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Abstract

The economic sustainability of social security systems is under severe pressure nowadays due to population ageing caused by a decreasing fertility rate, increased life expectancy, an increased share of recipients of social benefits, and a decreasing share of the active population. A number of studies prepared during the last eight years clearly show that ongoing pension reform will not be enough to compensate for the negative effects of demographic changes after the year 2025. The problem with sustainability of the public finance and pension system will therefore steadily increase in Slovenia, reaching one of the highest public finance deficits among the EU member countries. The need for the continuation of structural reforms, which started in 2005, but were in fact slowed down after the successful implementation of the tax reforms in the beginning of the year 2007, came out even more intensively with the financial crisis and substantial decline of GDP growth in 2009. Reforms in the areas of pension system, health care and long term care systems, system of social transfers, education and labor market are inevitable.

On the other hand there is, however, a lack of appropriately prepared and linked statistical and administrative data bases, as well as the lack of appropriate analytical tools. All these deficiencies in the linked data base area, as well as in existing models, call for further research involvement within both areas. Activities done in the area of constructing the system of linked databases represent a quality data framework for the move from static to dynamic micro-simulation modeling. With the developed dynamic framework we will develop a new module – pension micro-simulation model – which will overcome the stated deficiencies of the adapted Generational accounting model and thus increase the quality of the results of the simulated effects of the needed new pension reform. With additional areas covered within the system of linked databases a new starting point will be established for the further development of additional modules (health care, long-term care, labor market, social transfers, etc.).

In this Working paper we report on the current state of the project and describe activities which were undertaken within the three main planned phases: I) Development of the system of linked databases, II) Development of the dynamic framework of the micro-simulation model, and III) Development of the pension micro-simulation model.

**JEL classification:** E17, E62, H55, J11

**Keywords:** demography, social security, pension system, microsimulation
1. INTRODUCTION

The economic sustainability of social security systems is under severe pressure nowadays due to population ageing caused by a decreasing fertility rate, increased life expectancy, an increased share of recipients of social benefits, and a decreasing share of the active population. These are the reasons for an anticipated increase of traditional social security benefits and the introduction of new types of old-age insurance. Therefore, development of a sustainable, efficient and fair system of funding social security in the environment of a population that is only going to get older is among the most pressing topics of social security in Slovenia. Special emphasis is being placed on the pension system due to its weight in the system of public finances. A number of studies prepared during the last eight years clearly show that ongoing pension reform will not be enough to compensate for the negative effects of demographic changes after the year 2025. The problem with sustainability of the public finance and pension system will therefore steadily increase, reaching one of the highest public finance deficits among the EU member countries. The need for the continuation of structural reforms, which started in 2005, but were in fact slowed down after the successful implementation of the tax reforms in the beginning of the year 2007, came out even more intensively with the financial crisis and substantial decline of GDP growth in 2009. Reforms in the areas of pension system, health care and long term care systems, system of social transfers, education and labor market are inevitable.

On the other hand there is, however, a lack of appropriately prepared and linked statistical and administrative data bases, as well as the lack of appropriate analytical tools, both needed for: “improving the understanding of social exclusion and poverty issues, social protection and inclusion policies, in particular through analysis and studies and the development of statistics and common indicators, within the framework of the OMC in the field of social protection and inclusion” (article 5(a), PROGRESS, Decision No 1672/2006/EC of the European Parliament and the Council). We have to add that they are needed also as an analytical support for the preparation and assessment of the proposed reforms in the various areas of social protection and inclusion.

Substantial amount of research efforts has been already focused on the development of different analytical tools – generational accounting model (GAM) based on cohorts, static tax and social security micro-simulation model (MSM), recursive dynamic computable general equilibrium model (SLOMOD) – which were already used in practice in different Ministries. MSM was in fact used for the preparation of the income tax reform and reform of the system of social transfers and subsidies. GAM is regularly used at the Ministry of Finance for the preparation of the Convergence program, at the Ministry of Labor, Family and Social Affairs
and at the Slovenian Ageing Working Group (projections of the long-term expenses for pensions, health and long-term care and education and estimation of the fiscal sustainability of these systems). This work revealed the fact that there exists a lack of cooperation between different ministries in the area of connecting collected datasets.

Pressures for urgent analyses to be done for the income tax reforms as well as for the reforms of social transfers and subsidies on one hand, and pressures from researchers for the linked databases on the other hand, finally resulted in an ad-hoc linked database from different statistical and administrative databases for the sample of Slovenian households. Statistical office performed this procedure, without any check of the reliability and quality of the linked information. The original linked database was therefore controlled and further corrected during the process of construction and use of different modules within the static micro-simulation model. Despite of the static nature, MSM soon proved to be a useful analytical tool for the evaluation of the “first step” consequences of particular policy measures in the area of social security. But, on the other hand, pension system could not be modeled within the model. Original GAM was therefore adapted for estimation of the long-term sustainability of the pension as well as health care and long-term care systems. Based on one-year cohorts and taking into account the fact that our pension system is based (also) on horizontal equalization of the pensions (individuals have the same pensions regardless of the point in time they have retired if they have the same activity and wage history), it was possible to model pension system within the GAM. But, some characteristics of the system could not be modeled (bonuses and maluses system) and there were some limitations regarding modeling of the increasing retirement age. Additionally, GAM uses data on the activity shares for particular cohorts and on the share of retired persons within particular cohort from outside the model, which also represents a drawback. By using aggregated data at the one-year cohort levels, modeled pension system is a rather rough approximation of the pension system in the real life.

All these deficiencies in the linked data base area, as well as in existing models, call for further research involvement within both areas. Proposed activities of constructing the system of linked databases which will cover also additional areas (as well as fill in not yet included particular variables in existing database) will therefore represent a substantial positive step forward regarding the improvement not only of current information and projections of contributors and beneficiaries of pensions schemes, and revenues and expenditures associated with them, but also in the other very important areas of social protection and inclusion. It will represent a quality data framework for the move from static to dynamic micro-simulation modeling. With the developed dynamic framework we will develop a new module – pension micro-simulation model – which will overcome the stated deficiencies of the GAM, and thus increase the quality of the results of the simulated effects of the needed new pension reform. With additional areas covered within the system of linked databases a new starting point will
be established for the further development of additional modules (health care, long-term care, labor market, social transfers, etc.). And finally, results obtained with the new modules will be used within GAM (estimated number of active people and pensioners), thus increasing the quality of its results, as well as within the CGE model with the aim also to estimate complex effects of proposed reforms.

In this Working paper we report on the current state of the project and describe activities which were undertaken within the three main planned phases: I) Development of the system of linked databases, II) Development of the dynamic framework of the micro-simulation model, and III) Development of the pension micro-simulation model.

2. THE AIMS AND EXPECTED RESULTS OF THE PROJECT

Research activities on the project represent continuation of the further development and maintenance of the existing micro-simulation model with adding the dynamic dimension and creating the possibility of the construction of the new module – pension micro-simulation model. This module will enable simulation of the number of active population as well as the number of pensioners with the final aim of preparing the scientific/expert basis in the process of preparation of the necessary pension reform as well as the assessment of its consequences for the long-term sustainability of the proposed reforms.

Expected results are:

a) Establishing the system of linked statistical and administrative data bases (households and relations among the members, education, activity status, income statements, real estate, social transfers and subsidies, pensions, health) for the sample of 40,000 households with about 115,000 individuals;
b) Development of the new dynamic framework for the existing static micro-simulation model;
c) Development of the new module – pension micro-simulation model;
d) Use of the new module as an aid in policy-making in the process of the necessary pension reform;
e) Delivery of the analytical tool (together with the developed graphic interface) to the relevant ministries to enable its use for a more efficient decision making in the area of the pension system.
The results obtained will provide quality inputs also for the other developed analytical tools, regularly maintained and already used for different purposes: a) generational accounting model – Convergence program, and b) dynamic CGE model – complex effects of proposed reforms in the areas of taxes and social security. As the proposed research activities are of the infrastructural nature, they should continue also after the end of the project.

3. DEVELOPMENT OF THE SYSTEM OF LINKED DATABASES

Following one of the main objectives of the call: “Developing administrative datasets to further the understanding of current and projected social security benefits and coverage levels: notably pensions, given different work and life patterns”, as well as following the revealed needs of research community and relevant Ministries, the first and extremely important phase of the project aims at the development of the system of linked statistical and administrative databases. Important final step of these infrastructural activities is their inclusion in the regular annual activities of the Statistical office of the Republic of Slovenia.

Existing static micro-simulation model was based on the sample of 40,000 households and about 115,000 individuals with the statistical and administrative data bases linked together using the unique identification code each Slovenian inhabitant gets at his/her birth. Due to its static nature it does not allow for the analyses of the needed reforms in the fields of pension and health care systems. Linked data bases were prepared by the Statistical Office on ad-hoc basis, without the necessary “cleaning” procedures and with many missing information (though existing in different datasets and in different institutions), primarily the information regarding the contributors and beneficiaries of pension schemes, and revenues and expenditures associated with these schemes. Additional information not yet included represent datasets on health and long term care, all levels of education, wealth, and some missing variables in the area of social transfers and subsidies, as well as of incomes.

The aim of the first phase of the project was therefore to establish the system of linked statistical and administrative data bases covering all major areas in the fields of social security, health care, education and labor market. Based on the revealed needs of each public authority responsible for particular area, adequate data were defined, and measures provided for regular preparation of datasets. Procedures for linking different datasets, their control and regular maintenance were also established. As all these activities are of the infrastructural nature, they will have to be included at the end in the regular activities of the Statistical office.
The research activities already completed in the first phase of the project and in the period the interim report covers are the following:

- List of all variables (social security with pensions included, health, long-term care, education and labor) was prepared. There was a meeting with the representatives of all Ministries and other involved public institutions with the Statistical Office where an agreement on the list of all variables required was reached.

- Agreement was reached with the Statistical office for the preparation of the sample of linked database for the research use in this project. Data were collected for the sample of 40,000 households, which gives approximately 112,000 individuals, for the new base year 2007. It was also agreed that a new version of sample would be prepared by April 2012 with linked data for the new base year 2010. The new version will have a lot of additional information. Besides added new variables on health and long term care, and real estate, many annual variables will be extended to monthly ones (employment and unemployment data, social transfers).

Taking into account the limited resources at disposal, time needed for preparation of the data at each of the involved institutions, and time needed to prepare linked database, the decision was made with the representatives of the Statistical office that the sample will be prepared every three years, which is also the time interval for planned preparation of (administrative) Population Census.

- Databases at each of the involved institutions were prepared, including necessary cleaning and adjustment of their individual databases with the aim of linking them into a consistent joint database for the purpose of this project. Teams at individual Ministries were formed on ad hoc basis of those experts responsible for the databases at their institutions, while formally the team at the Statistical Office is responsible for the coordination.

- At the moment only data about health statuses, real estate and pensioners histories are still missing from the planned rounded up system of linked databases, due to their current unavailability.

- Separate databases data were successfully merged and linked together with the Statistical office database. In the next step data were de-individualized in order to fulfill protection requirements posed by law.
After data were merged, Statistical Office checked if data could still be individualized, due to the merging process of many different databases. This resulted in some information being concealed, so that the identity of individuals could not be traced back anymore.

Collection of data for the system of linked databases was successfully included into the Yearly Program of Statistical Research of the Statistical office which is to be executed regularly. This means that preparation and maintenance of the sample database is finally institutionalized – which we find a significant achievement of this project. The data will not be collected annually, but will be periodically (in three years’ periods) updated together with the refreshment of the census data.

Testing, debugging and correction of the data in the sample we already physically have, has been done on income data and social transfers with the aim of testing for the representativeness and quality of the sample. We found personal income data of really high quality as we came very close to the aggregate amount of income tax gathered when using sample data. On the other hand, we had problems with some social transfers, as we had yearly data on which our simulations were based, but social assistance transfer is based on the last three months income. This was also the reason for the necessary changes planned for the new base year 2010 sample database in which monthly data will be used for employment, unemployment, social transfers and pensioners.

The system of linked databases has been successfully established and institutionalized - with some exceptions, where the databases still have to be added to the new sample for the base year 2010:

- For the health status at the primary level the databases are under construction – pilot databases will be prepared in the year 2012 and complete database constructed in the year 2014. We finalized the list of variables with the help of representatives of different institutions: Ministry of Health, Institute for Public Health of the Republic of Slovenia and The Health Insurance Institute of Slovenia.
- Real estate database has already been prepared, but is still under surveillance and in the process of necessary corrections. Statistical office intends to get it from Surveying and Mapping Authority of the Republic of Slovenia and plans to prepare the data for our sample till April 2012. The list for real estate variables was also prepared with the help of the representatives from Statistical office.
These additional variable lists were successfully added to the proposal of the Yearly program of statistical activities of the Statistical office for the year 2012.

During this intensive phase of preparation and merging different databases an additional and unexpected problem arose. Namely, when increasing the number of databases with different information for the individuals we have in the sample, the possibility of revealing particular individual also increased. Statistical office had to hide more and more variables in the initial merged database in order to prevent the possibility of revealing particular individuals. Planned additional variables on health care, pensions and real estate will additionally increase the problem. On the other hand, one of the aims of the project is to prepare a graphic interface and to give the databases and model to users at different ministries and other government institutions. This would substantially increase the dissemination of the linked databases within the country and at the same time increase substantially also the possibility to lose the database or that somebody could steal it. We had meetings with the representatives from the Statistical office as well as from Ministry of Finance and the final agreement had been that the linked databases will not be physically available any more, but that they will be available at the computer server at the Statistical office. Researchers and government institutions will have remote access to the databases and model tools through the internet or direct access on the computer in the so-called “secured room” in the premises of the Statistical office.

This solution complicates our research work and had an important negative impact on the dynamics of the execution of the project tasks. We spent a lot of time for getting security codes (and special keys that generate passwords each two minutes) from the Ministry of Public Administration, to synchronize our computers with the computer server at the Statistical office, and to check and test the usability of the computer programs we have been using for the development of the pension micro-simulation model and planned graphic interface. It turned out that program files already developed do not work at all at the computer server and that Statistical office has to renovate their programs. After about four months from the decision made regarding the remote access, we were still not able to work normally on the development of the pension module using the data already available on the computer server. Statistical office was in the process of acquiring needed new programming tools, which would enable our researchers to work on the databases, although still with remote access, which, unexpectedly, complicates our activities and prolongs the time frame of the realisation of the project. But we should have in mind that we are really breaking
through regarding the use of the system of linked databases as well as the development of the modeling tools and their use by different government institutions.

- Regarding the data on the pension histories we started the meetings with the representatives of the Pension and Invalidity Insurance Institute of Slovenia (PIIIS) and Statistical office of the Republic of Slovenia (SORS) already at the end of 2009. The first main problem to be solved was the request of the Statistical office that the data for all pensioners should be transferred to the Statistical office which will in the second step select the data for the individual persons who are within the sample. This proved to be impossible due to the amount of the databases as well as different types of databases and programming languages still in use at PIIIS. After several meetings we finally came to the conclusion that SORS will prepare a database with the identification numbers of all individuals within the sample, send it to PIIIS and needed data will be filled into the database and sent back to SORS. A specific contract was then prepared and signed between both institutions and a test database with data for only one year (2007) has been prepared.

All these activities were carried out during the year 2010 and in the middle of the preparation of the proposal for pension reform which caused additional delays. We were able to test the data available in the “secured room” by the end of 2010 and after the approval of the test data base, a new round of activities between PIIIS and SORS began – new contract with the additional specification of all the variables needed for the longer period of 11 years (2000-2010) and the list of variables for all active persons within our sample, employed in the base year 2007, were prepared. In April 2011 PIIIS was in the position to start with the preparation of the agreed upon databases and in summer data were prepared and sent to SORS. There, the files were transformed (the original individuals’ identification numbers were erased and replaced with the new ones which correspond to the identification numbers in the sample) and in the second step transferred into the computer server in the “secured room” and into computer server to which the remote access is possible.

- Due to the outdated programs we could not access the data yet and we had to purchase the new version of STATA program in order to speed up the process. Namely, Statistical office has problems with the purchasing of the new programs due to the financial limitations it has.
The system of linked databases has been successfully established and institutionalized. The system was included into the Yearly Program of Statistical Research of the Statistical office and will be regularly updated with the new versions every three years. Linked databases will be put on disposal through the remote access for any researcher or research team, as well as for different government institutions, for the research purposes. There are some exceptions, but the missing databases will be included into the new sample for the new base year 2010 (time schedule agreed upon with the SORS is April 2012).

This unexpectedly very slow process of linking institutions with the aim of preparing and enabling different databases to be linked on the base of the unique identification number of each individual within the sample, was particularly complicated in case where no previous exchange of needed data occurred. Pension histories were such a case, but despite such a long period needed to come to the end of the preparation of these databases, we can conclude that a really important breakthrough in the field of linked administrative and statistical databases at the individual level was achieved.

4. DEVELOPMENT OF THE DYNAMIC FRAMEWORK OF THE MSM

Consultations with the scientific adviser dr. Dekkers (foreign expert on MSM) were held during his visit to Ljubljana on 3-4 May 2010, when he also participated in the research seminar »Development of Pension Micro-simulation Model« and the internal workshop »Micro-simulation models with static and dynamic ageing: a methodological discussion« at the Institute for economic research.

On the basis of consultations with the scientific adviser, plan for further activities on the project was prepared. Important advice regarding the type of pension model we should develop only once again confirmed our starting approach – namely, that we should start with static ageing procedure, while construction of the purely dynamic model would be left for the next phase of micro-simulation modeling development, after the conclusion of this project.

4.1. Development of the income tax and social security contribution module

Micro-simulation model contains the whole socio-economic spectrum of the population, i.e. it simulates all individuals in the representative sample at a particular moment in time. It simulates direct taxes, social security contributions and transfers with a direct translation of the legislation into the code of the model.
Slovenian micro-simulation model had already been used for the preparation of the expert background studies for the execution of the reform in the field of income taxation and subsequently for the estimation of the consequences of the proposed final version of the reform. The results of the micro-simulation model were in their aggregate form in the next step used as an input in the dynamic general equilibrium model of the Slovene economy, with which at the Institute for economic research we analyzed the complex effects of the proposed changes in the field of income taxation at the aggregate level and at the level of individual sectors of the Slovenian economy. Analyses which were carried out with both models were later on used as the background for the decision taken on the tax reform, which was adopted on 1 January 2007.

A developed version of the micro-simulation model had been directly used also for the preparation of expert background studies for the reform of social transfers. Numerous versions of simulations were carried out with the purpose of creating adequate new ladders for the individual social transfers in the light of the proposed corrections and defined objectives. At the same time, a starting proposal of changes in individual social transfers and subsidies was prepared and the assessment of their consequences was also undertaken. In the last period the model has been used for the preparation of the expert background of the new proposals for the reform of the system of social transfers, as well as for the estimation of the consequences of limiting the basis for the payment of social security contributions.

However, we also have to be aware of the limitations, as the model currently contains only static consequences – it refers only to the chosen current year and cannot simulate reactions of individuals/households to changes in policies. It can simulate only direct effects – is an adequate tool for the analysis of measures which have an immediate impact and depend only on current income. It does not take account of the responses of individuals to a specific measure and cannot simulate the effects of measures which will have an impact only in the longer run (such as suggested measures in the field of the pension system).

Long-term sustainability of the pension system, health system and system of long-term care can thus be at present assessed with the use of the model of generational accounts which is based on cohorts and not on individuals. Model itself does not generate an estimation of the movement in the number of active population and retired persons, but obtains these estimations from outside the model. This represents the main weakness of the model of generational accounts, since this represents an important limitation in the preparation of simulations of changes in the labor market and of the number of retired persons in the light of the assumed increase in the retirement age, as one of the important and necessary possible measures for lowering the deficit in the pension budget.
Of key importance for the need to obtain disposable income of individual family members is the preparation of the special module of the microsimulation model, which enables the calculation of the income tax for each individual in the sample used and at the same time enables the execution of any scenario of changes in any parameter in the framework of the existing system of income taxation, including with adding two more income taxation groups as well as with changing the amount of employers' or employees' contributions and setting the upper limit on payment of social security contributions basis.

Figure 1: Parameters of the income tax and social security contribution module

The module was developed on the basis of the newly acquired linked database for the year 2007. With adequate adjustment of the incomes, the module enables the calculation of the income tax in the year 2010 and the elaboration of the chosen scenario. The graphic interface is prepared and allows the user a simple preparation of the scenario, calculation and listing of the results for the purpose of entering them in the general equilibrium model or for the need of analyzing the consequences of a particular measure in the field of income taxation or social security transfers. Income module is available on CD attached. When using the module, the user beforehand has to obtain permission for the usage of the database from the Statistical Office of Slovenia.

User simply changes the necessary parameters within the sheet with parameters and runs the module. The results are automatically written into the sheet from where the user started the
module (see Figure 2). In the next steps (after some scenarios made) the user may prepare tables for comparison of the results obtained (see Figure 3).

Figure 2: Reference scenario prepared with the income tax module

Source: income tax and social security contributions module

Figure 3: Comparison of two scenarios

Source: income tax and social security contributions module
During further development of income tax and social security contributions module it will be linked with the other modules in the dynamic framework. From the pension module it will get data on new due to the pension reform activated individuals as well as data on changed pensions for the observed period 2010-2060. It would be thus possible to estimate also the change in government revenues (income tax and social security contributions). On the other hand this module will be linked also with the economic module which will use data on income tax and social security contributions.

4.2. Development of the socio-demographic module

In this chapter we present in detail the characteristics of the socio-demographic module which was created as the result of the need for a programming tool that would allow simple and rapid construction of population projections in a user friendly form. We follow the technical procedures as used in the programming tool LIPRO, which was used for the construction of the latest Eurostat projections. The results of projections of the demographic module are therefore completely in line with Eurostat projections. In contrast to the programming tool LIPRO, alternative assumptions on the movement of mortality, fertility and migrations can be implemented very simply and fast, and the results calculated in a moment.

Socio-demographic module tries to be user friendly:

- In entering assumptions regarding future movements of fertility, mortality and migration, which are necessary for population projections, as well as
- In presenting the results of population projections.

When entering assumptions on fertility, mortality and migration sliders are available, which allow quick and easy determination of the transition from initial to final values, which are also determined by the user. At the same time we have to be aware that assumptions on fertility, mortality and migration are not uniquely determined already by the total fertility rate, i.e. number of children who are born on average by one woman during her fertility age, life expectancy at birth (mortality) or the number of net immigrants (migration).

In the background of all of these assumptions is the distribution by age groups. The same total fertility rate therefore may have different age distribution of mothers, the same life expectancy at birth can be achieved by different intensity of dying at different ages and the same number of migrants may be differently distributed according to age. At the same number of live births we could also assume a different ratio between the live-born girls and live-born boys, but in practice this ratio is fairly stable. Behind a given value of total fertility rate, life expectancy at birth and the number of net migrations therefore lie hidden at least age
distribution, and sometimes also gender distribution, that can change from year to year. In the basic variant of projections, regarding these distributions we use assumptions of Eurostat's population projections EUROPOP2008. When changing parameters on the total fertility rate, life expectancy at birth and the number of net migrations, it is assumed that age and gender structure is preserved as in EUROPOP2008 projections. The basis of the demographic module are therefore projections of the population of Slovenia from EUROPOP2008, which were produced in 2008 by Eurostat (Eurostat, 2008; Giannakouris, 2008). These are also the projections, the use of which is required for the calculation of population ageing in communication with the European Commission.

In contacts with the representatives of Eurostat which made the projections, trends used in the assumptions on the age samples were revealed to us, so that movement of mortality and fertility can be extrapolated into the more distant future. At the same time in this way the user can select a life expectancy which is higher than that assumed by Eurostat for 2060. Specifically, we prepared a survival probability distribution for each age group for 0.01 distances of years of life expectancy at birth. The user can use any value of life expectancy at birth for men in the interval from 74.00 years to 93.00 years; for women in the interval from 81.00 years to 100.00 years.

4.2.1. A description of some technical procedures in the population projections

For population projections Eurostat used the programming tool EUROPOP2008 LIPRO 4.0. This is a programming application of the Dutch demographic Institute (NIDI), which is intended for population projections, while in addition to basic population projections, it also enables some other applications (multistate projections; projections of households, which consider different types of households and transitions between them, etc.). This is a very flexible programming tool in terms of the possibility of determining individual assumptions, but is at the same time also very user-unfriendly. The user must independently create all matrices with – as described – time, age and gender dimension. Parameters such as life expectancy at birth are not input data, but are given by LIPRO as a result, so that the calculations in the opposite direction have to be done independently.

Projections of the population at the beginning of next year are obtained by multiplying the Leslie matrix with the vector of the population by individual age groups - separately for both genders. Leslie matrix for the female gender contains in the first row the probability of birth of a child according to age of women. With the help of multiplying the first row in the Leslie matrix with the number of women in various age brackets we obtain the number of live births. Assumed ratio of live-born boys and girls is 0.515 versus 0.485 - more boys are born and this ratio is fairly stable, both in time and between countries. Both Leslie matrices have on the
diagonal, starting in the second line, the probability of survival for each age. In this way, the number of live born children (separately by gender) and the number of population in other age groups is generated.

Next, the assumed number of net immigrants by individual age groups is added. Technically, it is necessary also to take into account the mortality over the year – e.g. number of immigrants has to be appropriately corrected for mortality, to which immigrant people are also exposed, so the population at the beginning of next year is increased by slightly less than the number of net migration was during the year, etc. At the same time, the probability of death has to be adequately carried out, since LIPRO uses projection or »period-cohort« probability of death, while statistical offices usually publish "age-period" probabilities of death. Various other technical details that are evident from the mere links in the Excel file are also needed. For detailed descriptions of the procedures of the calculations used by the programming tool LIPRO, see Van Imhoff and Keilman (1991). In this way, we precisely reproduced the latest Eurostat population projections EUROPOP2008.

4.2.2. Independent development of population projections

As mentioned above, we prepared a user-friendly interface for changing the assumptions and thereby for the creation of independent population projections. As a starting point, the assumptions from population projections EUROPOP2008 are entered. The user can on a sheet of "Predpostavke_DEMOGR" change assumptions about future movements in mortality (in black boxes), fertility (in orange boxes) and migration (in blue boxes). Each category is divided into lower and upper part. In the lower part, the shape of the curve of the movement of an assumption is each time the same as in EUROPOP2008 population projections, except that the user properly rotates (mortality and fertility) or moves (migration) up or down (see Figures 4-6).

For mortality factors of the rotation of the curve (separately for men and women, in cells B23 and B24 on the sheet "Predpostavke_DEMOGR") determine how many times higher should be an increase of life expectancy in different years depending on the assumed increase in EUROPOP2008. For instance, determining factor 1.5 in cell B23 would mean that life expectancy for women in the period 2008-2060 increased from 81.90 to 92.26 years (instead of to 88.80, as assumed in EUROPOP2008). In this case, an increase in life expectancy for women in this period would be 10.36 years, instead of 6.91 years, i.e., 1.5 times more. Equally, also in all other years, a 50% higher increase in life expectancy than in EUROPOP2008 would be assumed. In the same way the user modifies also the birth rate, i.e. total fertility rate (TFR), which shows the number of children who are born on average by one woman in her reproductive age, assuming that all women live till the end of their reproductive
age. A user changes this factor in cell B62; the idea of changing is analogous to the case of mortality – therefore, it is to be determined how many times higher should be an increase in the total fertility rate in different years, depending on the values assumed in EUROPOP2008.

Factors for determining the level of net migration are found in cells B100 and B101. Coefficients this time determine how many times higher the number of net immigrants in different years should be, compared to the values assumed in EUROPOP2008. This time, therefore, it is not about the rotation of the assumptions from EUROPOP2008 projections, but about the movement of the curve.

In the upper frames in this "Predpostavke_DEMOGR" sheet the user has the possibility to determine completely independently the course of the curve of life expectancy at birth (in the case of mortality), total fertility rate (in the case of fertility) or the number of net migrations (in the case of migration). For user-more-friendly setting of these assumptions, for all three categories, a slider is added, by which the user simply selects the desired shape of transition from the initial to the final level (both determined by himself). User also determines which is the first year of transition from initial to final state and which is the last year of transition. If the slider is moved completely to the left, the transition curve has the shape of a logistic function, while if the slider is moved completely to the right, it has the shape of a logarithmic function. Between these two extremes, the transition curve has various other intermediate shapes. Of course, the user can also manually copy the values (without the use of the slider), if he would like to create completely independently the curves of the movements in assumptions on mortality, fertility and migration - in case that the shape determined by the slider (upper frames) or according to EUROPOP2008 assumptions (lower frames) does not suit his requirements.
Figure 4: Assumptions on mortality rates

Source: Socio-demographic module
Figure 5: Assumptions on Total Fertility Rate

Source: Socio-demographic module
Figure 6: Assumptions on net migrations

Source: Socio-demographic module
Which of the two possible modes of entering assumptions is to be used in the calculations (upper or lower), is selected by the user in a row that for each category (mortality, fertility, migration) is located in between the upper and lower part. Concretely, this concerns the cells B19, B58 and B96. Thus the assumptions in both the upper and in the lower part for each category are presented in separate charts. In all graphs the assumptions used in EUROPOP2008 are also entered as reference values (at the end label "_EUROSTAT" is added). In order to avoid mistakes, so that the user could more easily verify which set of assumptions is currently used in the calculations, the label "SELECTED>" is written to the left of the currently used graph in the green frame, which indicates that the calculations take into account that particular set of assumptions.

Other dimensions of assumptions - age distribution of net migrations, distribution of total fertility rates by age according to women age and changing mortality by individual age groups (considering that the user specifies the movement of life expectancy at birth) - are tied to projections EUROPOP2008. User could independently change also these assumptions at his discretion, but would require an intervention at appropriate places outside the user interface and it is not to be recommended.

4.2.3. Results

All demographic projections when assumptions change, are carried out immediately. Some delay could eventually emerge as the result of the time computer processor needs to calculate all necessary projections. However, this is more relevant if numerous links or even entire models were added to the demographic module, so that when changing population projections, all further recalculations in the model would have to be made at the same time.

For now we included a display of age structure of population with the age pyramid and age structure of population (absolute and relative). In this, age pyramid is interactive, so that the user with the slider selects any year for which he would like the age pyramid to display the age structure. Relevant for use are thus in the first place those sheets marked in red (sheet where assumptions are made) and green (sheet with the pyramid, charts, and number of population by age groups - separately for men, women and both genders together. Other sheets are for the moment not hidden, since some contents may be also interesting for the user (number of live births, deaths by age groups, etc.). The user should according to his preferences leave them open or hide them. Individual charts (structure of the population, age pyramid) can also (temporarily) be copied by the user to the sheet of assumptions, so he can in real time see changes in individual charts or results, while changing individual assumptions.

Figure 7: Age pyramid and age structure of population
Development of socio-demographic module is thus concluded. It is available and is also functioning as a particular programming package. Its main aim is to provide simple and quick preparation of demographic projections in a user friendly form. Module follows technical procedures of the LIPRO programming language used for the preparation of the latest
EUROSTAT projections. Therefore, the results obtained with the socio-demographic module are completely consistent with the EUROSTAT projections. The added value, however, lies in the graphic interface already developed and added with simple and quick implementation of alternative assumptions regarding the mortality, fertility and migrations and with the results obtained in a moment. As an important module within the model it enables inputs for the other modules, particularly for the pension module. This module is certainly a very useful programming tool which can be used also as an independent model in the field of demography. Linked with the pension module it will enable introduction of dynamics into the model.

4.2.4. Sub-module for generation of weights

Work on the development of the specific sub-module that generates weights for each individual person within the sample for the complete period of 2007-2060 with the aim of enabling the so called “static ageing” of the base year population into the future, has already started. By using the weights which are estimated with a particular procedure and data on the structure of population (gender and age) at the aggregate level in any year within the period 2007-2060, dynamics will be introduced into the model. In the course of further research activities we will also investigate the possibility of adding an additional variable – education, which also needs a preparation of projections on the structure of the level of education (split also by gender and age). This sub-module will be integrated into the socio-demographic module and will finally generate a matrix of new weights, whenever there will be any change in the assumptions on demographic variables.

4.3. Development of the economic module

Within the third phase of the project, planned research activities on the development of the economic module were conducted. Module is directly linked with demographic module (demographic projections) and income tax module (income tax and social security contributions) and indirectly (through income tax module) with the pension module, while at the same time it uses also some exogenously given assumptions about the movements of some important macroeconomic aggregates. The module already at this stage enables practical application, which is however at the moment still limited, as it presently still takes into account assumptions about the movements of the retirement rate from the current version of the adjusted model of generational accounts.

Below we briefly summarize the research activities carried out in the third phase of the project.
4.3.1. Employment and unemployment rates

Employment rates will enter the economic module from the pension module, where they will be calculated on the basis of model links, detailed (individual) data, as well as assumptions set by the user. Thus, the pension model will represent an alternative to European Commission forecasts on the future movements in the employment rates and the number of employees. The European Commission for the Member States presently uses a simple model for predicting future movements of activity rates, which does take into account the number of years of the pension qualifying period as well as various other information, that in reality in the future will influence the movements of the number of employees. Consequently, some of the other macro-economic categories associated with that will change – such as for instance GDP.

Assumptions concerning the future movements in unemployment enter the economic module exogenously. Again, for the moment a set of values (by calendar year, gender and one-year age groups) of the European Commission is taken into account. In the user interface which will be developed in the forthcoming phases of the project, we intend to include the possibility of a simpler entering of the assumptions regarding future movements in unemployment rates, so that the user enters only the unemployment rates for individual calendar years in the future. The distribution of unemployment by age groups and gender will be generated automatically – while retaining the same relative distribution as in the assumptions of the European Commission. However, if the user wants to change this, he would also be able to change the relative distribution by individual age groups and gender. Unemployment rates will thus be from the viewpoint of the whole model exogenous and will enter the economic module on UR (M) lists for men and UR (F) lists for women.

On the basis of employment rates (which will enter the economic module from the pension module), unemployment rates (which will enter the economic module exogenously) and the number of the population (which will enter the economic module from the demographic module), the economic module calculates:

- Absolute number of employees by individual (one-year) age groups and gender,
- Absolute number of unemployed - by individual (one-year) age groups and gender.

At the same time, from the employment and unemployment rates, while taking into account equations of interconnections of individual labor market statuses, participation rates - at the individual (one-year) age groups and gender – are calculated. By multiplying the participation rates with the number of population, the labor supply by one-year age groups and gender is calculated.
4.3.2. Retirement rates

In the economic module sheets with the retirement rates were also included and from them the absolute number of pensioners was calculated, both broken by one-year age groups and gender. The values themselves were temporarily taken on the basis of the results of the existing model, which is used for simulations of the pension system (modified model of generational accounts). From the five-year age groups used in this model, the breakdown to the one-year age groups (required by the economic module) is done with the help of an uniform distribution, i.e., for each five-years group, one-year groups were assigned equal values. This also causes the "stepped" graph in the chart when displaying results. In the future, the results from the pension module will enter at this point. It is not inconceivable that the results obtained by the pension module, once it is constructed, would be significantly different from the presently used results, since currently applied European Commission's assumptions regarding future movements in activity rates and working activity rates have a crucial impact on the current results. The results obtained by using the pension module will be based on individual data of the Pension Fund, including the information on how much of the pension age the existing structure of employees has. The results of simulations will in this way be much more precise.

4.3.3. Results

Technically, the fields where input data enter are marked with yellow - individual sheets and within sheets, individual fields (see Figure 8). Everything else that is not marked with yellow is calculated independently. Synthetic results are presented on the sheet "Rezultati_EkonModul". The summary shows the movement in the number of population, labor supply, employees, number of unemployed and the number of pensioners. The calculation of GDP growth is also presented following the same approach and assumptions.
At the same time, selected results are also shown in the form of charts. The chart showing the movements in GDP growth (and of the components from which it is calculated) and the chart showing the movements in employees, unemployed and pensioners, while displaying the...
currently selected scenario, it also in the background all the time displays the results of the reference scenario. In this way the user can at every change in the assumptions or calculations immediately see what the difference relative to the reference scenario is.

In this sheet of the results there is also an interactive chart that by scrolling through the slider shows the age and gender structure of population, employees, unemployed and pensioners in the selected year. For the display, the age pyramid is used, which due to technical limitations of Excel is lying to the right. If the chart is in the mind rotated by 90 degrees to the left (in the direction opposite to clockwise), we get an age pyramid of population, which beside the number of population itself also shows the structure of the population by individual economic categories. Above the x axis (in an upright standing age pyramid this would be on the left side, as it is usual in the age pyramids) is a display for men - dominated by blue, while under the x axis (which would be in an upright standing age pyramid to the right, as usually) is a display for women - dominated by red color.

Figure 10 shows the movements in employed and unemployed persons in accordance with the assumptions of the European Commission, as well as projected future movements in the number of retired, projected by using a modified model of generational accounts. Display is ready to compare movements in these categories in the selected scenario compared to the reference scenario (in this case both are equal).

It should be noted that an additional category will be those insured. The pension module will therefore have to establish a link between the number of employees and the number of those insured. From the point of view of the financing of the Pension fund the latter will be important. The number of those insured is and will be considerably lower than the number of employees. In the figure we see that the number of people retired in the last decade of the projection period is expected to come close to the number of employees. (Fig. 1), while the number of pensioners would exceed the number of those insured already considerably before the end of the projection period (not shown in the figure).
Figure 10: Structure of Slovenia's population according to economic activity in the period 2008-2060

Lying pyramid in Figure 11 shows, in addition to the total population, the number of employees and unemployed persons, and also the number of pensioners. Among other things, the figure 2 shows an early decline in the number of employees.

Figure 11: Structure of Slovenia's population according to economic activity in 2008
Figure 5 shows the structure of individual groups in the labor market in 2060.

Figure 5: Structure of Slovenia’s population according to economic activity in 2060

Results shown represent only the initial version. At the request of the user some other additional categories and/or in some other way will be presented. Final design will also depend on the final technical solutions concerning the links among individual modules and in the user interface. It may be that the user interface will summarize the results of individual modules in a separate section and present them in a different way or in a different programming environment.

4.3.4. Links with other modules

Input data in the economic module (sheets "Pop (M)" and "Pop (F)") can be linked directly to the results of the demographic module (sheets "Population_M" and "Population_F" in the demographic module), which was prepared in the previous phase of the project. In this way, both modules become interconnected and interactive. In the demographic module, the user can then change any assumptions about fertility, mortality and migration, the results of population projections are calculated independently and enter the economic module. (If the user has at the same time both models open, the calculations are carried out in real time. If
not, the results of the demographic module enter the economic module when opening the latter). All the results and graphical presentations of the economic module will with the establishment of these links already now make it possible to analyze the response to changes in demographic assumptions - including the response of the GDP growth, the number and structure of employees, unemployed, active, and retired persons (taking into account that retirement rates are so far taken from the modified model of generational accounts) to demographic changes. Table 1 lists abbreviations used and the marks at naming the sheets in an Excel economic module file.

Table 1: Codes used in the economic module sheets. In combination with various categories "M" indicates male, "F" female, and "T" total - both genders combined.

<table>
<thead>
<tr>
<th>Code</th>
<th>English expression</th>
<th>Slovenian expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop</td>
<td>Population</td>
<td>Prebivalstvo</td>
</tr>
<tr>
<td>ER</td>
<td>Employment rates</td>
<td>Stopnje delovne aktivnosti</td>
</tr>
<tr>
<td>EM</td>
<td>Employees</td>
<td>Delovno aktivni (ševidlo)</td>
</tr>
<tr>
<td>UR</td>
<td>Unemployment rates</td>
<td>Stopnje brezposelnosti</td>
</tr>
<tr>
<td>UN</td>
<td>Unemployed</td>
<td>Brezposelni (ševidlo)</td>
</tr>
<tr>
<td>PR</td>
<td>Participation rates</td>
<td>Stopnje aktivnosti</td>
</tr>
<tr>
<td>LS</td>
<td>Labor supply</td>
<td>Ponudba dela (aktivno prebivalstvo) (ševidlo)</td>
</tr>
<tr>
<td>RETr</td>
<td>Retirement rates</td>
<td>Stopnje upokojenosti</td>
</tr>
<tr>
<td>PENS</td>
<td>Pensioners</td>
<td>Upokojenci (ševidlo)</td>
</tr>
</tbody>
</table>

a: The same codes and descriptions are used by the European Commission.

Development of the income-economic module has also been concluded. As is the case with other two modules, it is available and functioning as a particular programming package, but will finally represent a linkage between demographic and pension modules, using exogenous assumptions regarding some macroeconomic aggregates. Independent use of the module is at this stage possible, but it is a rather limited one, due to the use of the retirement rates obtained from the generational accounting model. It uses inputs from the demographic module results (the number of population, split by gender and annual age cohorts) and calculates real growth rate of GDP taking into account exogenous productivity growth rate and the employment growth rate. Employment growth rate is the sum of growth rate of the number of active population within the age cohort 15-71 and the growth rate of the number of working hours per working active inhabitant. Both variables are for the moment taken from the macroeconomic assumptions made by the EU commission, but can be arbitrarily changed.
Employment rates will enter the economic module from the results of the pension module, where they will be calculated from the simulation of the number of the pensioners (depending on the assumptions of the possible pension reform scenarios).

Graphic interface, while underway, is still in the process of development. It was decided that graphic interface would be prepared as a broader tool, which would cover and link all modules in a consistent framework. The original plan in the project proposal was namely to prepare graphic interface separately for the individual modules of the project (this has already been done for the first three modules). In the process it was recognized that a more integrated approach to creating the graphic interface would have additional advantages for the users of the model. Final version will enable the user to work separately with each particular module as well as with the data stored in the data warehouse, and to run a dynamic pension model taking into account any possible change of all parameters in all particular modules.

Testing, including debugging and correcting the code, has been done for the completed three modules, as much as it could have been done in this phase, without the pension module being completed yet. Modules are still separated and not yet linked into the complete framework of the model – when linked together, a new series of testing, debugging and correcting the code will be performed.

5. DEVELOPMENT OF THE PENSION MSM

Pension module is the most important part of the micro-simulation model. When finished, it will enable the simulation of the existing pension system with on-going reform (with its implementation to be concluded in the year 2024), preparation of any possible scenario of any change in the valid system as well as the introduction of NDC system or point pension system. Existing system is extremely complicated and also a non-transparent one, long transition period of the reform complicates the modeling of the system, and the same is true also for any new proposed reform. All this poses severe problems in the static ageing model framework, as we have to in some way mimic real dynamics. We already had intensive discussions with our foreign adviser on how to solve the open problems (de-activation of already retired persons, how to deal with the disability retirement, correct use of increased education level and macro aggregates, etc.) and plan to have another meeting at the conference in Sweden. As already explained in the first part of this report, we have unexpectedly spent a lot of time for the preparation of the system of databases and especially for data on the pensioners’ histories and are still waiting for them at the moment of the conclusion of the reporting period.
Within this phase of the project a static version of the pension module and a special module for generating weights were developed, which allows the inclusion of the dynamics in the model itself. Pension module already at this stage allows the practical application - the preparation of various possible simulations with selective changes in the parameters of the eligibility age for retirement and the amount of the old age pension. Due to different conditions for men and women, as well as different lengths of periods of the progressive implementation of the current reform of the pension system, the model allows separate treatment of both genders and is designed so as to allow an easy upgrade of alternative pension systems. In the following paragraphs we summarize shortly the activities done within this phase of the project.

5.1. Preparation of databases

Pension module of the micro-simulation model is one of the basic elements (modules) of the complete model and is in its content a continuation of already completed modules (demographic-economic, personal income tax). Primarily it is based on the file of microdata on pensions for the year 2008, prepared by the Pension Fund. This file contains data for a sample of old age pensioners on the amount of wage, different periods (pension, insurance, added, etc.), the amount of accrued pension, gender and age. Based on these variables for each individual in the sample we first "reproduced" his accrued pension at the time of the retirement, which means that from the data we calculated one's pension base, retirement date, accrual rate or the level of individual’s pension.

In parallel, long-term activity of the acquisition of data described above is ending, but for the pensioners who are in the sample of households in the new base year 2007, and who retired during the 2000-2010 period. On the basis of pensioners in the period 2000-2007, we will be able to properly de-activate those already old-age retired due to the increasing retirement age. They will also serve us to assess the adjustment of pensions for all old age pensioners who retired before 2000 and are included in our sample of households. Those retired in 2008-2010 will on the other hand serve primarily as a basis for comparing simulated new old age pensioners with those actually retired during that period.

Due to changes in the structure of active population in time (especially extension of the time of entry into active period for younger generations), the Pension Fund prepared a file on wages histories for all active persons in 2007 who are in our sample. Based on these data, we will be able to properly correct the structure of the employed, and thus to correct retirement in the coming years, for which we expect that people would retire at an older age irrespective of the pension law in force, due to later entering into active period.
Significant delay in the preparation of data for the development of the pension module, which has consequently led to a delay of the planned activities under the project, is due primarily to the fact that these data were basically for the first time prepared at the individual level for a selected sample of households and individuals within them. Despite the absolute readiness of the representatives of the Pension Fund as well as of SORS that this should be done, it was necessary in practice to overcome quite some technical as well as legal barriers which have all required time and especially a lot of patience of all involved. Further complication was due to significant expansion of the scale of the sample base of linked data. With more and more new variables included in the primary database, the likelihood of detecting individuals in the sample quickly increases. Consequently, this means a significant and growing need of hiding problematic variables, leading to impoverishment of the database and the loss of information. Finding an adequate solution that would satisfy both the legal restrictions on the use of individual data, while at the same time allow the use of data for research purposes, was thus a parallel, but very important activity, which engaged all three groups: SORS as an authorized institution and an administrator which can link different databases at the level of an individual - different ministries and other government institutions that are interested in using model tools based on the individual, and researchers – which on the basis of linked databases develop, maintaining and also use model tools. The uncontested fact is that an outstanding work in the field of integration of administrative and statistical databases has been done, which also had its final confirmation with the inclusion in the Annual Program of Statistical Research of the Statistical Office. After two linked databases for the sample of households for the years 2004 and 2007, in spring 2012 we can expect a third with the data for the year 2010, to which monthly data (employment, unemployment, social transfers, pensions), information about real estate and health data (medications, hospitalization and sickness leaves) will be added. The last agreement with the representatives of SORS is that the database for the sample of Slovenian households will be prepared every three years, this coinciding with the planned administered population census.

5.2. Pension module

Pension module, which at this stage reproduces the pension system in 2008, is divided into two parts according to the gender of the individual. The reason is different retirement conditions that apply to men and women. Within each part the following groups are defined:

1) Conditions of meeting pension qualifying period and age. There are three basic combinations, as according to the existing system a man can retire when he fulfills:

* A: 40 years of pension qualifying period and 58 years of age;
* B: 20 years of pension qualifying period and 63 years of age;
* C: 15 years of insurance period and 65 years of age.

Similarly holds for women, except for somewhat different boundary conditions:
* A: 38 years of pension qualifying period and 58 years of age;
* B: 20 years of pension qualifying period and 61 years of age;
* C: 15 years of insurance period and 63 years of age.

(These values are valid for females after the end of the transitional period)

In the computer code itself boundary conditions (A, B or C) are recorded in the form of variables, so that the user of the model can himself determine their level and combination.

2) Length of the period or the number of consecutive best years of completed years of service taken into account in calculating the pension rating base. Model allows selection from one to forty consecutive best years (in the current system uses best consecutive 18 years) in the form of parameters so that the user of the model can select any number of the best consecutive years for the calculation of the pension rating base.

3) Micro-data about an individual contain detailed information on pension qualifying period, insurance period, insurance period without bonus, added qualifying period and purchased period. All these periods are taken into account in the model when calculating the pension rating base by selecting the number of consecutive best years.

4) The pension formula. In the existing system the calculating accrual rate is the following one: for men 35% for the first 15 years, and then it increases by 1.5 accrual points for each additional year of pension qualifying period. For women it is 38% for the first 15 years, and then it increases by 1.5 accrual points for each additional year of pension age. (These values are valid for women after the end of the transitional period). In the pension module code, the pension formula is written in the form of parameters, so that the user of the model himself can determine the percentage of the calculated rate, which is calculated for an individual.

5) The pension formula is connected with the bonus/malus system which results from early retirement or later retirement. Both are considered in the pension formula and are in the program code written in the form of parameters, so that the user of the model himself can determine their values.

6) The pension formula takes into account the number of children. The existing system counts for the first child lowering the retirement age for 8 months, 12 months for the second child,
etc. Number of children and the "age bonus" for an individual is in the program code written as a parameter, so the user of the model can himself determine their values.

7) Health care contribution for pensioners. In the existing system, the contribution for health insurance for pensioners is 5.96% of the so called “gross” pension. The percentage of this contribution is in the program code written in the form of a parameter, so that the user of the model can himself determine its value.

The final result of the pension module is determination of an individual who qualifies for an old-age pension and the calculation of an individual’s old-age pension in accordance with the parameters set by the user of the model. Individual data are in the model aggregated to the national level. They are presented in the form of the aggregate amount of the pensions, contribution for health insurance of pensioners, total number of pensioners and so on. In connection with income tax module, the amount of income taxes for retirees is also calculated. The module enables the preparation of a listing according to various criteria, e.g. separately by gender, age or level of pensions. Pension module is at the moment still at the starting stage and developed modules could not be linked together and integrated graphic interface developed.

6. CONCLUSIONS

The system of linked databases has been successfully established and institutionalized. The system was included into the Yearly Program of Statistical Research of the Statistical office and will be regularly updated with the new versions every three years. Linked databases will be put at disposal through the remote access for any researcher or research team, as well as for different government institutions, for the research purposes. There are some exceptions, but the missing databases will be included into the new sample for the new base year 2010.

Unexpectedly long period needed for the completion of this (first) phase of the project, which can be explained by the fact that what has been done was something completely new and therefore done for the first time – we had to convince several different institutions to come together and agree on the preparation of databases at the individual level and, in the second step, on linking all these databases into the system of administrative and statistical databases – this causing a substantial delay, compared to the planned time schedule of the project activities. Additionally, emerging problem of increasing the probability of locating particular individual, as a result of the new data linked together, had to be solved. Solution with the remote access and “secured room” was the only acceptable one, but again being something new, required additional time for its successful implementation. But despite such a long period needed to come to the end of the preparation of these databases, we can conclude that a
really important breakthroughion the field of linked administrative and statistical databases at
the individual level was achieved.

For the calculation of the disposable income of a particular individual within the sample a
special personal income tax module has been developed. It can be used as a particular
programming package which enables simulation of any scenario about the possible change of
any of parameters within the valid personal income tax system, with the possibility to increase
the number of income brackets, to change the rates of the employers’ and employees’ social
contributions as well as to introduce any capping of the tax base for social contributions.
During the next steps, income tax module will be linked with the other modules into the
dynamic framework. From the pension module it will get data on new, due to the pension
reform activated individuals, as well as data on changed pensions for the observed period
2010-2060. It would be thus possible to estimate also the change in government revenues
(income tax and social security contributions). On the other hand, this module will be linked
also with the economic module which will use data on income tax and social security
contributions.

Development of socio-demographic module is also concluded. It is available and is also
functioning as a particular programming package. Its main aim is to provide simple and quick
preparation of demographic projections in a user friendly form. Module follows technical
procedures of the LIPRO programming language, used for the preparation of the latest
EUROSTAT projections. Therefore, the results obtained with the socio-demographic module
are completely consistent with the EUROSTAT projections. The added value, however, lies
in the graphic interface already developed and added with simple and quick implementation
of alternative assumptions regarding the mortality, fertility and migrations and with the results
obtained in a moment. As an important module within the model, it enables inputs for the
other modules, particularly for the pension module. This module is certainly a very useful
programming tool which can be used also as an independent model in the field of
demography. Linked with the pension module, it will enable introduction of dynamics into the
model.

Development of the income-economic module has also been concluded. As is the case with
other two modules, it is available and functioning as a particular programming package, but
will finally represent a linkage between demographic and pension modules, using exogenous
assumptions regarding some macroeconomic aggregates. Independent use of the module is at
this stage possible, but it is a rather limited one, due to the use of the retirement rates obtained
from the generational accounting model. It uses inputs from the demographic module’s results
(the number of population, split by gender and annual age cohorts) and calculates real growth
rate of GDP taking into account exogenous productivity growth rate and the employment
growth rate. Both variables are for the moment taken from the macroeconomic assumptions made by the EU commission, but can be arbitrarily changed.

Graphic interface, while underway, is still in the process of development. It was decided that graphic interface would be prepared as a broader tool, which would cover and link all modules in a consistent framework. The original plan in the project proposal was namely to prepare graphic interface separately for the individual modules of the project (this has already been done for the first three modules). In the process it was recognized that a more integrated approach to creating the graphic interface would have additional advantages for the users of the model. Final version will enable the user to work separately with each particular module as well as with the data stored in the data warehouse, and to run a dynamic pension model, taking into account any possible change of all parameters in all particular modules.

Pension module at the present stage of development is capable to identify an individual who qualifies for an old-age pension and the calculation of an individual’s old-age pension in accordance with the parameters set by the user of the model, but in the base year only. Individual data are in the model aggregated to national level. Design of the module allows an upgrade (which is in accordance with the plan of work scheduled for the next phase of the project) for the simulation of alternative pension systems, such as individual or notional pension accounts (NDC) and the points system.

In further work, we will first complete the development of pension module. With constructed matrix of the conditions for old-age retirement for both genders separately, we will simulate the continuation of the reform of the existing pension system, which will be fully implemented by 2024. We will also add a new module that will allow simulation of the system of notional accounts.

The next very important step in developing the model will represent the integration of all developed modules into a single system that will allow the use of dynamics. In doing so, the process of proper calibration of variables to exogenously given aggregate values will be particularly difficult, but also essential in ensuring an appropriate quality of the model.

In parallel, work on the development of graphic interface platform now runs, which will in practice connect the modules as well as the two models - pension model and model of generational accounts. At the same time it will allow independent work with each module separately as well as work with the basic data stored in a data warehouse.
7. LITERATURE AND SOURCES


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