The Reformed Pension System in Germany – a System Dynamics Model for the next 50 years

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This paper analyses the 2002 reform of the German public old age social security program. Reforming the traditional pay-as-you-go system the reform firstly implemented a complementary funded system which every contributor finances via additional private savings. An elaborate System Dynamics model (Vensim) has been used in order to examine both the necessity of the reform and its sustainability.

Official data from the Federal Office for Statistics (demographic development 2002 to 2050) and published research data of the economical development from 2002 to 2050 (integrated as table functions) served as input values. Different pension systems and scenarios will be presented. System Dynamics provides an outstanding instrument to compare these different systems. Results show that reforming the pension system was inevitable to avoid a collapse of the pay-as-you-go system.

Keywords:

SD-model, German pension system, simulation, scenarios.

Introduction

The pension system in Germany consists of contributions of all employees into a so-called "pension pot" from which retirees will be paid (pay-as-you-go). Due to unemployment and demographic development this system is in danger. In future the contributions to the pension insurance are likely to exceed 20 percent of total earnings (currently between 19 and 20 percent). To avoid this situation, in 2002 the government decided to reform the pension system. Now total pensions consist of a statutory pension and a private pension. An elaborate System Dynamics Model (Vensim) has been used to calculate different simulations and "shock scenarios". Official data from the Federal Office for Statistics (demographic development 2002 to 2050) and published research data of the economical development from 2002 to 2050 (integrated as table functions) served as input values. The age structure of the population has been split up into cohorts of 5 years each; nevertheless the simulation period covered a time span of one year.

Some preliminaries and assumptions for the SD-Simulation: "Pension System"

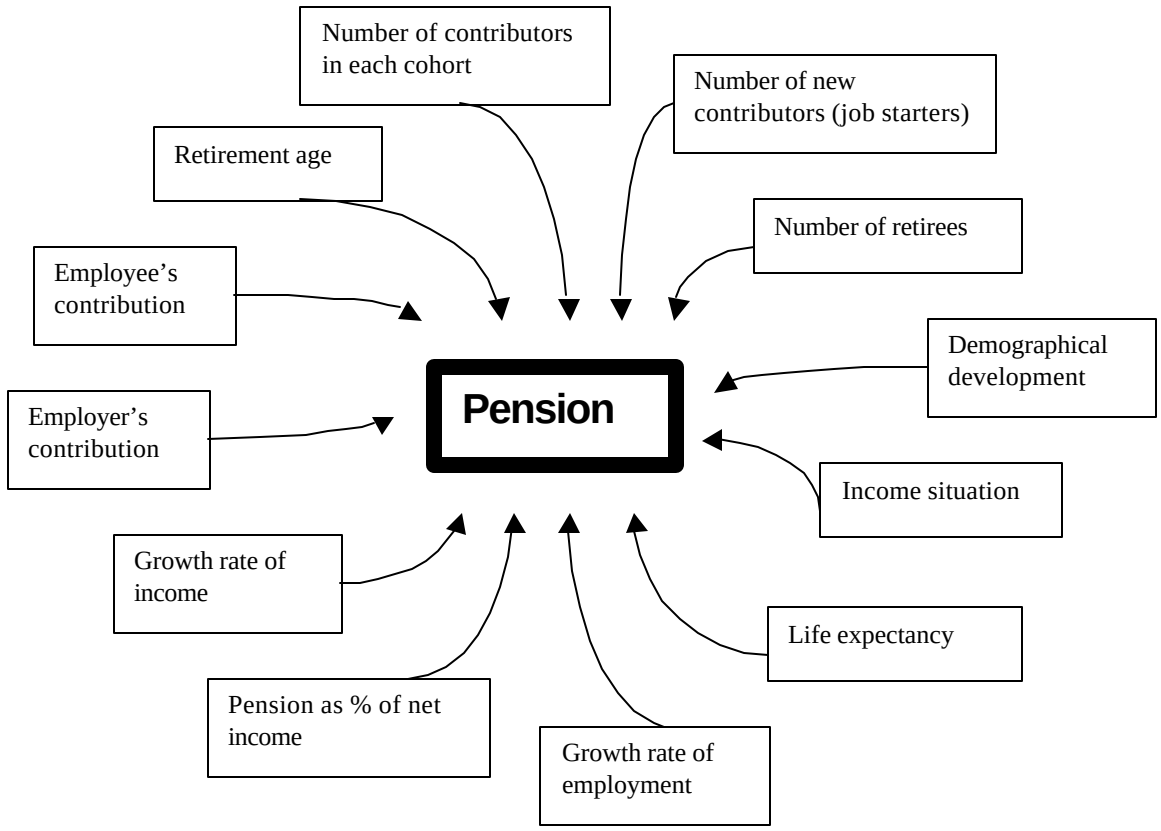
We used the following assumptions for the System Dynamics Model:

- All individuals are split up in cohorts. Each cohort is assumed to represent a heterogeneous group of employees and covers five years.
- The age of working individuals is between 20 and 60 years. Therefore we have eight cohorts.
- A simulation period covers a time span of one year.
- One "cohort" of retirees is introduced. Its age structure is from retiring to death. Thus this cohort is larger than 5 years.
- The average gross income of individuals in each cohort[1] is given.
- The estimation of the growth rate of income[2] is given.
- Both employers and employees contribute to the pension system in equal shares.
- The "balance" is defined as the sum of total pensions minus the "pension pot".
- The dependency ratio is defined as the sum of all retirees divided by the sum of all contributors.
- Concerning the Calibration: The choice of parameters is estimation! Nonetheless we tried to estimate consistently with observable empirical facts; e.g. growth factor of income is 2.5%; life expectancy of people aged 60 is 80.2 years today and 84.15 years in 2050; etc.[3]

[1] Börsch-Supan: „Micro-Modeling of Retirement Decisions in Germany", Mannheim 2002
[2] Börsch-Supan: "Rentabilitätsvergleiche…", Mannheim 2000
[3] "Statistisches Bundesamt (Germany)" 2002

The influence factors of aggregated pensions

Some factors that have an influence on the (German) pension system:



As we can see, there are a lot of interdependencies to be considered as far as contributions to and payments from the pension systems are concerned. It is quite challenging to model all these details.

The New Pension System ("Riester-Rente")

(The name was given according to Walter Riester, the former Federal Minister for Labor and Social Affairs.)

The "Riester-Rente" adds a personal pension schema to the traditional pay-as-you-go system. The pension payments of the traditional pension system are equal to 67% of the average net income. This seemed to be not sustainable in the future because Germany has a declining population and a growing dependency ratio meaning that contributions to the pension system would have to increase from actually less than 20% to more than 25% of the gross income in future.

Therefore the “Riester-Rente” postulates the following main ideas:

- Pension payments ***should not be*** below 64% of net income in future.
- Contributions to the pension system ***should not be*** above 24% of gross income in future.
- Implementation of a complementary funded system which every contributor finances via additional private savings.
- Private savings will be subsidized to make them attractive.
- Lower (via subsidy) and upper (via tax benefits) boundaries for the amount of money to be saved.

The “Riester-Rente” introduces the following government subsidies:

- In the years 2002 and 2003: 38 € per person plus additional 46 € for every child
- In the years 2004 and 2005: 76 € per person plus additional 92 € for every child
- In the years 2006 and 2007: 114 € per person plus additional 138 € for every child

- From 2008: 154 € per person plus additional 185 € for every child

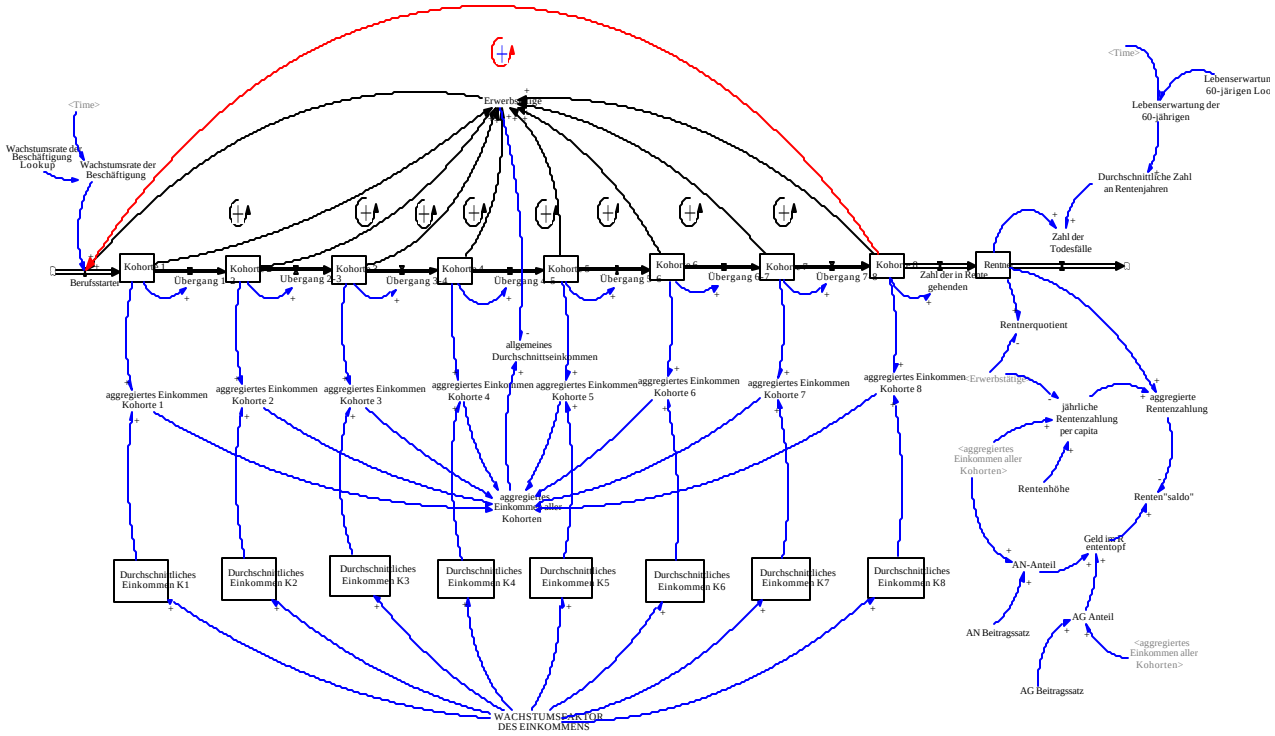
These government subsidies will only be granted if the individual chooses to participate in the private component of the pension system. Then the Minimum and Maximum private savings (PS) depend on the gross income (EK):

- In the years 2002 and 2003: 0.01*EK <= PS <= 525 €
- In the years 2004 and 2005: 0.02*EK <= PS <= 1050 €
- In the years 2006 and 2007: 0.03*EK <= PS <= 1575 €

- From 2008: 0.04*EK <= PS <= 2100 €

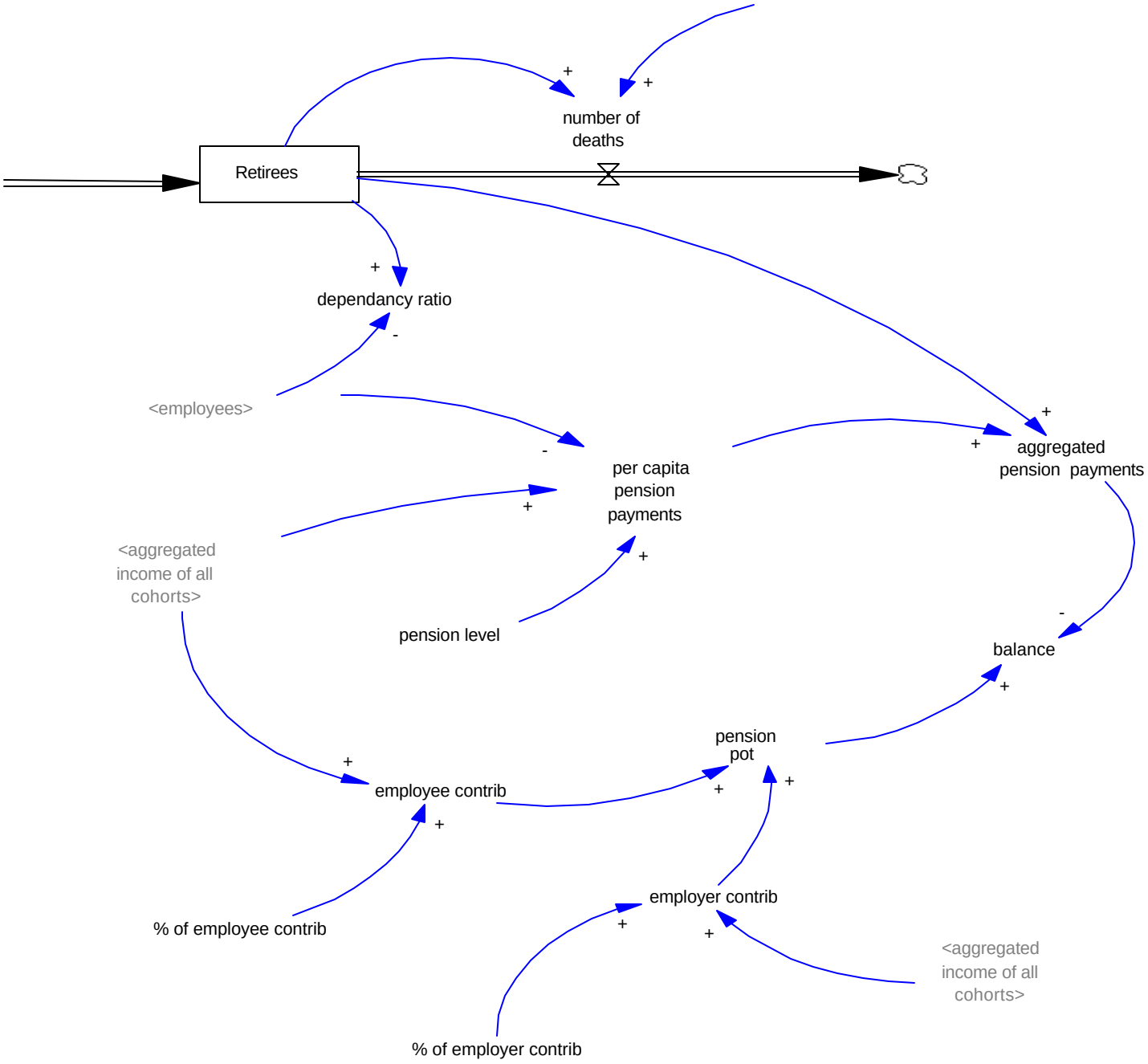
The Model (complete):

The System Dynamics model has the structure of an aging chain for the cohorts:



Some Characteristics (Part of the SD-model):

The influencing factors and parameters are modeled as follows:

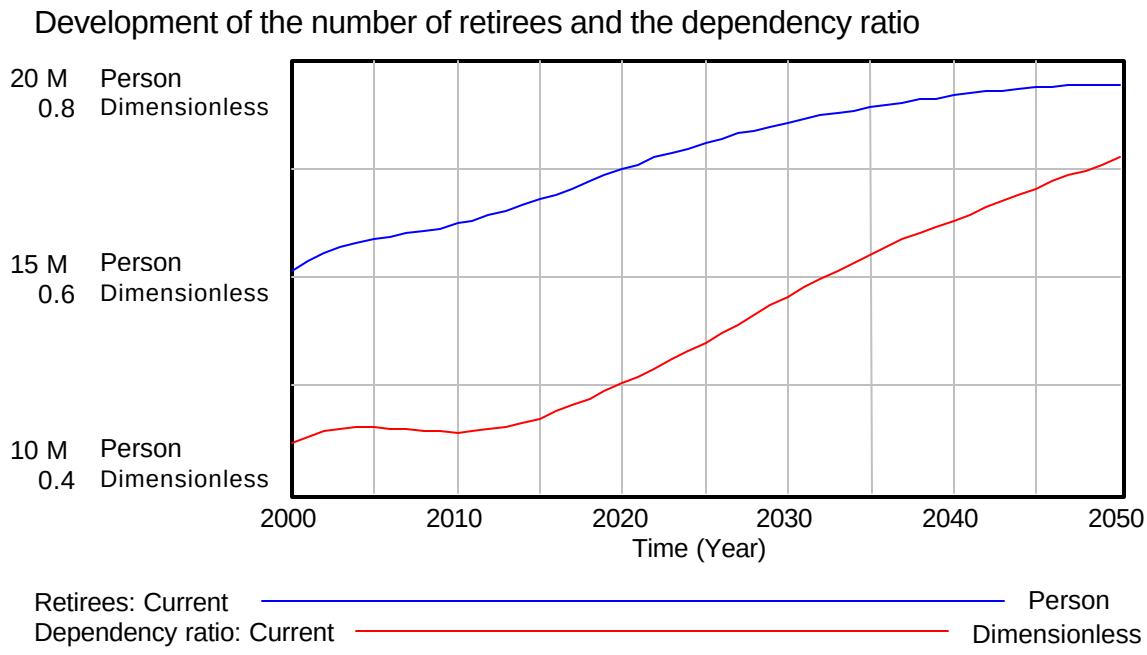


First Summary

A sophisticated System Dynamics Model (Vensim) of the German pension system has been introduced. Its structure follows an aging chain for the cohorts. The complex official data from the Federal Office for Statistics (demographic development 2002 to 2050) served as input values. Published research data of the economical development from 2002 to 2050 (integrated as table functions) helped to fulfill the crucial part of parameter choice and calibration. With the model being complete different pension systems and scenarios can be analyzed by altering the parameter values.

Results of the Simulation (1):

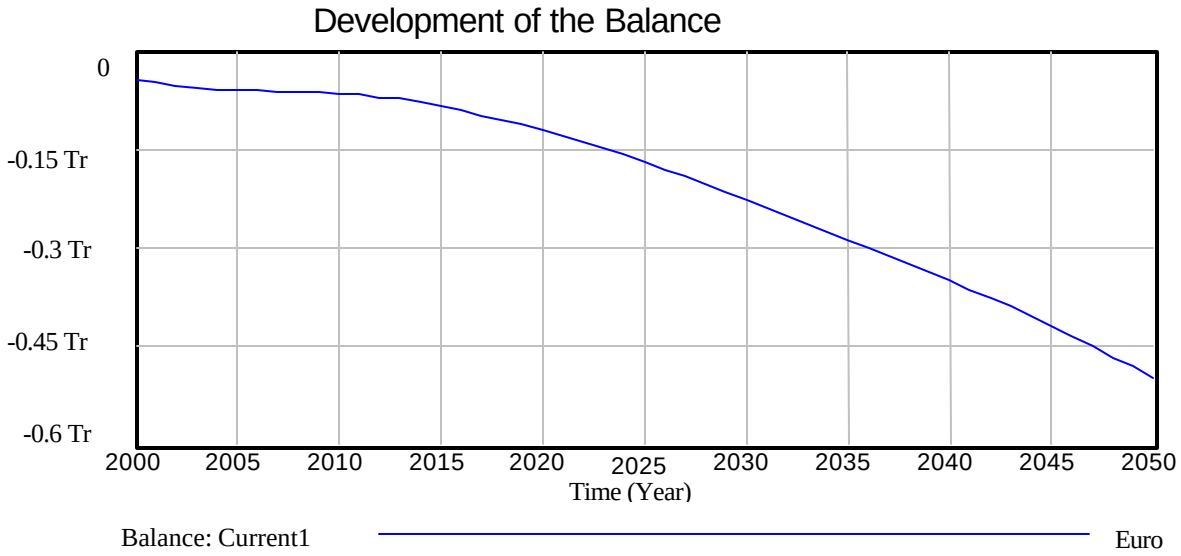
The first simulation shows us the demographic development in Germany:



To understand the drastic increase of the dependency ratio one must be aware of the fact that from 2014 on, the number of contributors is constantly sinking. In other words: The German population is aging drastically.

Results of the Simulation (2):

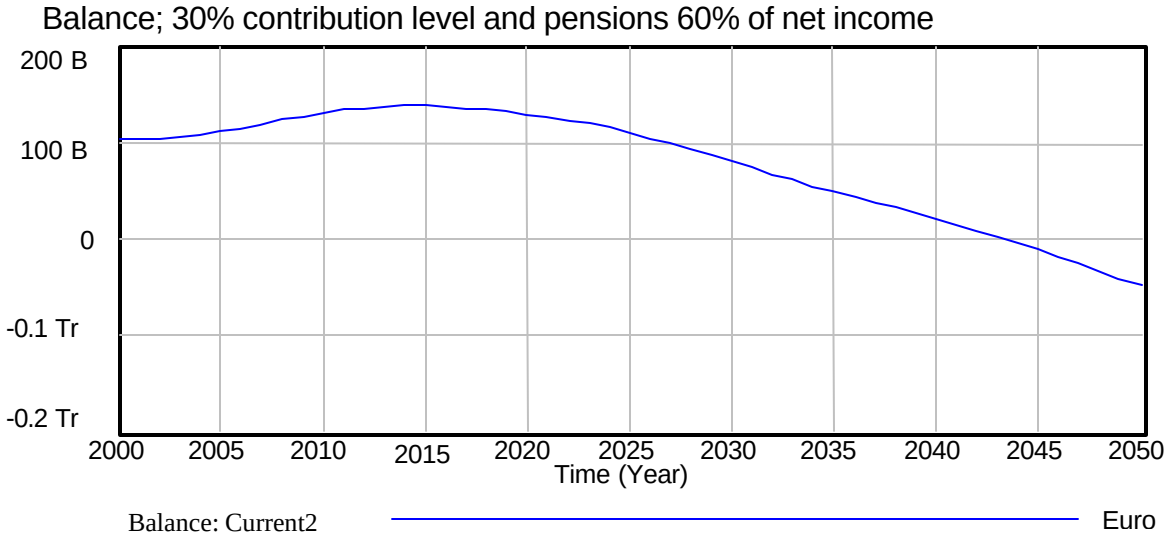
The balance was defined as the sum of all contributions to the pension system minus the "pension pot". It is quite interesting how it would develop without a pension reform as it is an indicator for the sustainability of the pension system:



The deficit of the balance, as we can easily see, is increasing dramatically. It seems to be not payable in future. A reform of the pension system was inevitable.

Results of the Simulation (3):

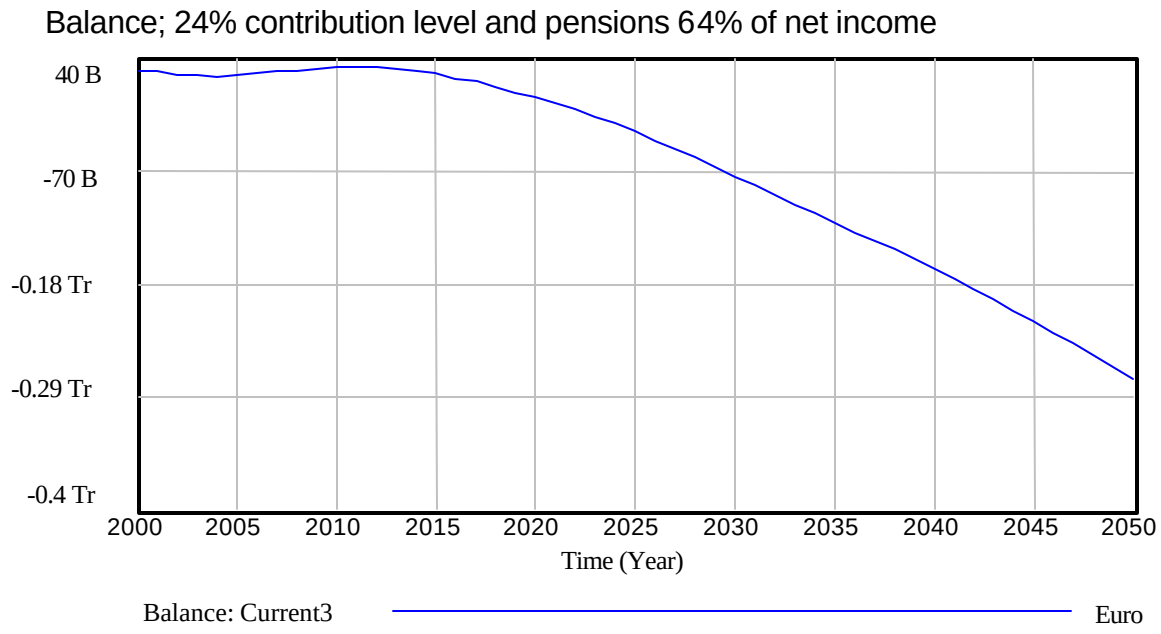
As one way out of the threatening situation, one very pessimistic point of view emerged: The contribution level was said to rise to 30% of net income while pension payments would decrease to 60%. Our simulation of this scenario tells another truth:



This is a possible solution because the balance is mostly positive thus payable. Nevertheless it is far from being a good solution because a pay-as-you-go system must not make profits. The burden for the contributors would be far too high while the level of the pensions would be far too low.

Results of the Simulation (4):

The next step is the analysis of the 2002 reform – the "Riester-Rente". As mentioned above, contributions are assumed to remain at 24% and pension payments at 64% of net income. We get the following development of the balance:



This shows that the expected deficit in 2030 is about 70 Bill. €. This seems to be payable – especially when compared to the traditional system without any reform and its expected deficit of 225 Bill. € in 2030.

Conclusion

Results show that reforming the pension system was inevitable to avoid a collapse of the pay-as-you-go system. The reformed pension system as it was introduced in 2002 seems to remain stable – at least until 2030. Different pension systems and scenarios were presented. System Dynamics provided to be an outstanding instrument to compare these different systems. A further analysis would encircle the effects of the reform on individuals.

References

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