on these two output files resulting from the first stage. The paper presents the main characteristics of this new organization and an example of a very simple program showing how the new organization allows the simple production of flexible scenarios for pension projections.

## Introduction

The Destinie model started being built at the French national statistical institute (INSEE) during the 1990s. It is a dynamic microsimulation model whose main purpose is the long run projection of pension entitlements at the household level. It has been used for the follow-up of pensions reforms that took place in France in 1993 and 2003 (Bardaji et al., 2002), in conjunction with more aggregated models or projections realized by pensions schemes themselves (Conseil d'Orientation des Retraites, 2006). It has been also used for some other exercises, for instance the assessment of the intracohort redistributive properties of pensions (Walraët and Vincent, 2002), or the long run projection of old age disability and of its cost (Duée and Rebillard, 2004), or the consequences of ageing or pension reforms for poverty trends among retirees (see Crenner, in progress). On the whole, the model has been able to partially adapt to the evolution of questionings about the future of pensions or general consequences of ageing. But some problems have also emerged, that have called for a complete rewriting and a partial reorientation of the model.

First of all, Destinie I had large entry costs. Even the production of standard variants remained a heavy task, especially for a team of modelers, which is a small one with strong turnover (typically two to three persons with a complete renewal every third year). The task was still heavier when the question that is asked required substantial additions to the basic model, as it is frequently the case: such difficulties have been encountered, for instance, for specific simulations of widows' benefits, or the simulation of changes in incentives to postpone retirement beyond the normal age.

Some other limits have appeared in the quality of projections. Some divergence exist between results provided by the model and more official demographic projections or labour force projections performed with the traditional method of components. Adjustment to macro projections was not completely inexistent in Destinie I, but it remained indirect and relatively loose. This lead to inconsistencies, especially concerning trends in labour force participation. Such discrepancies not only matter for the projection of numbers of contributors to the pension system, but could also bias the simulation of retirement decisions: for instance, a systematic underestimation of LFP rates for women will result in an underestimation of the number of years of contributions reached at age 60, a parameter that has a very important role in the French pension system.

Another point of concern for the relevance of projections is the modeling of retirement behaviour: the model initially assumed a very simple behaviour, consisting in a systematic retirement at the "normal age", i.e. with a full rate pension, which depends both on age and number of years of contributions. After that, the model has been enriched with a behavioural module describing retirement decisions as a prospective income/leisure tradeoff in the spirit of Stock and Wise (Stock and Wise, 1997; Mahieu and Blanchet, 2000). This has been used to estimate the impact of some aspects of the 2003 reform that intended to introduce more flexibility of individual decisions both before and after the normal retirement age. But the calibration of this model remains very fragile and the model has been frequently criticized for its exclusive emphasis on this specific behavioural assumption. An answer to such a criticism can be to offer a larger menu of behavioural assumptions in the model allowing the multiplication of sensitivity tests.

A third point of concern about the quality of the model has been its short-term properties. As it is the case for many similar tools, Destinie has been essentially developed to shed light on long-term consequences of population ageing and less attention has been paid to the relevance of short-term projections. In a sense one could argue that this reflects a normal specialization of simulation tools: some models can be good for the short-run and bad for long-run projections, and some other ones have the opposite properties. But the logic of such a specialization of models is not always obvious for policymakers, and this is not without reasons: as far as possible, we must therefore try to combine accuracy for the short and the long run.

On top of this, one additional element pushed toward a rewriting and a reorientation of the model. One of the successes of Destinie is that is has stimulated the apparition of similar projects in other administrations. One has been developed by the *Caisse Nationale d'Assurance Vieillesse* for the population of its affiliates. A parallel project exists at the French ministry of Health and Social Affairs, based on a new data source matching administrative information from all existing French pension schemes for a sample of the French labour force. On the whole, the general trend is certainly toward an appropriation of microsimulation techniques by administrative teams that have the double comparative advantage of having access to more detailed datasources, and of being closer to decision makers. The consequence is that Destinie is likely to become less solicited on pension issues *stricto sensu*. Our answer to this new context is to enlarge the range of topics potentially covered by the model by proposing a new tool allowing a very easy incorporation of additional modules.

The new version of the model that is currently becoming operational takes into account this new context and tries to solve some of the problems encountered with the previous Destinie I model, while keeping as much as possible of the positive points that have made the success of this first model. A general view of these answers is given on table 1. We shall not deal extensively in this short note with all the details of these changes, but concentrate on a few points. As far as the general structure of the model is concerned the main novelty is a complete separation of the model in two subcomponents. The first one is a simulator of individual demographic and labour market trajectories whose results are stored in intermediate files of micro-data. The second component is not a model in the usual sense of the term. It rather consists in libraries of subprograms allowing the easy development of projections based on the micro-files produced during the first step. While the first stage remains relatively heavy, programs developed for the second stage can be very small ones with very rapid execution times. At this stage, this second component essentially consists in a library of programs allowing the easy simulation of alternative pensions scenarios, but it will be possible, in the future, to develop similar tools to deal with other socio-economic topics.

**Table 1** : The main changes from Destinie I to Destinie II and their motivations

| Main strengths/weaknesses of the initial model | Improvements or corrections brought by Destinie II |
|---|---|
| *Strength*: closed population approach, allowing a simple simulation of family and kinship ties. | Unchanged |
| *Strength:* separate simulation of the most important pension schemes (CNAV, ARRCO, AGIRC, Civil Servants) | Maintained, with the additional possibility of simulating heterogeneous careers (mobility between sectors and part/full-time.) |
| *Strength/weakness*: a behavioural module for simulating retirement behaviour (Stock and Wise model). Better than nothing, but many doubts have been expressed about the empirical relevance of this module. | The existing module has been maintained, but is only one among several possibilities for simulating retirement behaviour, with improved facilities for changing preference parameters. |
| *Weaknesses*: heaviness, execution time, entry costs, lack of portability/versatility. | The model has been split in two subcomponents:<br>1. Demographic and labour market events are simulated first, with results stored in intermediate files.<br>2. Pension projections (or other applications) are made with small *ad hoc* programs, based on relatively synthetic and easy to use libraries that use these files as inputs. |
| *Weakness*: Insufficient consistency with macro projections | Automatic adjustments of transitions probabilities to satisfy some predefined macro-targets |
| *Weakness*: short run behaviour | Initial conditions are partially imputed to avoid inconsistencies that can exist between initial observations and projected values. This also facilitates the simulation of counterfactual initial conditions (e.g. “what would have been the starting point in 2003 if no reform had taken place in 1993?”) |

The following section will present the first submodule, with a special emphasis on how this module deals with the issues of consistency between the model and other existing macro-projections. The second section will show the typical way of building a pension projection on the basis of micro-files produced by this first step.

# 1. Generating demographic and labour market trajectories

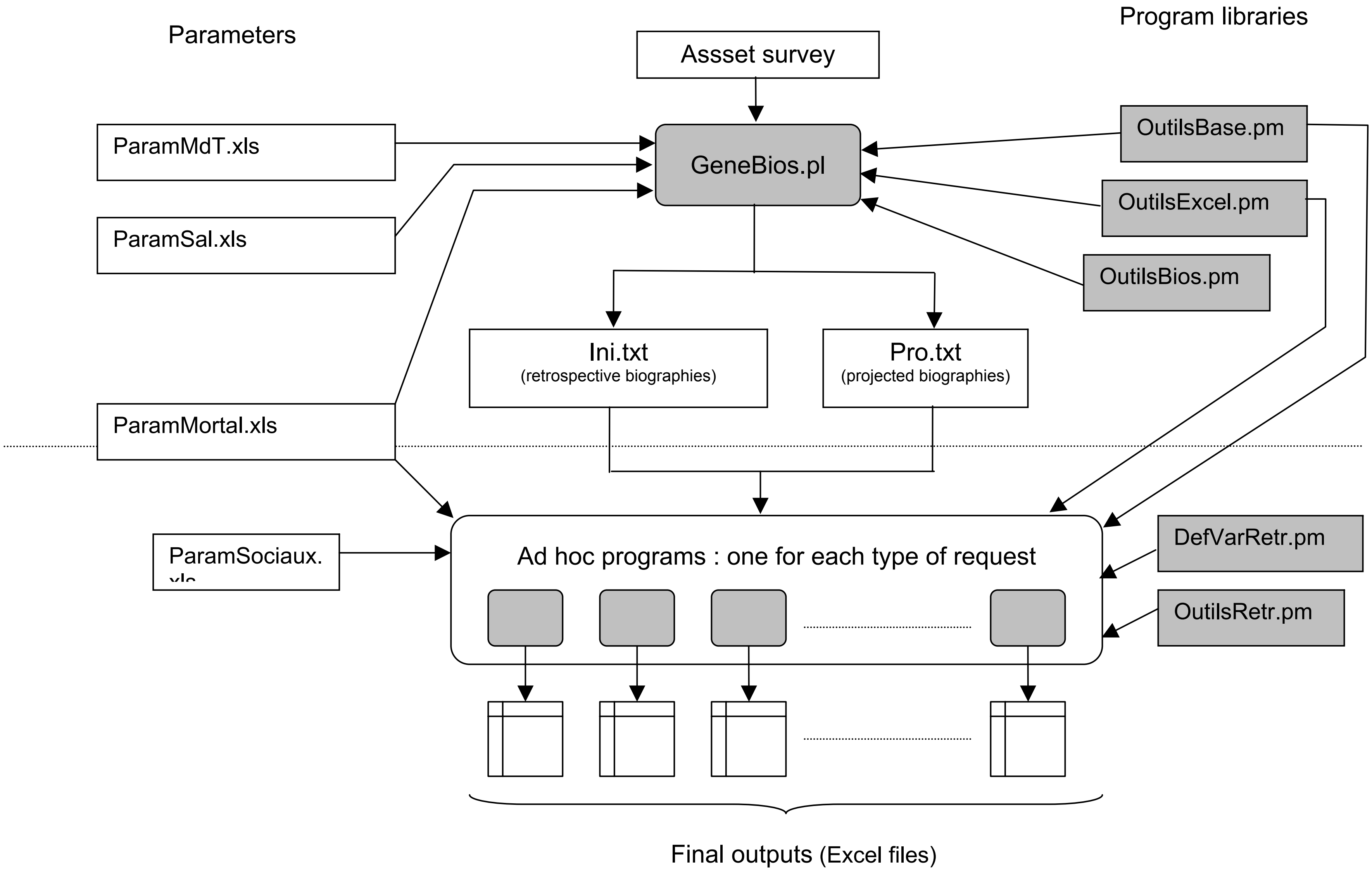
This section describes the first half of the Destinie model, the so-called “biography generator”, corresponding to the top half of the general structure of the model displayed on figure 1.

This new version of DESTINIE is based on individual data derived from the 2003 Assets Survey collected by INSEE. The original sample has been reweighed to account for the demographic structure of the whole French population as known from the 2004 French Census. We decided to duplicate the sample according to these new weights. Thus the initial sample of DESTINIE contains about 20 000 households and 65 000 individuals.

## 1.1. A relatively complete simulation of kinship ties

One element that we had been chosen to introduce in DESTINIE 1 and that is fully kept in this new version is a relatively complete simulation of kinship ties, with the idea that simulating such an information could be useful for many questions related to aging, e.g. projections of the level of informal support by relatives in case of old age invalidity, or the intergenerational transmission of assets.

**The Destinie 2 model : general structure**



How do we generate such a structure ? The 2003 Asset survey provides us with relatively rich demographic data. As usual, people who live in households are known. We also have some demographic informations on children of surveyed persons even if they do not do not live anymore with their parents. Symmetrically, we know whether people's parents are still alive or not. Given this information, a pseudo-global kinship structure is created in the initial population by linking each person to other people in the sample that will play the role of this person's children or surving parents. These artificial links are creating by finding in the sample pseudo-kins whose characteristics are as close as possible to those of real-world kins in terms of age, education level, labour market status.

Once these links have been initialized, their evolution is easy to simulate. We juste have to constitute new unions beween members of the sample, this sample being renewed only through births issued from these unions (plus an additional flow of in-migrants). Kinship ties for these newborns are automatically generated at birth. The resulting database is only made of individuals, but with some individual variables that identify household and kinship ties. It enables us to reconstitute family circles concentrically from the couple outwards to include all siblings living in other households.

Apart from this specific treatment of kinship ties, the other demographic characteristics of Destinie are relatively standard. The model simulates demographic changes from the initial year (2004 in this new version) up to 2050, using a mix of deterministic rules, behavioural hypotheses and random components. The demographic events are union, breaking-up, birth of a child, death and migration. The probabilities to have a child, to start or terminate a partnership or to die derive from logit models. In most cases, the probabilities depend, beside other variables, on the school living age, which is the synthetic variable that we use to describe qualification and social status: this variable codetermines labour market and demographic behaviour (box 1). Current demographic behaviours are estimated in a quite simple way, and depend on the covariates that have the major influence on each behaviour. Probabilities to live a demographic event have been estimated by duration spent since the previous event, which is a significant source of demographic heterogeneity. We basically rely on updates of these estimates performed in 2005 for the Destinie I (Duée, 2005).

The coefficients of all exogenous variables are considered to be constant over time, but, in order to fit every year the long-term demographic projections made by the INSEE, the probabilities predicted by the equations are adjusted. The parameters of the equations are stored in files called "Parameters" (see Fig. 1). The annual macro targets are stored in Excel files: the number of births and deaths by gender, the balance of migrations, etc. In order to reach the targets, the intercepts of the logit models are changed keeping constant the relative chances for an event to occur or not (i.e. the odd ratio) for the different categories of population considered in the model. In practice, those "event alignments" are realized automatically in the model: the user of Destinie only has to know the probabilities of the event at the individual levels and the target number of events. All the demographic changes by individual are stored each year in an output file hereafter called "Pro.txt" (see again Fig.1).

**Box 1** The school leaving age: a major exogenous covariate

The age at leaving school represents both social changes between generations and social position differences within a generation. This variable is of primary importance for the model as it sums up the social class and the qualification. In the model, the mean age at leaving school is increasing, following past observed trends, and we make the assumption, its mean values remain roughly constant over time after 2010. For people who have not achieved their studies in 2003, the first year of the simulation, for children not yet born and for the in-migrants, the gap between the individual's age at leaving school and the mean age at leaving school of his/her cohort is modeled as a function of the gap observed for his/her parents, allowing for some type of social replication.

## 1.2. Work histories and lifetime earnings - past and future

The Asset Survey also provides information about careers until 2003. Indeed, the description of past careers is much more detailed in this new survey than in the previous 1997 Asset Survey that was used by Destinie I. This should improve the quality of long-term projections of pensions, which remains one of the basic aims of the model. For each year beyond the school-leaving age, we know what has been the status of the individual on the labour market: wage earner in the private or public sector, self-employed, unemployed, retired, inactive. This information is stored in the other output file "Ini.txt" which includes all current information and past trajectories of individuals alive in 2003. The only modification with respect to the Asset Survey files is that we do not use the information on retirement status: for reasons that will be explained further, this status is imputed later in the model. For individuals of retirement ages, the Ini.txt file therefore contains notional projections of continued activity until the current age. The other information from the Ini.txt file that does not directly derive from the survey is the sequence of past wages, which are imputed according to wage equations whose main explanatory variables are gender, age at leaving school and tenure.

After 2003, the projection requires the modelisation of both activity statuses and wages paths. To model transitions on the labour market, five main statuses are distinguished (the status reached at the age of 60 years being kept constant at this stage until death):

(1) Wage earner of the private sector
(2) Wage earner of the public sector
(3) Self-employed
(4) Unemployed
(5) Non participant, inactive

Transitions on the labour market are treated as a first-order Markovian process. Thanks to the new series of Labour Force Surveys (LFS) conducted by Insee since 2003, we can estimate transitions probabilities between these statuses depending on individual's characteristics. Of course, we restrict ourselves to characteristics that are present in the model Destinie. Transitions depend on age at leaving school, on current age and on the status. They are estimated separately for men and women. Because of senior labour market specificities , dummies are incorpored for people between 55 and 59. The modelling allows young people to work during their studies. Transitions beyond the age of 60 are not modeled however: once again, their simulation is left to the pension module that is presented later. Some interaction exists with demographic events, for women. The probability to become a participant on the labour market or to withdraw from the labour market depends on the number and the age of child(ren) and on marital status, which are imputed before the simulation of transitions on the labour market.

Two points are particularly important in this new version of Destinie: the people can move between the public and the private sectors during their careers and the probabilities of the transitions between the different statuses are adjusted in order to:

- be consistent with official labour force forecasts made by INSEE, the annual LFP rates by gender and ages (by 5 years) until 2050
- be consistent with the assumptions made on the macroeconomic environment (the unemployment rates or other targets such as the proportion of public jobs in the economy).

Several specifications for the labour market transitions (multinomial logit, sequential logit model, choice of covariates) have been tested thank's to the LFS data over the years 2003-2007 and used to impute the individual transitions into the Destinie model until 2050. We have noted that different specifications can induce significative differences in annual LFP rates simulated until 2050. We have selected the specification which is in line with the official annual LFP rates forecats provided by INSEE. It is the best way to respect the consistency of individual trajectories throughout the years and, finally, the annual LFP rates simulated with Destinie by gender and ages are similar to the forecast.

Nevertheless, as our transition model is based on the years 2003-2007, it induces spontaneously an unemployement rate too high relatively to the assumptions of a decrease made by the COR : the unemployment rate is supposed to be reduced to 4.5% in 2015.
So, we have to determine which flows we will constrain in order to reach the unemployement target. The way we choosed to adjust the transitions to macroeconomic targets is the following. For each

status, transitions equations give *ex ante* figures for the number of people who enter in the status, who remain in this status or who leave it.
Once we know who is active, the nextstep consists in determining the people working in the public sector. Several hypotheses can be made, for example to keep constant the proportion among the participants. As the transitions give without surprise this result, we keep the probability to be employed in the public sector given by the model. But, if we have to make an another hypothese, we will choose to keep free the probability to quit the public sector (spontaneous decisions) and we will constrain the probability to be hired in the public sector with respect to the target.

In a following step, among active people not employed in the public sector, we have to simulate the flows of people who will be unemployed and of people who on the contrary will leave unemployment to occupy a job in the private sector. We keep first the probabilities free and compare the resulting "spontaneous» unemployment rate with the unemployment target. If the "spontaneous rate" is higher than the target, we constrain the probabilities to quit the status of "unemployed" to be higher (it will be often the case in practice, because standard scenarios for pension projections generally make the voluntary assumption of strong declines in employment rates over the years to come). If the opposite is true, we adjust upwards the probability to become unemployed.

At the end, we have just to compute the status of "self-employed" or "wage earner of the private sector", in order to respect for each individual the relative odds to belong to one category or the other.

Conditional on labour market status annual wages are finally imputed following the same wage equations as the one used for the retrospective reconstitution of careers: sum of a "deterministic" component (depending on school leaving age, tenure -quadratic form- and the product of both) and a "stochastic one" (including an individual fixed effect and an autocorrelated residual). To take productivity gains into account, we add to these equations a time trend (the current assumption is the one made by the COR in its last report, i.e. 1,8% per year).

At this stage, all these components of the new model are almost stabilized. We have re-estimated a wage equation based on the 2003 Asset Survey : the Survey has been merged with tax return files, so we know precisely for each individual who worked in 2003 his annual earnings, and thanks to the calendar we are able to estimate their experience on the labor market ; so we have good recipe for a wage equation which will use to simulate wages until 2050; we have also estimated a second equation that takes account professional changes during the career, i.e. mobility between sectors, but we have not implemented yet this new specification. The "deterministic" component is simulated with wage equations estimated for each sex and each sector (private, public, self-employed) according to the standard theory of human capital. The specification implies that the return of one year of schooling is between 4 and 8% (depending on sub-populations) whereas the return on tenure is decreasing from 3% at the beginning of the career to 1%-2% at the end.

To simulate the stochastic components, we draw random variables for every individual: every year for the transitory component ($e_{it}$), in the first year of employment for the fixed one ($u_i$). For those in employment in 2003, we used observed earnings to calibrate the stochastic components for 2003. We derive past and future components from these 2003 values, thanks to an autoregressive process.

In order to complete the output file used in the retirement module, we have to impute a level of qualification in the private sector ("*cadre*" *vs* "*non cadre*"), because of differences in complementary pensions for these two categories of workers. For the moment, high levels of qualifications are choosed among the highest earnings in order to reflect the proportion of high levels of qualification in the economy during several periods.

# 2. Deriving a pension projection

As it was displayed on the top half of figure 1, this first step that has been described in the preceding section generates two intermediate files (or various versions of these two files):

- One file of initial individual data that includes demographic information on these individuals, identification numbers for other individuals of the database that are related to them, and retrospective information on individual's labour market trajectory, i.e. the yearly succession of labour market statuses since leaving school (inactive, unemployed, employed with a subdivision between different categories of employment) and associated wage levels for each period spent in employment.
- One file storing subsequent changes for all years of projections, including the entry of new individuals in the database, either by birth or in-migration.

At this stage, no information is given neither on pensions nor on retirement status. Notional labour market biographies are artificially continued beyond normal retirement ages in order to leave a complete control of retirement behaviour for the next step that we are now going to describe.

Module 2 (« pension simulator ») re-reads the results from this first stage and adds the simulation of retirement behavior and pension benefits.

A major feature of this second tier of Destinie 2 is that, contrarily to the choice that had been made for Destinie I, it does not consist in an all-purpose and ready-made model. Our choice has rather been to develop a set of simulation tools that allows building small *ad hoc* simulation programs adjusted to users' requests. This is what was represented in a very stylized fashion in the bottom half of figure 1. Using files generated by the biography generator and libraries of subprograms provided by Destinie, the user builds as many simulation programs as he wishes to, the rule being to have one different program for each application. For building these programs, a lot of flexibility is offered for changing pension parameters, types of outputs…In practice, this does not imply a heavy programming work, because each program developed for a new application is generally not built from scratch but by reworking a program previously built for another application.

The advantages of this two tier and modular organization are numerous :

- In the development phase, it allowed autonomous work between the two components of the project (the pension
- The generation of demographic and labour market histories is fixed once for all, with an improved alignement on «official» projections and a pension simulation does not require the costly resimulation of all other categories of events. Programs that produce pension results are very compact and their execution is relatively rapid.
- It facilitates detailed analysis of the impact of reforms at the individual level : two runs with different pension rules apply exactly to the same individuals and we can directly compare the individual outcomes after and before the reform.
- The « one simulation/one program » principle leads to a better tracability : all the assumptions behind a given result can be retrieved by returning to the source code that has simulated this result.
- The library of pension modules can be (and has been) used for other applications. Eventually, it can be also be used for microsimulations based on biographies coming from other sources than Destinie's biography generator.

We shall now give a few more details about how such simulation modules work.

## 2.1. A typical pension projection

A typical pension projection includes six sub-steps. Let's go on assuming that Ini.txt and Pro.txt are the names of the two output files generated by the first module. The six sub-steps are the following :

- Read initial and retrospective micro-data from the Ini.txt file.
- Impute these pension variables for the initial conditions. For each individual beyond the minimum retirement age, this means finding at which age he is likely to have retired, compute

the resulting pension at the time he retired and actualize this pension until the initial year of projection, based on indexation rules.

- Read updates of individual variables from the Pro.txt file for each year of projection.
- For each year t, update pensions levels in t for all those that were already retired in year t-1, and simulate eventual transitions to retirement for those having reached or passed the minimum retired age but still not retired at time t-1.
- Compute tabulations that are desired for each year of projection.
- At the end of the projection, store tabulated results. This is directly done in Excel files.

The choice of imputing initial pensions statuses and pension levels instead of using actual values provided by the Asset Survey deserves some justifications. It has two main advantages:

- One is to avoid discontinuities during the first year of projections. Imputations of current pensions or pensions statuses are made in a way that is consistent with the way the projection works. It avoids the declaration bias that may exist of the survey. Of course, it creates another bias due to the fact that the pension simulation module does not exactly describe the reality of pensions, because it neglects some details of these rules or some information on individual determinants of pension levels that are not available in the data base. But such a bias, whatever its importance, will remain constant all over the projection period. This is preferable to a simulation where some initial accidents are generated by the shift from one measure of pension levels to another one, or from the shift from actual retirement behaviour to behaviour proxied by a model that will never be able to fully reflect actual behaviour.
- A second interesting property of this approach is that it automatically allows the simulation of scenarios based on counterfactual initial conditions. For instance, a typical demand is the comparison of a scenario decomposing changes in future pensions between what is due to the 1993 and what is due to the 2003 pension reform. To do this, we need a counterfactual projection of what would have been the evolution of pensions without the 1993 reform, including the fact that having had no reform in 1993 would have led to different initial conditions in 2003. This is easily done in the new model through reimputing initial pensions and past ages at retirement on the basis of pre-1993 legislation.

What are the options available to reimpute or project these pension levels and retirement choices? The general-purpose modules written for the simulation of pension allows simulating historical and prospective pensions rules for the basic *Regime Général*, the two complementary schemes ARRCO and AGIRC and civil servants. This module also offers a function modeling the choice of the retirement age. This function has five options for the description of retirement behaviour. The first one assume that individuals retire as soon as they reach the so-called full rate (i.e. what is generally considered as the normal pension), access to the full rate depending both on age and the number of years of contribution through a rather complex non linear formula. The two next options assume some form of utility maximization with an income-leisure trade-off, either instantaneous (people retire as soon as the value of leisure outweighs the immediate income loss) or prospective (the option value model of Stock and Wise that was used in Destinie I). The two last ones are based on measures of social-security wealth (SSW), i.e. the actualized expected flows of benefits from retirement age until death, with two suboptions: a myopic one under which people postpone retirement as long as delaying by one year leads to a higher level of SSW and a forward-looking one analogous to the Stock and Wise model where people delay as long as delaying leaves them with the option of getting a higher SSW level at a later age.

The option based on instantaneous utility maximization requires one preference parameter, which is the preference for leisure. The Stock and Wise option is the most demanding in terms of parameters: preference for leisure, risk aversion, a discount rate and expected survival probabilities. The two options based on the SSW need both a discount rate and survival probabilities. All these parameters can be individual-specific. The problem is of course to calibrate them. At this stage, this calibration exercise has not been fully completed. One of the requirements of this calibration exercise will be to give current retirement behaviours as close as possible to actual ones. But this, in general, will not be enough to determine them very accurately. In practice, our policy will probably be to provide ranges of results using different behavioural assumptions and/or different sets of parameters for each of these behavioural assumptions, to avoid excessive focalization on one set of results, as it has been too frequently the case with the Destinie I model.

It is also possible to apply purely exogenous ages at retirement. In particular, a scenario can re-use ages at retirement saved from a previous one simulated within the same program. This allows producing variants with unchanged retirement behavior

## 2.2. An example

Just to give an idea of how such pensions simulations can be performed, Box 2 gives one example of a very basic program computing average projected pension levels under four scenarios: a no- reform scenario (pre-1993 *status quo*), with two subvariants corresponding respectively to an indexation of pensions after retirement either on prices or on wages[1], and two scenarios incorporating successively the impacts of the 1993 and 1993+2003 reforms. We shall not comment here the syntax of instructions (Destinie II is written in Perl). The purpose of this example is just to show how easy the production of various scenarios can be. More complex programs can be built based on such a template, using the facts that:

- the user has access to all Destinie-generated variables (@pension is the only one explicitly used in the box, but all other variables are accessible in the same way). He can use them for building any kind of additional individual variables and for tabulations (function SVar is an example of procedures available for such tabulations)
- the user has many possibilities for adjusting pension scenarios: he can do so with the UseLeg function which gives access to all the legislations that have been or are planned to exist for members of successive cohorts, but he can also customize scenarios by directly manipulating pension parameters. In the example that is provided, this is the case for the $RevaloRG parameter that governs past and future revalorizations for first pillar pension.

In the same vein, applying the model to topics other than pensions can be done by generating and tabulating the requested variables within such a program. The only limit of this two-stage procedure is that it precludes feedback effects from these simulations to demographic and labour market transitions, but the advantages of this two-step procedure clearly outweigh this drawback, at least for applications of the model that we have in mind at this stage.

[1] The shift to an indexation on prices is generally attributed to this 1993 reform. In fact, what this reform did has been to confirm this principle but it had been already effective since the end of the 80s. It is therefore difficult to say what would have happened in terms of indexation if this reform had not been implemented. In any case, it is interesting to separate consequences of aspects of the reform that have affected initial pensions and the pure impact of indexation rules.

**Box 2 : Simulating a pension scenario : a basic example**

```
                                                                      IMPORTED DATA AND TOOLS :
use OutilsBase; use OutilsExcel;                                      - BASIC TOOLS AND EXCEL INTERFACE
use DefVarRetr;                                                       - DECLARATION OF STANDARD DESTINIE VARIABLES
                                                                             AND LEGAL PARAMETERS
use OutilsRetr;                                                       - PENSION SIMULATION TOOLS

my ($i,$t,$sc,$legislation,$index_rule,$outfile,@buf,%PENSIONS);      DEFINITION OF INDEXES AND VARIABLES
@buf=@RevaloRG;                                                       DEFAULT INDEXATION  RULE SAVED IN  @buf

UseBios("..\/Bios\/IniMod.txt","..\/Bios\/ProMod.txt",2003);          DEFINITION OF INPUT FILES
UseOpt("TP");                                                         OPTION FOR RETIREMENT BEHAVIOR

for $sc ("1992-wages","1992-prices","1993-prices","2003-prices")      LOOP ON SCENARIOS
{
  ($legislation,$index_rule)=split "-",$sc;                           DECODING OF SCENARIO
  for $t (93..150) {
    if   ($index_rule =~ "wages") {$RevaloRG[$t]=$PlafondSS[$t]/$PlafondSS[$t-1]}   RETROSPECTIVE AND PROSPECTIVE CHANGE
    else                          {$RevaloRG[$t]=$buf[$t]}                                 FOR THE INDEXATION RULE
  }
  for $t (103..150) {                                                 TIME LOOP
    Relec($t);                                                        RE-READING OF BIOS FOR PERIOD $t
    for $i (1..IMax) {                                                LOOP ON INDIVIDUALS
      UseLegRetroMax($legislation);                                   CHOICE OF RETROSPECTIVE
      UseLeg($legislation,$anaiss[$i]);                                 AND PROSPECTIVE LEGISLATIONS
      DroitsDir($i);                                                  PENSION SIMULATION FOR INDIVIDUAL $i
    }
    $PENSIONS{$sc}[$t] = SVar(@pension);                              SUM OF INDIVIDUAL PENSIONS
  }
};

$outfile = ClassOut("Reformes.xls");
SavHS($outfile,"PENSIONS","Pensions - total",%PENSIONS);              SAVING OF RESULTS IN AN EXCEL FILE
CloseOut($outfile);
```

## 3. CONCLUSION

The building of the new Destine II model started in 2005 and has occupied a limited team on a very part-time basis over the last two years. The new model now enters its validation phase.

This new model does not have the ambition of becoming the dominant tool for pension analysis in France, for two reasons : more aggregate models are more convenient for general variants and more detailed microsimulation models based on administrative data more relevant for detailed financial projections (eg Prisme at the CNAV).

But this new version of Destinie should keep and even reinforce its comparative advantage for many applications such as variants of retirement behavior or computations involving the household level (pensioners standard of living, means-tested benefits…). And the kind of modular approach that it has applied to the simulation of pensions could easily be extended to the exploration of other domains : disability and health, savings behavior…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