

Can a Budget Simulation Model of Decentralized Territorial Authorities be Enhanced by an Artificial Intelligence Method

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Local authorities in Madagascar do not have yet a budget simulation model. Budgetary rationalization makes it possible to effectively predict and manage budget implementation. However, the local finance budget is always based on an ex-ante situation without taking into account the economic, political, the behaviour of the elected official, the electoral cycle, and performance indicators. Therefore, a numerical simulation (use in many developed countries) from computer tools or the use of artificial intelligence or AI that can effectively predict a local finance budget. Predictive analyses help to better identify the fundamental characteristics of the budget elements, in order to model them and anticipate the executions as best as possible. Rather, it is a practice that relies on statistical tools, but also on the search for correlation and regressions that are methods used to discover functional models, connecting a variable to be explained and a set of explanatory variables. The prediction of a primitive budget then consists of using the different models from a simulation in Prex-B-developed software for the budget of local finances or decentralized territorial collectivities.

Jel Code: C13, C12, C15, C63, P43, P47, C87, C88

Keywords: Econometric Analysis, Decentralized Territorial Collectivities Budget, Economic Modeling, Digital Simulation, Accounting Simulation, Artificial Intelligence (AI), Decision Tools.

1. Introduction

Information plays a fundamental role in a country's economic and social development. However, this information can only perform its function if it is supported by an information system, with computer equipment. In addition, information systems in developing countries operate on a traditional information process. As for developed countries, they are currently entering the post-industrial phase. This is how, at the moment, funding¹⁸ for public finance reform is turning to information technology, to maintain transparency, security, reliability, and

¹⁸ [...] The operational setting up of the program budget, of a Setting of Costs Medium-term, (CDMT) of a system of integrated computerized information and the popularization of the public finance procedures are the key elements to assure the transparency and the execution traceability of the public finances in Madagascar in the setting of the DSRP implementation. For the first year of bets implementation, the administration must make enormous coordination bus efforts of the needs of conceptions, information, communications, trainings and facilities are essential: trainings on the new procedures and new tools, facilities. To have an idea of such an effort, for the only project of the World bank. PGDI. more than 25 millions dollars will finance the SIGFP and (Integrated System of the Management of the Public Ministry of Finance) the reform of the procedures of management of the public finances.

Hajaniaina RAZAFIMAHARO, "Abridged of the budget analyses in Madagascar ", Public Governance and Politicians for a Lasting Human Development, Program UNDP MAG/97/007. DAP1, Office of study in System of information, Organization, Ministry of Finance and Data processing, February 2005, p. 29, 811 pages.

speed of accounting and financial data. Computer science has a significant impact on the functioning of modern economies.

2. Methodology

The tool of modelling and Prex-B¹⁹ forecast is among the indispensable tools to the treatment and to the resolution of the economic problems (algorithm, modelling and numeric simulation). It is also a rational means of access to the applicable²⁰ information of the budget of the decentralized territorial collectivities (CTD), to measure the long-term budgetary consequences, by the slant of the *DataWarehouse*²¹. This situation drove us to choose an architecture of *Data Warehouse or Store of data*. We excluded the choice of Big dated²², because the information is localized and updates to the level of the Township, but non centralized for all Townships.

The first process consists of creating a data base that will collect the information :

- of the administrative account ;
- of the political and economic conjuncture ;
- the electoral cycle, the type of the elected and his/her ideological preference ;
- on the parameters of the behavior of treasury of its organizers or the elected ;

¹⁹ A specific software for the budgetary modelling of the CTD called Prex-B: Forecast and Budgetary Execution developed by the author in 2017 coins Embarcadero Delphi RAD Studio XE 10 and SQLite data base.

Amaïde Arsan Miriarison TSIKOMIA, "To Optimize the budgetary performance of the Decentralized Territorial Collectivities: Research of a model", Thesis of Doctorate in economics. Public Economy, University of Antananarivo, 2017, p.151, 536 pages.

²⁰ [...] If they want to control the total level of the expenses and to distribute them efficiently of the economic view point, the budgetary authorities must fix priorities founded on two considerations. It is necessary, on the one hand, to improve the system of information to illuminate the budgetary and better choices to negotiate the possible outside contributions. It is necessary, on the other hand, to plan the public interventions to manage the conjuncture while preserving the future.

Pierre JACQUEMOT, Marc RAFFINOT, "The new politics / economic in Africa ", EDICEF, France, 1993, p. 288, 343 pages.

²¹ The best means to create a model are to search for similar events in the past. It is necessary to have a data base of all accounting information then.

Dates Warehouse: collection of data-oriented topic, integrated, non-fowls and historiated, organized for the support of the help process to the decision.

Architecture of a Dated Warehouse :

The food of the data from the bases of production is a primordial phase of a data warehouse. Some software tools are then necessary to integrate the data in the data warehouse. One speaks of ELT (Extract, Transform, Load). The phases of the food of a data warehouse are the following :

Discovered of the data: It is about identifying in the systems sources the data to import in the data warehouse. It is necessary to take the most discriminating data. A bad choice can complicate the following phases of the food considerably.

Extraction of the data: It is about collecting the useful data in the productive systems. It is necessary to identify the data having been modified in order to import the minimum of data in the data warehouse.

Transformation of the data: It is necessary to return the coherent data with the structure of the data warehouse. One of wall lamp then of the filters on the data. It can be necessary to convert the format of the data (EBCDIC toward ASCII for example) or to harmonize the formats of dates (dd/mm/yyyy). It is necessary to associate the fields source also with the fields targets. A field source "addresses" will be able to be decomposed thus for example in "number", "street", "postal code", "city" or the inverse. Finally, data of the production systems must either be aggregated calculated before their loading.

Loading of the data: It is the last food phase a data warehouse. It is about inserting the data within the data warehouse. It is a delicate phase because the quantities of data are often very important.

<http://www.supinfo.com/articles/single/1460-date-warehouse-warehouse-data>, consulted May 29 2017.

²² massive Data or mega data.

- on the indicator PEFA and (or Public Expenditure and Financial Accountability) indicator of objective by promise or electoral objective for every budgetary line (management centered on the result or GAR), the ratios and the analysis coefficients, of the management model of the free fund wished (fashion of cash balance)

In this design phase, explanatory variables are converted to a data field. We chose the SQLite²³ database, given its portability (no need to install drivers from the database), free version or freeware (no additional cost), not requiring a lot of resources (memory capacity) and open source²⁴.

The second process is to centralize in a single database or Data Warehouse.

And the third process is to program the interface of the budget prediction and simulation software and its various features in the calculation of regression, using the mathematical computing units of the publisher Embarcadero Delphi XE8²⁵ and a Microsoft Excel²⁶ spreadsheet in the background.

The search for different models from CA_N to CA_{N-k} , restructured by section and category, including the integration of explanatory variables (components) is carried out in the Prex-B software, performing multiple²⁷ linear regression operations in order to find the models by accounting equation.

The CTD chosen for the numerical simulation²⁸ is the Urban Municipality of Toamasina - I as the economic capital of Madagascar.

3. Some models of accounting simulations and local finances

Since the 1970, the development of computer and managerial equipment in public administrations (NPM) has given rise to numerous models of accounting simulation and local government finances. Like what:

- **Simulation models²⁹:**

- the SCRIBE (Rational Calculation System of the Budgetary Impact of Equipment) software created in 1971, to simulate the financing of each investment, taken separately, taking into account external factors such as: changes in tax revenues, the rate of inflation or the financial conditions of borrowing, and factors within the local budget: revenues and expenses induced from each investment and fiscal balance constraint;

- the MILIGRAM model (1977) was carried out by the Office of Technical Studies for Urbanism and Equipment (BETURE) to assess the financial situation of local public administration or APUL;

- the ORACLE model, created in 1979 by the Urban Planning Agency of the District of Rennes (AUDIAR) and the Research Centre for Applied Economics and Finance of the University of Rennes (CREFAUR) which takes into account the economic

²³ A data base embarked of serverless type.

²⁴ Code source of the program is modifiable, that is a possibility to update by the user.

²⁵ Publisher of interface in fast application development (RAD) in language Pascal object for the Windows platform and cellphone.

²⁶ Use of the VBA language for (Visual Basic Application) the statistical formulas, the multiple linear regression and of the boxcalf-contact graphic representation implemented via Delphi.

²⁷ The objective of the regression is to analyze a causal relation Y between a dependent variable and one or several independent variables X_i . In other words, the regression permits to determine the effects of the variable X_i on the dependent variable Y .

²⁸ Use of the artificial intelligence (IA): the development of the software Prex-B.

²⁹ Philippe ABECASSIS, "The behaviors of management of treasury of the territorial collectivities ", Thesis of doctorate in economics, University Paris X-Nanterre, 1992, p.314-330, 543 pages.

environment, with a large number of variables (inflation rates, updated tax bases, financial conditions of borrowing, housing programs in the community,...) often finer and better integrated into the scheme. For example, the rate of inflation is present thanks to three indices: the public service wage index is used to estimate the growth rate of personnel costs, the construction cost index affects housing and investment programs, and finally, the consumer price index serves as a deflator for other positions, the concept of public service is present in the simulation (this can only be carried out if the supply of services decreases maintenance of a minimum cash or political-financial coefficient (stagnation or decrease in one of the tax rates) may be taken into account. In the estimate, local decision-makers are made aware of losses caused by over-cash.

- **Local finance projection models:**

These models are of macro-economic order. " [...] *It is for this reason that, as make it notice P.H. DERYCKE and G.GILBERT (1988), these evolve in the setting of the National Accounting and without distinction between the different types of local collectivities*³⁰ ". For example, the survey of P. MANTZ and M. UNGEMUTH (1981)³¹ that uses the model "Administrations" to measure the effect on the local finances, in relation to an reference evolution, of six economic politics variants (prompt inflationary shock, drift stag flationniste, least growth of the spending power of the wages, slowing of the social help expenses, reduction of the state subsidies to the APUL and increase of the interest rate); It is in 1981, M. FOUNTAIN³², the model attributes for objective the impact survey of the economic policies on the balance of the local finances and measure, like P. MANTZ AND M. UNGEMUTH (1981), the effect of five economic shocks carrying on the product merchant and financier, the taxes received, the expenses of working, the current transfers received, and the versed current transfers.

- **Explanatory models of local financial behaviour:**

- the explanatory model A. GILLOUARD³³ (1982) proposes a behavior investment analysis of the Commons based on the assumption of a trade-off between medium-term considerations (autonomous factors of local sector growth) and short-term considerations (financial and/or political constraints);

- « [...] *the microeconomic CEREVE model (P.H. DERYCKE, G. GILBERT and A. TREMBLAY (1984-1985)*³⁴, *it was estimated on aggregated data for 715 municipalities with more than 10,000 inhabitants (Administrative accounts over the period 1973-1981): The municipal budget is traditionally separated into the operating section (called the current operating budget in the model) and the investment section (capital operations budget) and the institutional rules impose an ex-ante balance of each of these sections. The model describes local behaviors for achieving these balances: - the balance of the current operating budget is achieved by a confrontation between a desired amount of expenditure (some of which is incompressible, the other responds to a social demand) and associated operating revenues, of which only the tax can be changed. The balance is achieved by variation of tax resources, within the double limit of a (psychological) cap on taxation and the maintenance of self-financing capacity. In the event of an imbalance,*

³⁰ Philippe ABECASSIS, "The behaviors of treasury management t of the territorial collectivities ", Thesis of doctorate in economics, University Paris X-Nanterre, 1992, p.320, 543 pages.

³¹ Patrick LEVAYE, Patrice MANTZ, Michel UNGEMUTH, " The local public administrations since twenty years: a report, a problematic ", Statistics and financial studies, red set; n°379, 1981, pp 5 -34.

³² Martine FONTAINE, " The operations in capital of the administrations: Elements in view of a modelling ", Thesis of doctorate in economics, University Paris-I Pantheon-Sorbonne, 1981, p. 367, 410 pages.

³³ GILLOUARD Alain", the behaviors Analysis of the local sector investment - Test of econometric formalization ", Economic Notebooks of Brittany, n°1, Rennes, 1984, 21 pages.

³⁴ Quoted by Philippe ABECASSIS", The behaviors of treasury management of the territorial collectivities ", Thesis of doctorate in economics, University Paris X-Nanterre, 1992, p.328, 543 pages.

discretionary spending serves as a closure variable; - the balance of the investment section results from the same arbitration: part of the expenditure is incompressible (the principal repayment of the debt), while another responds to a "social demand" (induced, as in previous models by the Gross fixed capital formation (or FBCF) - household housing). Of the capital resources available, only debt can be the subject of local policy; it is therefore this variable that will serve as a closure, but without exceeding a certain standard (expressed per capita). (...) An unbalanced version of the model was produced by P.H. DERYCKE and A. KELLER (1986): it deepens the structural, static and dynamic properties of the model, and updates conventional adjustment parameters."

The goal is to implement a computer program for a digital simulation³⁵. François BOURGUIGNON and Amedeo SPADARO point out that " [...] *Micro-simulation models are analytical tools that simulate the effects of a given economic policy reform on a sample of agents (individuals or households) at the individual level. They are based on the analytical representation of the specific economic and institutional constraints faced by an agent and, if possible, his way of adapting his behavior to changes in these constraints*³⁶."

To conclude our search for the feasibility of using artificial intelligence for a budget model, the integration of process-modeling budgetary decision-making tools, and decision-making systems, will be carried out into a computer program, to create a prediction model, using the multiple linear regression method, called "Prex-B", followed by a numerical simulation, performance evaluation and internal budget indicators.

4. Mathematical model and modeling

The main objective of the models³⁷ is to become aware of the multiple interdependencies and to assess the cumulative effects of a phenomenon. According to Armatte (2005), " [...] *In a very general way, a model seeks to make intelligible a phenomenon perceived as*

³⁵ [...] *The word "simulation" means "to hold the role "or" to have the appearance" of an object. By " econometric simulation ", we will hear here the act to imitate the studied real world, while using a computer and the techniques of the econometrics. Since the real economic world is constantly in movement, the computer will always simulate the economic world changing more known under the appellation of " dynamic economic system ". The simulation is also an analogy, or more precisely it is a model of the studied system. It is why some experiences can be achieved on models and be impossible in the case of a real system. For example, the effect of different amounts of the State expenses can be tested" on an economic simulation model; such a test would be impossible in the reality. (...) The econometric simulation is a way to make a computer calculate a succession of processes and parameters that could take place in a complex and concrete economic system, under some hypotheses and definite constraints in the models of the mathematical equations, serve to solve the problematic. To establish these processes so that they are comprehensible by a computer tool, one must create algorithms of treatment and create a computer program.*

Sid MITTRA, "The theory of the econometric simulation and its applications ", Economic Magazine, Volume 19, n° 02, 1968, pp. 209-210.

³⁶ Of Burgundy François, Spadaro Amedeo, "The microsimulation models in the analysis of the redistribution policies: a brief presentation ", Economy and forecast, 2003/4, n° 160-161, 2003, page 232.

³⁷ Decision and modelling: " [...] *From the moment we must take a decision in a complex situation, notion that we can define the optimum, the minimum and the maximum, by the fact that it makes intervene a set of interdependent elements, we have need of a representation simplified of the reality that allows it to clarify the questions that it asks to define suitable answers. In a choice implying the collective, like the East all decision of a public actor, it can be about illuminating a collective deliberation. A model is thus commonly definite like a schematized representation and formalized of a reality to the sense where it mobilizes definite analytic categories, aiming to clarify the results of an analysis, to articulate its different components in a whole coherent, to simulate a dynamics "*

Quoted by Jean-Daniel KANT, "Math Contributions and of the data processing for the modelling in liberal arts and social ", Mathematical and social science, n° 197, 2012, p. 2, pp. 47-64.

*complex, and/or make possible experimentation, simulation and prediction. This dual use, as a figuration of a certain reality and a blueprint for its study, is characteristic of the model in modern sciences*³⁸."

In economics, the reference to "models" refers to very different questions and methods, the main categories of which are probably:

- Econometric models that aim to test relationships, highlight correlations, sometimes causalities (especially when it is difficult to identify direct mechanisms);
- Simulation models that, based on relationships between variables, allow scenarios to be developed of what their evolution might be;
- and optimization or game models (optimal control, dynamic, continuous or discrete, balances, games) that aim to highlight inefficiencies, study regulatory mechanisms,...

The relevance of a model is contingent on the objective for which it was built, and which makes it possible to judge the intelligence of simplifications. Criticism of the more or less great model realism must be discussed from this perspective: it cannot be assessed on the basis of the sensation of a resemblance between the model and other subjective representations of reality, but from the judgment that the parameters and useful variables to the understanding of modelled phenomena or situations of choice, have been appropriately retained and represented.

As in other scientific disciplines, economic modelling often uses mathematical formalization to represent relationships in the form of equations or diagrams. These equations allow for analytical solutions or computational calculations and computer simulations that can be compared to measured data.

This is then that modeling is a global process that involves the use of mathematical language as a means and as a tool but not as an end in itself, because of the importance of a numerical simulation to calibrate (concordance between probability predicted and observed empirically) the robustness to the variation of parameters or dynamism, or even the model versatility on different data types of the same category, such as the community budget. The conceptualization phase of the problem to identify the elements of uncertainty that will be addressed by the sensitivity analyses. In general, it is the identification of hypotheses that will need to be tested by sensitivity analyses.

The models then constitute a structured representation of the events observed in the field studied (management of public finances or GFP at the level of the CTD budget management sector), based on a theoretical approach and adapted to empirical observation. They quantify the causal relationships that govern the budget management of the CTD in a systematic and accessible way. By their intrinsic nature, they are therefore an important tool for helping design and decision-making. They can be used to:

- better understand the current situation and their historical evolution;
- forecast the short-, medium- and long-term fiscal outlook;
- simulating and testing political alternatives (ex-ante simulation);
- and evaluate the results of policy decisions, once they have been implemented (ex-post simulation).

The model predicts well for the basic sample, from which it is established hence a problem of optimism. Hence, from these simulations, the experimental results allow us to return to modeling to enrich it.

³⁸ Quoted by Jean-Daniel KANT, "Math Contributions and of the data processing for the modelling in liberal arts and social", Mathematical and social science, n° 197, 2012, p. 48, pp. 47-64.

5. Digital simulation

The purpose of numerical (or classics) simulations is to reproduce by calculation the behavior of a system described by a model that very often consists of equations with partial derivatives. They are also called "*digital experiments*", which allow to reproduce, on a computer, a phenomenon whose evolution one wishes to study. It is based on the programming of theoretical or mathematical models (integration of movement equations, differential equations, etc.) that are adapted to numerical means.

The use of digital simulation has very important economic impacts, with on the one hand a reduction in research and development costs, because everything happens in a laboratory (including an existing computer tool) and on the other hand, a greater reactivity regarding the development of new software by bringing a specific software development on the system studied. In fact, the numerical simulation of a mathematical model simulates the equations that describe the different economic problems and their solutions in the real phenomenon.

"The word "*simulation*" means "*to play the role*" or "*have the appearance*" of an object. By "*econometric*"³⁹ simulation" we will mean here the act of imitating the real world studied, using a computer and techniques of econometrics. As the real economic world is constantly changing, the computer will simulate the ever-changing economic world known as the "*dynamic economic system*." Simulation is also an analogy, or more precisely it is a model of the system studied. This is why some experiments can be carried out on models and be impossible in the case of a real system. For example, the effect of different amounts of government spending can be "*tested*" on an economic simulation model; such a test would be impossible in reality. (Sid MITTRA 1968)⁴⁰. »

Econometric simulation is a way of having a computer calculate a succession of processes, and parameters that could take place in a complex and concrete economic system, under certain assumptions and constraints defined in the models of mathematical equations, used to solve the problem. To establish these processes, in order for them to be comprehensible through a computer tool, one must create processing algorithms⁴¹ and create a computer program.

To achieve a reliable and stable model, several simulation tests will calibrate models⁴² (constraints, constant values and estimation of errors or residues) by experiments from the past to the present or from the present to the past (ex-post versus ex ante and vis-versa).

³⁹ [...] The electronic computers make possible of the fast progress in three branches of the economy, to know: The analysis of the regression, the analysis of the pictures of entries/exits (input-output analysis), and the linear and nonlinear programming. The increasing understanding of the dynamic nature of the computers has, besides, led to the development of the most recent technique commonly named in the literature present "*simulation on computer*". However since it covers the simulation as well as the technical econometric, we prefer to name it technique of "*simulation econometric*". (...) A mathematical model of an economy has two complementary aspects; firstly, a set of equations that constitutes the model abstracts and, secondly, a numeric information representing the efficient behavior of the economy. When this model is translated in language for computer so that some experiences are feasible, it became a model of econometric simulation.

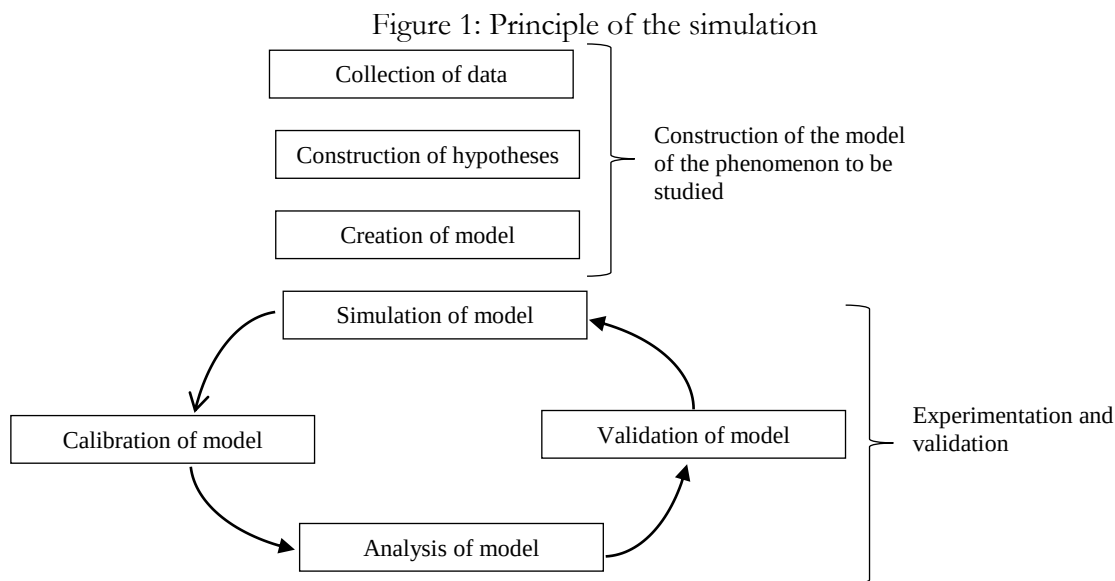
Sid MITTRA, "The theory of the econometric simulation and its applications", economic Magazine, Volume 19, n° 02, 1968, p. 209.

⁴⁰ Sid MITTRA, "The theory of the econometric simulation and its applications", Economic Magazine, Volume 19, n° 02, 1968, p. 210.

⁴¹ The set of the rules specifying the symbols to transform, the moment and the modes of these transformations. It is incorporated to a set of instructions for the named computer "*programs*".

⁴² The introduction interest of adjustment constants: For Raymond COURBIS (1983, p. 82), " [...] the introduction interest of adjustment constants is multiple: "*to wedge*" the model on recent observations or on "*probable*" evolutions encoded "*out model*" with the help of other methods (one could also return exogenous some endogenous variables but the model cannot be used more in simulation); to permit to correct the systematic slants that appear the simulations made ex-post on the past; to take account of that

According to Benoît CALVEZ (2007), "[...] The term computer simulation can have different meanings. Thus, as Varenne (2001) points out, Pritsker (1979) has identified 21 different definitions. (...) Drogoul (1993): Simulation is called simulation, the scientific approach of making an artificial reproduction, called a model, of a real phenomenon that one wishes to study, observing the behavior of this reproduction when one varies certain parameters, and inducing what would happen in reality under the influence of similar variations⁴³".



Source: Benoît CALVEZ (2007, p. 4)

6. Computer simulation: development of a Prex-B Budget Prediction Program

The best way to create a template is to search for similar events in the past. It is therefore necessary to build, from a budgetary and accounting information system, this information base that will enable learning to be built.

Even though the massive management of scattered data and the ability to analyze it to transform it into a decision-making tool, "[...] Big Data - or automated analysis of massive amounts of individual data thanks in particular to "machine learning" (or machine learning, by virtue of which computers learn from the data transmitted to them, and no longer simply content themselves with "running algorithms) to make it into a sort of Smart Data-, is **therefore one of the essential evolution challenges of business services professions**, such as more particularly business intelligence consulting which is characterized by its ability to find, protect and use qualified information⁴⁴".

the "residues" correspond for part to the impact of factors non introduced in the relations (or that, for statistical reasons or econometric, one could not take in account); and to translate the impact of factors or new mechanisms".

Thus, several models using the interfaces articliers appeared, to know: - Macroeconomic model of Madagascar (or two MA), Strategy Papers heart Human Development, Model of Simulation for the economy Guinean, National-regional Integrated model of the economy Moroccan. Projection Macro econometric and of Simulation, Poverty Analysis Macroeconomic Simulator, revised Minimum Standard Model, R V Revised Minimum Standard Model with additional year modulates heart poverty and social indicators.

⁴³ Benoît CALVEZ, "The calibration of models to basis of agents for the simulation of complex systems", Thesis doctorate in data processing, University of Évry Valley of Essonne, 2007, p.4, pp. 153.

⁴⁴ <http://www.portail-ie.fr/article/1248/L-intelligence-e-conomique-have-the-meeting-of-Big-date-1-2>, consulted the 20/09/2017.

Data recovery can be facilitated by existing technologies (databases with structured and homogeneous data by category or the existence of a comprehensive Data Warehouse, unlike Big Data⁴⁵ whose data are variable or heterogeneous, on different media and formats).

According to Forrester Research, predictive analysis highlights a six-step cycle:

- Identify useful data by evaluating a variety of possible sources
- grinding data, aggregating it, completing it...
- build a predictive model from statistical algorithms;
- assess the effectiveness and accuracy of the predictive model;
- use the predictive model to guide business decisions;
- and to monitor the application and effectiveness of the predictive model.

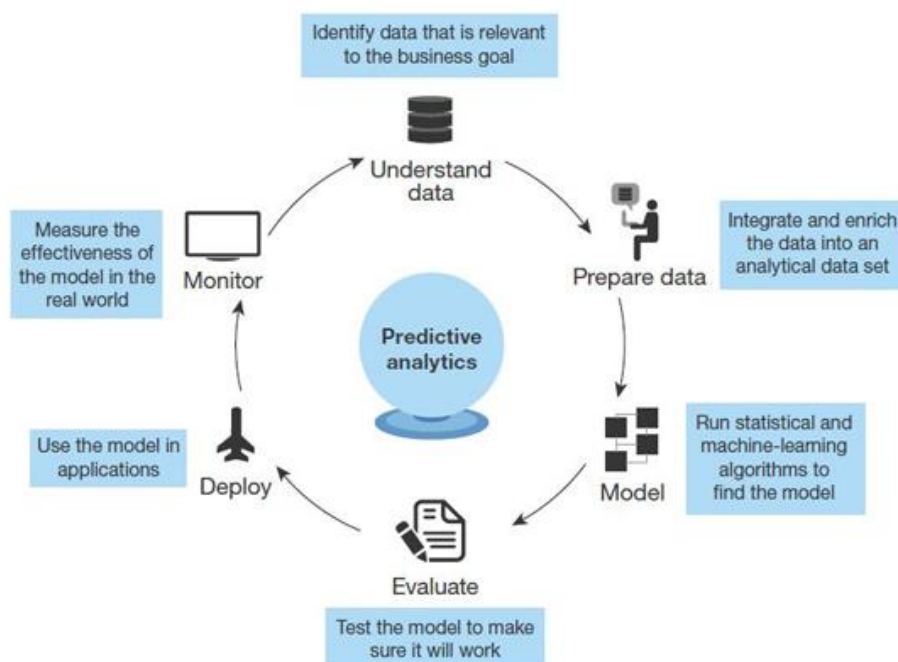


Figure 2: Forrester Research's Six Predictive Analysis Steps

Source: <https://www.forrester.com>, "The Six Key Steps of Predictive Analytics," April 2017.

Predictive analysis helps to better identify the fundamental characteristics of the budget elements, in order to model them and anticipate the executions as best as possible. This predictive analysis is not a tool in itself, it is rather a practice that relies on statistical tools of course, but also the search for correlation and regressions that are methods used to discover functional models, connecting a variable to explain and a set of explanatory variables.

⁴⁵ The notion of "Big Data" refers (data massive or mega data) so to a set of data voluminous that it is difficult to treat it with the classic tools. It is often about data coming from various sources and that are recorded in order to permit their exploitation and their analysis without predetermined goal and without limit of time. The Big Data answers in principle four features: volume (big quantities of data), speed (the delays of actualization and analysis of the data are always shorter and they are the more often treated in real or almost real time), variety or heterogeneity (the analyzed data are not necessarily structured) and value (the increment that the analysis of the data represents and the uses that it is possible to make some).

7. Basic concept

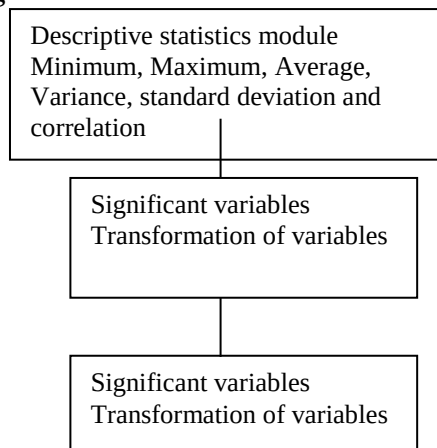
7.1. Data Clean-Up

Defining the size of the database and choosing how it is developed requires a diagnosis of the potential data quality. Poor data quality (input errors, zero fields, outliers) usually requires a data clean-up phase. The purpose of this is to correct or circumvent inaccuracies or errors that have crept into the data. This is the data from the centralized Data Warehouse.

7.2. The actions on the variables

Now the data is reliable, it needs to be transformed to prepare the analysis work. It is a question of intervening on the variables, to facilitate their exploitation by modeling. This process consists of removing outliers and using averages (descriptive statistics and box-plot), checking correlations, and transforming the value of variables⁴⁶. The transformation of the variable has improved the predictive quality of the model; it describes better, is closer to the observed data.

Figure 3: Process of actions on variables



Source: Author, 2017

7.3. Assessing the result of modelling

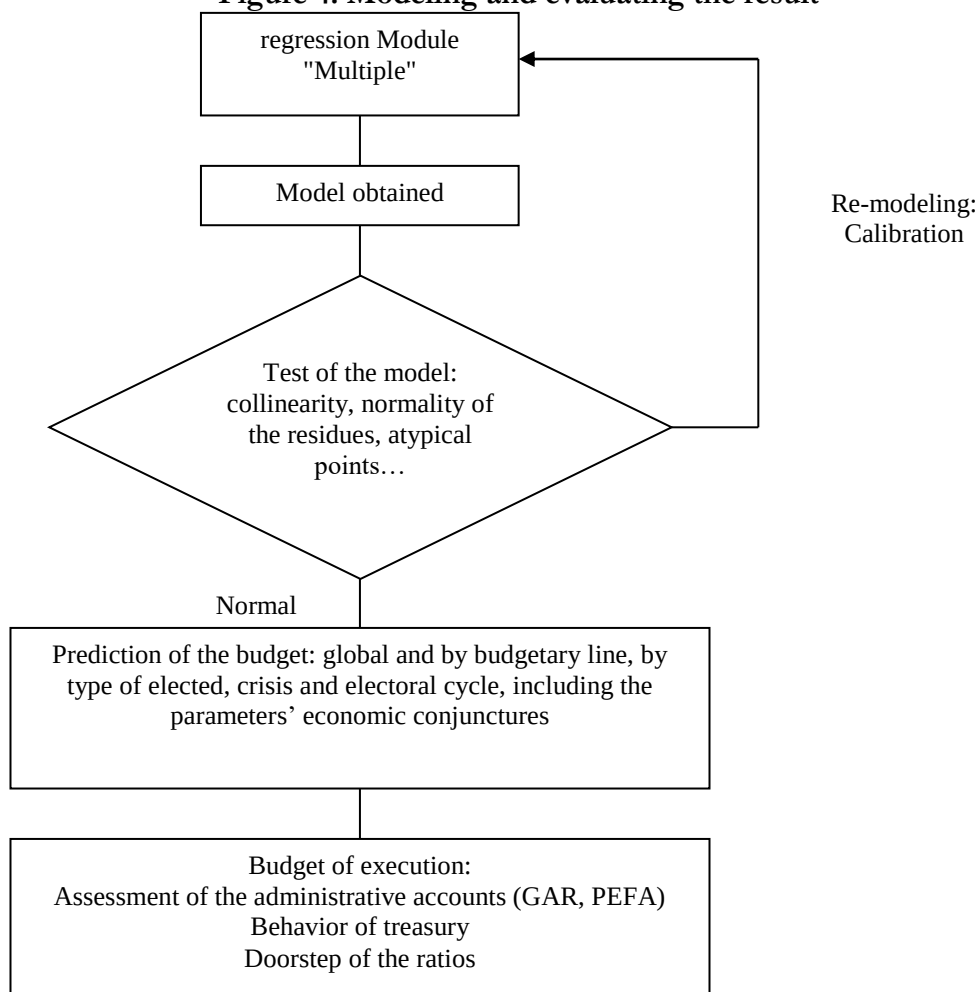
The evaluation of the result allows us to estimate the quality of the model, i.e. its ability to correctly determine the values it is supposed to have learned to calculate on new cases. This assessment usually takes a qualitative and quantitative form.

The qualitative form consists of rendering knowledge in graphic or textual form. This contribution improves the understanding of the results.

Quantitative form requires some functional expertise such as interval confidence, test validation,...to interpret the results.

⁴⁶ it is very important so that the values have the same proportion to avoid the effect of one or several variables on the model so that their average and gap marks will be more or less the same. The most current transformation for a dependent variable is to take its logarithm, the most often the natural logarithm, while using the basis that is worth 2 roughly⁷¹⁸²⁸.

Figure 4: Modeling and evaluating the result



Source: Author, 2017

7.4. The emergence of decision-making tools: expert system in artificial intelligence

Expert systems⁴⁷ technology is one of the disciplines of artificial intelligence (AI). Expert systems then allow to:

- know how to make deductions from a proposal;
- store factual data (initial facts, intermediate results) in short-term memories and depends on the situation studied;

⁴⁷ [...] The birth of the LA is often positioned to the seminary of 1956 that was held in Hanover (USA) and that united notably John Carthy, the promoter of the seminary and the father of the artificial intelligence term Herbert A. Simon, theoretician of the organizations and future Nobel prize of economy as well as mathematicians Allen Newell, Marvin and Claude Shannon (...) this ambition rests on the hypothesis according to which thought functions like a logical machine that solves some problems to the manner of a programmable automaton. (...) The practiced systems, or system to basis of knowledge, are the computer programs that simulate the reasoning of human experts. The architecture of the practiced system is constituted of four elements: a basis of knowledge (Knowledge Base), a basis of facts (Facts Base), a motor of inference (Inference Engine) and a module of explanations (Self Explanatory Module).

Emamnuel LAURENT, " To Optimize the management of treasury by the modelling econometric of the financial fluxes: Theory and application to the treasury of the general régime of the social security in France ", Publibook: Economica & Management, France, 2006, p. 238, 431 pages.

- program the successive stages of problem solving (algorithms) to achieve a goal given. A resolution process, either by modification or by adding elements to the de facto basis;
- and create a module to explain one's own reasoning, to develop the result (reports or reporting data), in order to make decisions in an uncertain environment.

Currently, decision-making systems (or DSS for *Support System Decision*) are broadly "*an organized set of people, procedures, software, databases and tools used to facilitate decision-making and the emergence of solutions to complex problems (Stair and Reynolds, 2006, p.243)*"⁴⁸. "Always quoted by Cité by Simon Doucet, Olivier De La Villarmois, " [...] Frolick and Ariyachandra (2006) present BPM as an evolution of DSS (*Support System Decision*), EIS (*Executive Information System*), DW (*Data warehouse*) and BI⁴⁹ (*Business Intelligence*) tools. DSS were the first decision-support tools to help managers deal with semi-structured problems in the early 1970s. In the mid-1980s, EIS was added to help executives easily manipulate this information, without necessarily reprocessing it, with quick, synthetic and visual access. The explosion of computer systems has led to the emergence of DW. They are revolutionizing decision-making tools by bringing data together in a single, object-oriented database, allowing for great flexibility and precision in information production. A few years later, Intranet and Internet technologies gave rise to BI's tools; They bring together all the infrastructure needed to store information (e.g. DW) and new analysis tools such as OLAP (*OnLine Analytical Processing*) and SQL Server, facilitating data⁵⁰ integration and analysis."

BPM (Business Performance Management) is a budget decision-making tool, based on the modeling of the company's processes (integrating all the company's processes and facilitating simulation). While only BI tools usually concern certain parts.

According to Simon Doucet and Olivier De La Villarmois, the following features characterize these tools:

Table 1: Features of BPM

Functionality	Description
Structuring information and the process	Modeling the company's various "trades," key factors for success, resources and relationships with other "trades." Synchronization financial and operational variables. Evolution of models according to strategies (acquisition, restructuring, project, etc.) and understanding of processes.
Management of iterative processes and simulation	Automation and security of iterations that facilitate simulations. Decomposition of phenomena in stages. Bottom up and top down simulations (causes or consequences) for analysis.
Spreadsheet interface (native)	Preservation of the spread shivery as an interface and work tool, which is an incentive for creativity by the ability to introduce external elements or modify patterns.
Network operation	Operating in OLAP and SQL server technology (single database), sharing projects t associated data, interactive data (all places, anytime) and real-time processing.
Versioning	Budget versions are automatically codified and classified to maintain traceability of the progress of the respective reasoning and commitments.
Pre-configured financial tools	Revenue of actual or simulated financial statements (balance sheet, revenue statement, cash flow, interim management balances, financing table, ...).

⁴⁸ Quoted by Simon DOUCET, Olivier OF THE VILLARMOIS, "To Reconsider the budget: The way of the decisional computer ", Accounting and environment, May 2007, France, p. 6, 25 pages.

⁴⁹ The decisional computer or Business intelligence (BI) covers a whole with technologies and tools that permit to treat an important sum of information, at the end of the process, to present to the decision-makers of the reliable and applicable indicators.

⁵⁰ Quoted by Simon DOUCET, Olivier OF THE VILLARMOIS, "To Reconsider the budget: The way of the decisional computer ", Accounting and environment, May 2007, France, p. 7, 25 pages.

Functionality	Description
Multi-analytical syntheses	Restitution of analytical statements (strategic, product, financial, commercial, managerial,...), in different forms (tables, graphs) and interactively (zoom in/out/cross-sectional and real/simulated). These statements give players (managers or operations) an integrated version of the strategies, actual results and prospects predicted.

Source: Quoted by Simon DOUCET, Olivier DE LA VILLARMOIS, "Rethinking the Budget: The Way to Decision Computing," Accounting and Environment, May 2007, France, p. 7, 25 pages.

According to Craig SHIFF⁵¹, PMOs are characterized as follows:

- formalization of budgetary and planning processes, allowing for iteration reduction and time control;
- the centralization of strategic data (internal and external, real or simulated, operational or functional), giving a common view of the performance axes, present and future;
- the return of this information and strategic objectives, allowing easy and immediate access to all the latest simulations, new projects or models;
- the identification and traceability of sources of profits or losses, allowing for immediate reframing of operations or strategic options.

According to E. TURBAN, Jay ARONSON and TING-PENG LIANG (2005), the formalization of budget processes is presented as in the figure below.

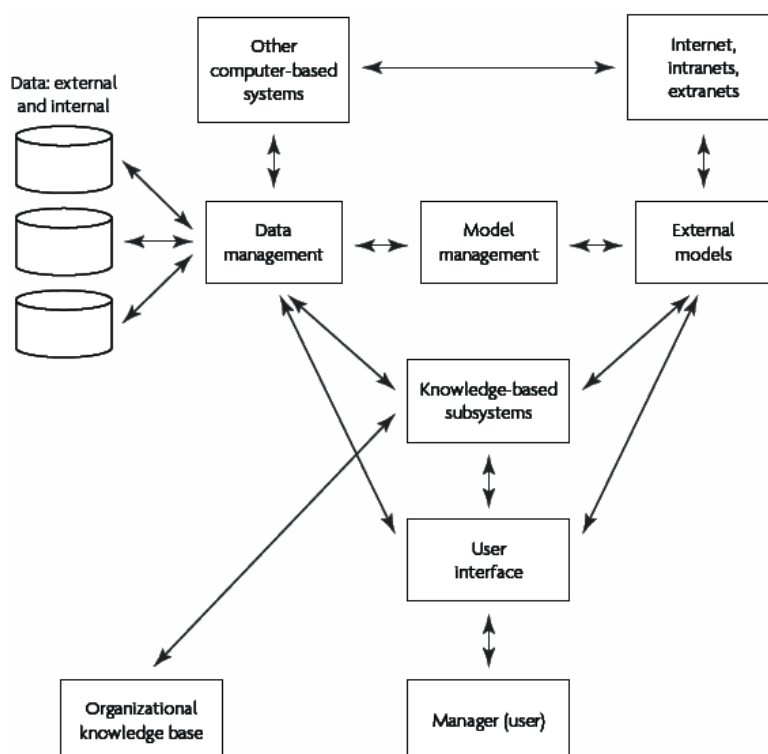


Figure 5: Support Systems Decision and Intelligence Systems

Source: E. TURBAN, Jay ARONSON, Liang TING-PENG, " Support Systems Decision and

⁵¹ Craig SCHIFF, "Maximize Business Performance: BPM. the Real Benefits, " In three parts, DM Review Magazine, October, November and December Issues 2003.

Intelligence Systems," 7th edition (Upper Saddle River, NJ: Prentice Hall, 2005), 109. For example, based on BPM key steps in budget information and key elements of ERP for better management and accounting control, the Prex-B software modeling and simulation process was developed in Figure 6 below.

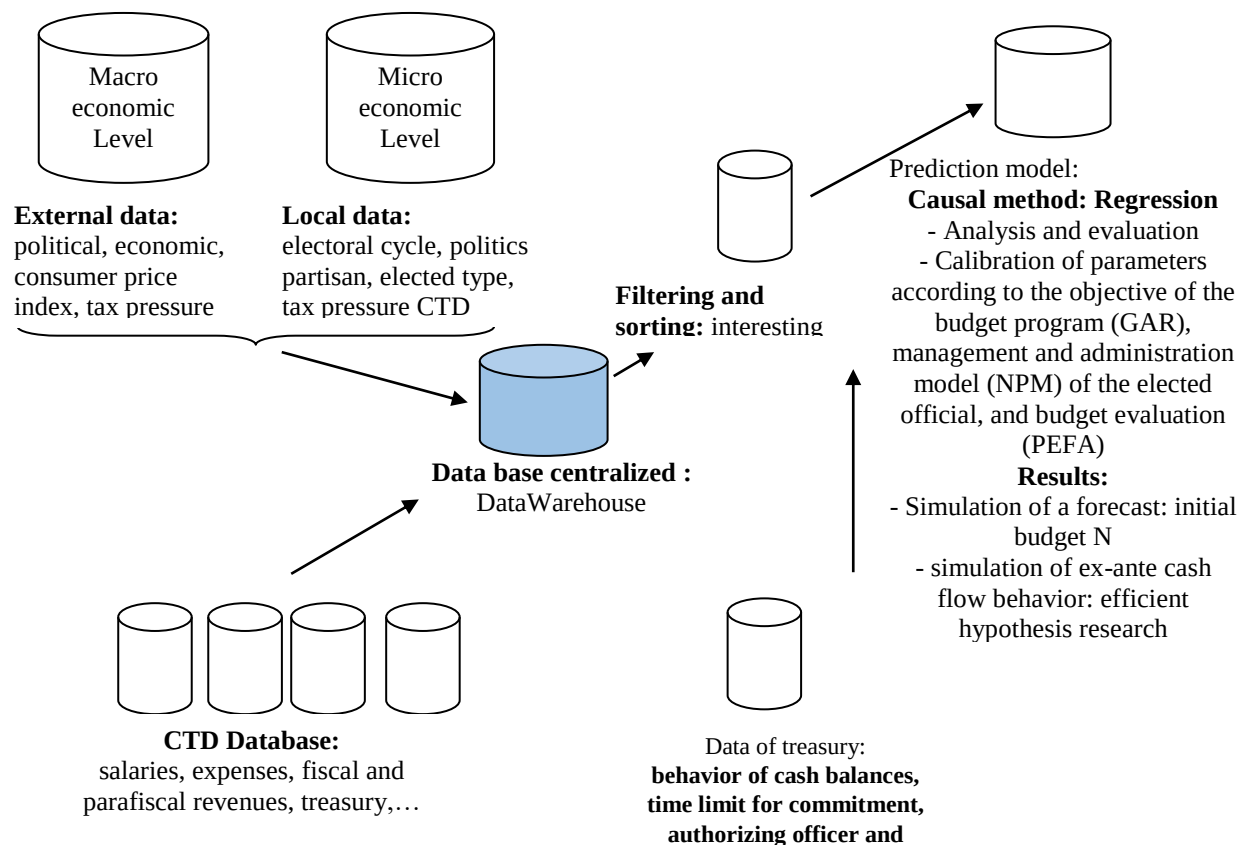


Figure 6: Key step for the modeling and simulation process

Source: Author, 2017

7.5. Transforming explanatory variables into data fields

The transformation of explanatory variables is to codify these variables. They will then be considered data fields for each table (entity) in the Data Warehouse database⁵².

Short-term stability variables (CT) are variables where their values can be influenced by socio-economic variables. Those of the medium term (MT), due to a frequent evolution (for example, an increase in housing that changes the securities issued by the property tax on built properties or IFPB, annual change in investment, change in the political strategy or status of the elected official (non-partisan to partisan or vice versa), the annual remainder of the budget, the budget transfer due to the change of objective and program... and long-term (LT) process throughout the program budget implementation process.

⁵² A data base is constituted of a set of data structured, stocked on physical supports, and managed by a set of software and materials that one calls Management System of Data bases (SGBD). A SGBD is, therefore responsible of the creation, manipulation and maintenance of the data base. A relational database is a data base structured according to a model permitting to raise some relations between the different objects that it includes.

7.6. Computerized Regression Processing Modules

Before establishing the different modules of regression processing, it is necessary to define the different practical elements of multiple regression. In general, according to Frédéric LAVANCIER⁵³, in order to regress⁵⁴ well, the following three steps must be carried out:

- *first step*: the process of estimating and validating a model are as follows:

- observe the link between Y and each of the explanatory variables: through dot clouds and by calculating linear correlations (check that a linear link seems reasonable). Failing that, the explanatory variable must be transformed to make the linear link with Y more convincing;
 - check the significance of explanatory variables (Student tests);
 - change the model accordingly (delete non-significant variables);
 - check that there is no instability due to multi-colinearity. If a problem removes from the analysis an explanatory variable that is too correlated to another, or perform a robust regression;
 - analyze the residues $\hat{\epsilon}$ by checking:
 - the non-correlation of $\hat{\epsilon}$ and $\hat{Y}$: graphical point cloud $(\hat{\epsilon}, \hat{Y})$ analysis. If a problem, the initial linear link may be called into question;
 - homoscedasticity: graphic analysis of tested residues, Breusch-Pagan test. If a problem, a transformation of variable Y may be useful; or if the different variances are estimated, adjust the model by the Generalized Least Squares (GLS).
 - if the observations are sampled over time, the temporal non-correlation of the residues: graphic analysis, Durbin-Watson test, Breush-Godfrey test. If a problem, we can include Y past in the explanatory variables, or model the temporal dependence of residues to use GLS;
 - if there are few observations, the normality of the residues (using a qq-plot);
 - to analyze the impact of each observation: by calculating their distance from Cook (distance of Cooks), possibly to exclude from the analysis the individuals too atypical;
- *Step two*: choose the best model from $X_1, \dots, X_p$ explanatory variables

- Automatic procedure:
 - The selection criterion in these algorithms can be chosen AIC (Akaike information criterion, measure of the quality of a statistical model proposed by Hirotugu Akaike), BIC (bayesian information criterion), measure of the quality of a statistical model derived from AIC proposed by Gideon Schwarz), R^2 .

When the number of observations is large ($n \rightarrow \infty$), only BIC chooses the right model, the others can select a model too big (but not too small).

⁵³ <http://www.math.sciences.univ-nantes.fr/~lavancie/enseignement/Pratique%20de%20la%20re%CC%81gression.pdf>, consulted the 11/09/2017.

⁵⁴ To explain to best the quantitative variable Y like a function refines some p variable explanatory X , with X_p all supposed quantitative, it is necessary to respect the procedure of evaluation and validation of the model, and to choose the best model descended of the explanatory variable p .

- Comparison between two models:
 - Fisher test (ANOVA) if they are entangled, if not by comparing their AIC, BIC, or R^2 .

Whichever final model is chosen, points 4, 5, 6 of the above model estimation and validation procedure should be checked.

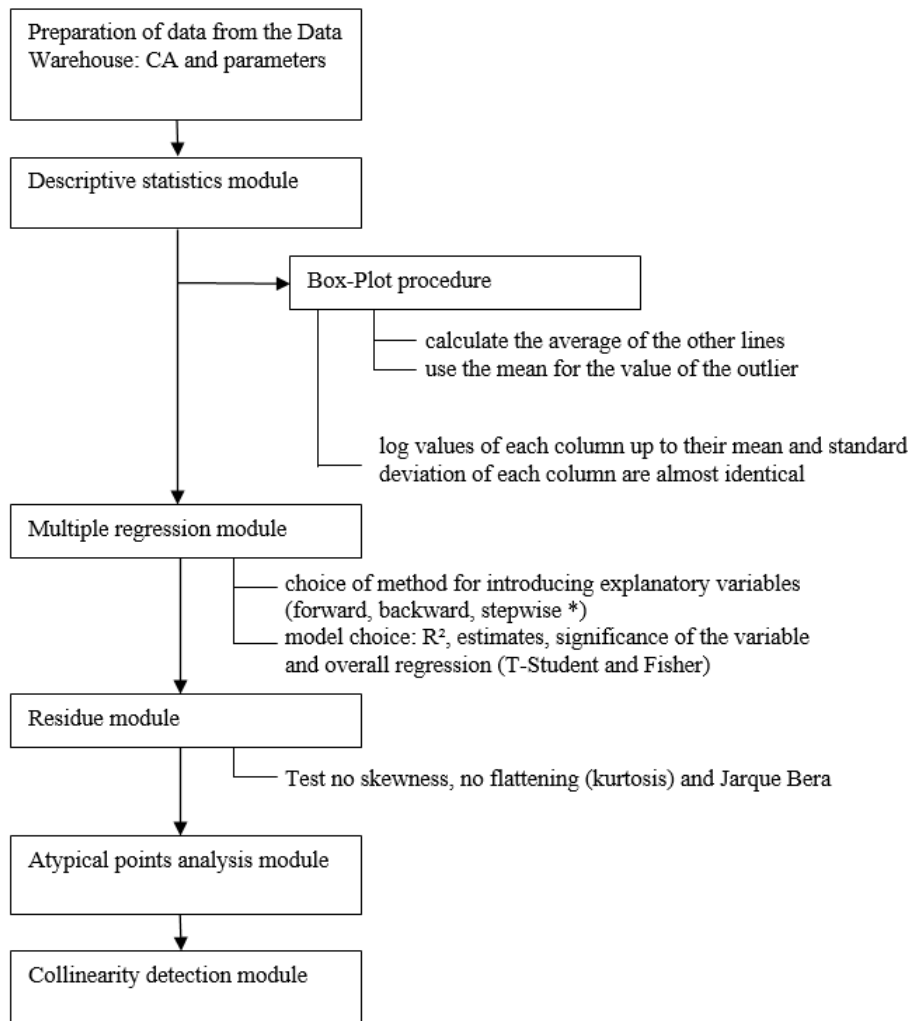
- *Third step:* use the model

- Testing linear constraints on parameters: either by hand by comparing the SRS of the constrained model and the full model;
- Forecast.

Thus, we have the four regression modules:

- descriptive statistical module;
- multiple regression module;
- residual module;
- and module analyzes atypical points.

Figure 7: Computerized Multiple Regression Processing Module



Source: Author, 2017

* *The forward (or ascending) method*: it consists of introducing as the first explanatory variable the variable most correlated to the variable to be explained. If this variable is significant (at the error threshold that can be given), it looks among the remaining explanatory variables for which the partial correlation coefficient is the highest, i.e. the correlation between y and this variable, conditionally has the presence of the variable already introduced. If this new variable is not significant, the procedure proposes to retain the model obtained before the introduction of the latter variable. If it is significant, the procedure continues to introduce variables until there is no longer any significant variable to introduce.

The backward (or descending) method: it consists of introducing all the explanatory variables and looking at their significance. If some variables are not significant, it removes the least significant. Once this variable is removed, it looks at the significance of the remaining and removes, among the non-significant, the least significant. The procedure then proposes to retain the model where all the remaining variables are significant.

The stepwise method: it starts as the *forward* method, and then when it adds a variable, it tests whether the previously introduced variables are still significant. Otherwise, it removes the least significant and then tries to introduce another one. It combines the two methods. Taking into account the importance of ex-ante evaluation of all budget allocations in the design of the means budget and program budget, Prex-B software is configured in *backward* mode. So once the parameters or variables are estimated, we can check them and remove the non-significant ones in the calibration⁵⁵. The value of the R^2 is also verified at each type of model, not to mention the overall regression assessment. It is after that one can use a model, build a forecast for the future value of the primary budget (in terms of volume, expenditure and revenue). Forecasts by heading are based on the percentage or ratios of CA_{N-1} .

7.7. Data warehouse data preparation

A first column of data corresponds to the labels of the observations (budgetary year).

The first line corresponds to the name of the variables.

A final variable in the last column corresponding to the endogenous variable (annual budget volume), i.e. the other columns correspond to the exogenous variables. The number of exogenous variables is not limited, the Prex-B program automatically compiles CA information at this disposal (for example, an `Annee.prexb` compilation file: 2013.prexb). All examples of numerical simulations are presented in the appendix (Prex-B software interface and simulation guide).

7.7.1. DESCRIPTIVE STATISTICS MODULE

This module allows to calculate descriptive statistics on the data, several indicators are available, they allow to give an idea on the characteristics of the data. For example, if the standard deviation is zero, it means that the variable is composed of a single value, it is a constant, it is unusable for regression; If the difference between the averages or the standard deviation of each variable is too large, the logarithm must be made for the variable concerned...

⁵⁵ After the deletion of the atypical observation, one achieves the procedure backward (order calibration in Prex-B). One eliminates the least applicable variable, to the sense of the Student's t (the square of the weakest T-Student), if it is not meaningful to the risk of 5%. One restarts with the remaining variables. The process must be interrupted, when it is not more possible to suppress a variable. Thus, one gets the optimal balance model (a verification of the individual uselessness of the coefficients, test simultaneous uselessness and global significance of the regression and test of collinearity).

7.7.2. Multiple Regression Module

To perform the classic tests of coefficient meaning:

- R^2 determination coefficient and error standard deviation;
- individual nullity test of coefficients;
- variance analysis test;
- simultaneous nullity test of all coefficients associated with variables: test of the overall meaning of regression.

7.7.3. Module of residue

This is the projection of values from the coefficients of the regression right and calculates the residues. Several statistical indicators are calculated, the coefficients of asymmetry and flattening allow to evaluate, very approximately (very asymptotically), the normality of the residues. It also verifies the *p-value* value. If it is well above zero, compliance with the normal law of error is not contradicted by the residues observed. And the average residue is necessarily equal to zero for a regression with constant.

7.7.4. Atypical point analysis module

It calculates series of indicators designed to highlight the possible existence of atypical observations in compiled CAs. The most interesting indicators used are LEVERAGE, which indicates an anomaly in the exogenous variables, and RSTUDENT, which indicates an anomaly in regression. Observations (atypical) for which the value of the calculated indicator is above the threshold value, are highlighted with appropriate formatting of the data (or to be deleted)⁵⁶. By Ricco RAKOTOMALALA⁵⁷, atypical points and influential points are used to identify observations that play an abnormal role in regression.

Table 2: Importance of Atypical and Influential Points Analysis

It takes an unusual value on a variable Example: one of the values of the field property tax (IFT) variable is negative, an error in the source of turnover data ... It takes a combination of unusual values on several variables Example: the sum of the balances (investment and operation) greater than the difference in revenue and overall expenditure,...	Atypical (aberrant)
It weighs excessively in the regression, that is to say that the results are very different depending on whether the point is taken into account or not in the regression	Influential
It is very poorly reconstructed (explained) by the regression, i.e. the observed residue is very (too) high, the point does not obey the relationship that was established by the regression	Atypical (regression)

Source: Ricco RAKOTOMALALA, Atypical Points and Influential Points, Lyon University 2, Lyon, 2005, p. 2, 18 pages, eric.univ-lyon2.fr/~ricco/cours/slides/Reg_Multiple_Points_Atypiques.pdf, consulted on 11/09/2017

⁵⁶ A current approach to detect aberrant or atypical points consists of representing a whiskered box of the data: Box-Plot (graphic approach).

⁵⁷ Ricco RAKOTOMALALA, "atypical Points and influential points", University Lyons 2, Lyons, 2005, p. 2, 18 pages. eric.univ-lyon2.fr/~ricco/cours/slides/Reg_Multiple_Points_Atypiques.pdf, consulted the 11/09/2017.

7.7.5. Colinarity detection module

This is a calculation of the correlation coefficient and the square of the correlation coefficient between the exogenous variables. It can detect any collinearities that may disrupt the results of regression. A simple indicator: when the square of the correlation coefficient between two exogenous variables is close to the regression coefficient, i.e. if it is close to R^2 , there is cause for concern. The variable should be deleted or the data compiled from the CA⁵⁸ should be verified and re-modeled.

8. Construction model and numerical simulation⁵⁹

Digital simulation is the creation of the budget forecasting model for the year K of a decentralized territorial community.

8.1. Setting parameters for modeling and source data

The parameters and source stages of budget data are:

- creation of budget year K and closing of previous K-1 budget years;
- seizing the K-1 administrative accounts of the year;
- update all elements of the simulation settings:
 - annual local taxation K-1: average rate voted, number of titles issued and corresponding amount;
 - economic variable K (inflation rate, tax pressure rate, annual average rate of increase, and growth rate specifying whether it is a period of political or economic crisis);
 - election cycle K_0 in K_n : post-election or sub-electoral period, type of elected official (appointed for the President of the special delegation (or PDS) or universal suffrage for the Mayor), and politics in favor of central or non-central power;
- Update all the parameters to remember for modeling:
 - number of ex-ante years from CA K_0 to K_{n-1} to remember;
 - cash flow for year K;
 - minimum cash threshold or free treasury fund;

⁵⁸ For example, in a forecast of a budgetary account (lasting n years), its value is always constant and that the engagement and payment of expenses are always constant. To this effect, the collectivities achieved a zero budgeting. It is necessary to mistrust the operations of every 12th month therefore where the organizer and the accountant always attempt to liquidate their budget (with a free fund being sufficient) to zero by ascription in order to justify a good management. " [...] The objective of a "treasury management optimized" consists of the reduction of the availabilities deposited to the Treasury. It is about not to necessarily succeed to a treasury "zero", but to approach itself of it most possible. (...) An excess treasury doesn't always reflect a good financial management of the collectivity. Indeed, the possibilities of investment of the excess treasury are larger for the commercial enterprises than for the townships. Actually, to maintain the liquidity required without leaving an idle treasury at all times, the estimable management of treasury aims either the cover of the needs in treasury is the investment of the treasury excesses ".

Jean-Bernard MATTRET", Treasury of the territorial collectivities ", http://www.colloc.bercy.gouv.fr/colo_otherfiles_fina_loca/docs_som/premiers_resultats08.pdf, consulted the 05/09/2017.

⁵⁹ [...] The techniques of simulation are going to undergo the influences of the artificial intelligence and the programming more and more oriented object. We could give a first indication that the modelling objects (...) can advantageously be used as tools of simulation.

Daniel K. SCHNEIDER, "Modelling of the decision-maker's gait politicizes in the perspective of the artificial intelligence ", Thesis of doctorate, Faculty of economics and social, University of Geneva, Geneva, 1996, p. 281, 440 pages.

- period (months) of the vote on the additional budget by the municipal Council; budget performance: budget evaluation criterion K : **for GAR**: it defines each electoral objective of the elected official at the time of the sub-annual cycle, if any, the policy of the central government, the number of years of achievement K to $K+n$ (increasing or not for the indicator of the program: if the indicator is increasing, the indicator is divided by the number of years defined), define the percentage of maintenance for the forecast, i.e. its value is not taken into account in modelling, if the percentage of budgetary execution from the K_0 to K_{n-1} period is less than this percentage⁶⁰, and define the budget allocations concerned for this objective; **for PEFA** select a strategic axis of the State's general policy (or PGE) or Madagascar action plan (or MAP), the title of the indicator, minimum indicator to be achieved and maximum, corresponding rating (A,A-,A-B,,C,C-C-,D,D-), define whether the imputations attached to this strategic axis should be maintained for the forecast, and define the budget allocations concerned for this purpose;

Budget performance in terms of ratio: for each budgetary year K_0 to K_{n-1} , define current cash flow coefficient tax mobilization ratio of structural rigidity (or margin of maneuver) and budget structure ratio.

If the original budget for year K does not exist, primitive budgets must (usually already be entered in the Data Warehouse: data centralization). The plan of accounts for public operations (or PCOP)⁶¹ must also exist, before all transactions to compile⁶² the CA K_0 administrative account (or CA) at K_{n-1} .

8.2. Descriptive statistics

Before starting modeling, you need to merge all data from CA K_0 to K_{n-1} to have a CA K_0 file to K_{n-1} compiled from the Prex-B.

This module gives us general information on the overall analysis of observations. In general, the box and the whiskers or box-plot diagram⁶³ will be all the more extensive as the dispersion of the statistical series is large. This representation allows us to visualize concepts such as symmetry, dispersion or centrality of the distribution of values associated with a variable. They are also very interesting to compare variables based on similar scales, and to compare the values of observations of individuals' groups on the same variable (for example, the case of variables inflation rate, growth rate, tax pressure rate (CTD and the organic law of finance law or LOLF).

⁶⁰ One can consider ex-ante like a doorstep of tolerance by budgetary ascription of the administrative accounts (or CA). Sui the value is underhand of this doorstep, the forecast doesn't take into account the analysis of this value. Evidently, its value is hopeless in the new primitive budget.

⁶¹ To mark the ascriptions always for the obligatory expenses and for the revenue descended of the decentralization effect

⁶² Preparation of the source of data, to see VII.7 to the page 17.

⁶³ When the observed set contains one or the other extreme value (very small or very big), the mustaches risk to become very long, that overnight to their interpretation. The solution to this problem consists of constructing or to modify the observations.

It also adjusts the values of all values on the same proposal (for example, for ten budgetary years, only two years have a very high subsidy value and the other zero. So you have to use the average for the other missing years).

8.3. Estimated budget forecasting model

By changing the CA_{k0} to CA_{k-1} , we have different models, depending on the policy of decentralization, of the cycle of the elected official and of the political-economic crisis.

8.3.1. Models

The method of choosing to introduce a variable among the sets of explanatory variables is three (3): - *either forward (or ascending) method*; - *either the backward (or descending) method*; - *and the stepwise method*.

8.3.2. Analysis of early variable trends

8.3.2.1. Compilation DES CA

After defining all the parameters of the model:

- variable crises, inflation, election cycle, LOLF tax pressure, average wage growth rate, average local tax rate (CTD tax);
- Preparation of CA_{k0} to CA_{k-1} .

The information must be compiled to create the model variables (grouping of imputations by variable) and by observation (year of the CA).

8.3.2.2. Descriptive statistics of the variables studied

This analysis is done to highlight the early trends in the variables studied in CA. This will identify the initial hypotheses⁶⁴ to be confirmed eventually in a later more refined analysis, before the search for possible mathematical relationships or significant links beyond the simple correlations, between the variables studied from the CA.

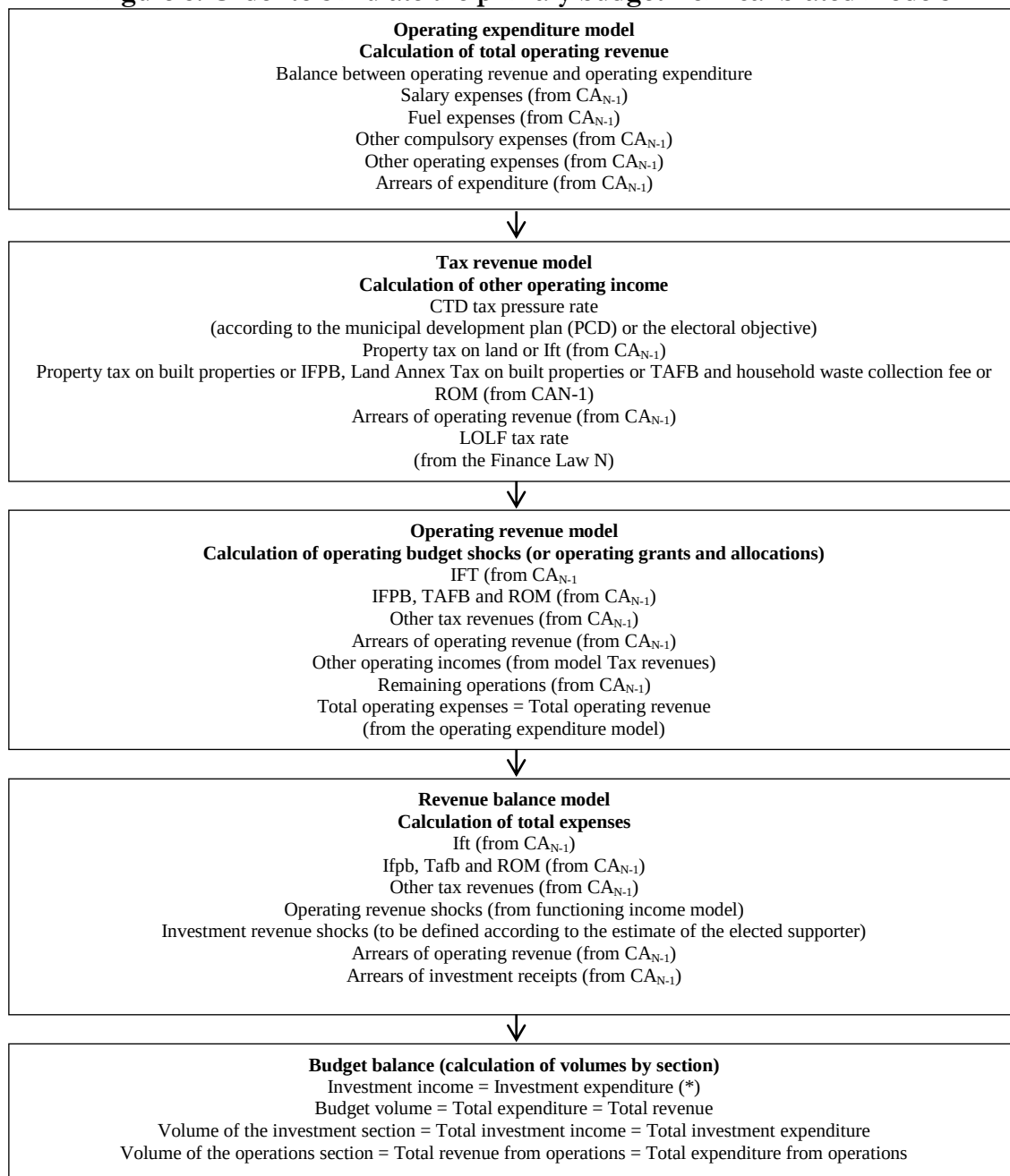
8.3.2.3. Adjusting the values of the variables studied

The adjustment of values consists of turning the data into logarithm, to have observations of each variable on the same proportion. Observations exceeding the maximum and minimum limit will be modified by their averages. It is made in the box-plot module.

⁶⁴ Adjustment of every variable observed values.

8.3.3. Different models

Figure 8: Order to simulate the primary budget from calibrated models⁶⁵



Source: Author, 2017

(*) : Although there is an increase in investment in the pre-election and sub-annual periods, this budgetary balance also allows for the volume of investment expenditure, taking into account the scissor effect on public finances. The effect of decentralization (subsidies and

⁶⁵ To see note of foot note n° 38 to the page 17.

endowments) depends on the political variable *PARTISAN* (Boolean) of the local elected official.

Effective management of the CTD budget is essential to the long-term success of local public finances. Establishing an appropriate budget and good producing forecasts can then contribute to financial and accounting health.

A well-organized budget must be based on realistic figures and assumptions. Forecasts allow:

- making strategic decisions
- determine the appropriate time of year for the elected official to launch investments, pay arrears,...;
- to calculate the extent to which the cash period must be secured, in order for CTD to survive an economic slump.

The prediction of a primitive budget then consists of using the different models.

To ensure citizens' doubts about their tax contributions, the target must be met with some skepticism about the willingness of local elected officials to deliver on their local development commitment (PCD). In this regard, the establishment of evaluation indicators is to be pre-defined in advance.

The evaluation is subject to two methods:

- Results-based management or GAR for the phase-in of the local program budget, compared to the PCD ;
- and a measure of the performance of public finance management or PEFA, an assessment of the budgetary position of the municipality, in relation to its strategic objectives.

9. Prediction of a primary budget: GAR evaluation indicators

The GAR indicator is associated with the budgetary forecast, by budget line concerned, with the electoral objective of the elected official. In the case of an elected official suspension, vacancy, the electoral objective is replaced by the PAG (government action plan), MAP or PGE, in principle that of the Ministry of Guardianship.

For example, in table 6 of the next page, a list of GAR indicators for the simulation of a primitive budget.

Table 6: Example of GAR indicator for a forecast of a primary budget in 2020

Year	References	Objectives	Indicator in %	Number of period	Progression	Indicator required for the CA	Imputation concerned
2020	O-1	Strengthen the Civil Status service (endowment, income from Civil Status)	70	1		50	7268;7513
2020	O-2	Build standpipes: Drinking water	80	2		75	2143;2151; 2158
2020	O-3	Reinforce EMO agents for canal cleaning	70	1		70	6012
2020	O-4	Rehabilitate administrative offices	85	1		80	2131;6211
2020	O-5	Computerize the supply and stock department	85	1		85	2014

Year	References	Objectives	Indicator in %	Number of period	Progression	Indicator required for the CA	Imputation concerned
2020	O-6	Provide computing equipment to the district (arrondissement)	90	2	☒	80	2163
2020	O-7	Improve the management of local finances	75	3	☒	50	2011;2013; 6283;6225; 6287
2020	O-8	Improve the social situation of staff	70	1		65	6031;6032
2020	O-9	Improve household waste disposal	85	3		80	6131;6213; 2172
2020	O-10	Improve local tax revenues	75	2		60	7140;7152; 7151;7273
2020	O-12	Reduce expenditure arrears	40	3		35	9992;9993 ⁶⁶
2020	O-13	Improve other non-tax revenue	75	2		70	7262;7263; 7274;7276; 7277;7278; 7280;7718; 7732;7734
2020	O-14	Maintenance of paved roads: point in time, potholes	65	3	☒	50	2141
2020	O-15	Improve the quality of administrative services: supplies and consumables	75	3	☒	70	6111;6112; 6113;6215; 6218

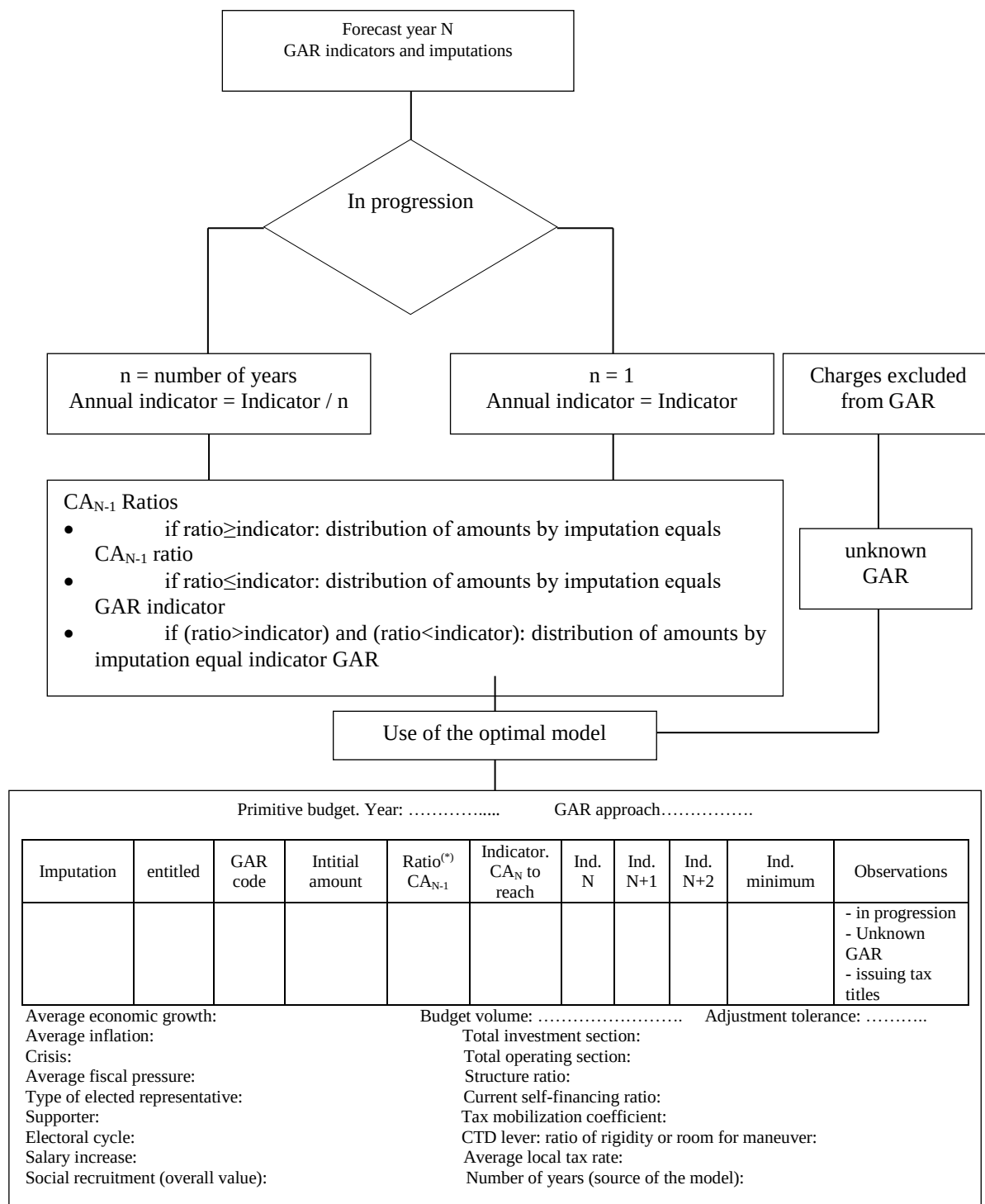
Source: Simulation in Prex-B software

The number of periods must not exceed the period of the program budget (three years), and by default, one year.

The method of inserting indicators into the forecast is compared to the budget execution ratios for year N-1. As part of a progressive indicator (long and medium term), the value of the indicator is divided by the number of years of the program budget.

⁶⁶ Account of waiting: the late sum of the investment and working expenses.

Figure 9: Process for integrating the GAR indicator into the forecast of a primary budget



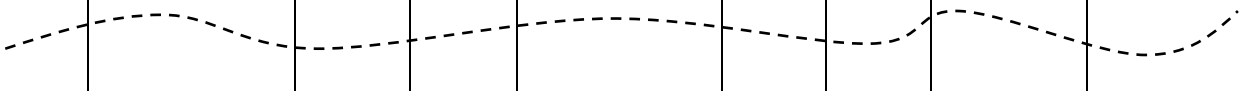
(*) Excluding securities revenue: The amount of the forecast is equal to the issued property tax card.

Source: Author, 2017

Simulation of a forecast consists of:

- calculating CA_{N-1} budget execution ratios;
- choose the optimal forecast model (*balance models, budget shock model and model by nature*) and other models (*margin of maneuver on operating expenses, performance, budget structure and cash flow*) are *models of analysis*. Only budget allocations in the forecast year's GAR list will be allocated to earnings-based indicators.

Figure 10: Example of a GAR for the forecast of a primary budget in 2013

Account	Entitled	Coded GAR	Ratio CA_{N-1}	Primitive N (in ariary)	GAR N_1 to N_n	GAR N %	GAR minimum _N %	Observations
1311	Subsidy received from the State	***	82.11					ignored GAR
2131	Administrative building	O-4	98.86	921 107 763.63	86.00	98.86	80.00	annual GAR
2161	Technical material	***	20.00					ignored GAR
2163	Hardware	O-6	16.36	83 960 762.82	90.00	45.00	40.00	increasing over 3 years
6012	No-permanent employee	O-3	90.56	1 013 677 477.40	70.00	90.56	70.00	annual GAR
								
Average economic growth : 2.40%			Budget volume : X ariary			Adjustment tolerance rate : X%		
Average inflation rate : 7.20%			Total investment section : X					
Economic and political crisis : No			Total functioning section : X					
Average tax pressure rate : 11.40			Structure ratio : X%					
Type of local elected representative: Universal suffrage			Cash flow ratio : X%					
Supporter of current political power : No			Coefficient of tax mobilization : X%					
Electoral cycle: Infra annual			CTD lever (ratio of rigidity or leeway) : X%					
Annual salary increase rate : 10.00%			Average local tax rate : X%					
Social recruitment of local elected representatives (global amount) : 10 000 000 ariary			number of years (model data source) : X%					

Source: Prex-B software

(cutting a state from a simulated primary budget forecast with sample data)

The effect of the use of economic, political, accidental, and electoral cycle variables in the simulation of the forecast of a primitive budget alters the final level of fiscal balance. The gap between the investment and operating section is considered a budget adjustment value (plus or minus). The representation of this difference as a percentage of budget volume is considered the "*forecast tolerance threshold*" for each budget cycle. This discrepancy also identifies whether to look for other resources or to reduce excessive spending.

10. Delivering a primary budget: PEFA evaluation indicators

The difference between the GAR and the PEFA assessment is that the PEFA depends on the Strategic axes⁶⁷ MAP/PGE. The indicator is always annual (short-term).

Among the pillars of the PEFA framework and the performance budget cycle of a public finance management system, the main one to take into account at the Prex-B-compatible CTD level are:

- is *the reliability of the realistic budget execution and executed as planned?* The evaluation is carried out by comparing actual revenues and expenditures (immediate results obtained through the Prex-B system) with the budget initially approved;
- are *the budgetary strategy and budgeting based on public policy* (revenue collected and capital expenditure)?
- and are *the budgetary strategy and budget* developed with due consideration for the government's fiscal policies and strategic plans, and on the basis of adequate macroeconomic and fiscal forecasts? For example, the difference between the change in the tax pressure rate under the Organic Law of Finance (or LOLF) and the change in the recovery rate of direct local tax revenues.

Indeed, for *accounting and reporting of data*, are they accurate and reliable? Are they kept up to date? And reports are prepared and disseminated in a timely manner, to meet the decision-making, management and information needs that are of relative importance to aspects of performance? Their assessment is not supported in Prex-B. They are evaluated in a relative⁶⁸ way by the elected official.

For a simulation of a primitive budget, Table 4 on the next page provides an overview of the few lists of PEFA indicators and their ratings⁶⁹.

⁶⁷ The PEFA is (Public Expenditure and Financial Accountability) an initiative that values the level of transparency and accountability (redevability) in the setting of the implementation of the expenses and the public finances.

The case of Togo republic (February 2016), the first certification PEFA CHECK on the basis of new methodology for the improvement of its management system of the public finances.

"[...] The PEFA CHECK insures, in the first place, that the government's budget is realistic and is put in implementation as foreseen. He also insures, that the information on the management of the public finances is complete, coherent and accessible to the users. It is as question to verify that a management efficient of the active and passive, that assures exists that the public investments provide the value for money, that assets are posted and managed, that the budgetary risks are identified, and that the debts and guarantees are planned carefully, approved and consistent. The PEFA CHECK also verifies that the budgetary strategy and the budget are prepared while taking into account the fiscal policies the government, the strategic plans and the adequate macroeconomic and budgetary projections. The Togolese government knew how to pull the teachings from the first assessments, to improve their positioning in relation to this indicator".

<http://www.agenceecofin.com/gestion-publique/2406-39104-the-togo-receive-the-first-certification-of-pefa-check-on-the-basis-of-the-news-methodology>, consulted the 20/10/2017.

⁶⁸ The relative importance is described below by the terms standards for the whole set of indicators: "All" means 90% or more (in value)", "most" mean 75% or more (in value)", "The majority" means 50% or more (in value)", "Some" mean 25% or more (in value) and "Some" means less 25% and more of 10% (in value).

PEFA secretariat, assessment Setting of the public finances management ", Washington-state-unite, February 2016, p. 9, 121 pages.

⁶⁹ Maximum four (04) components, that is that indicator's title can include several components and a component can include to the maximum concerned four budgetary ascriptions.

For example, indicator's excerpt to two components :

Indicatory of the measure of gap between the efficient fiscal revenue and the budget initially approved :

To conduct a reform of the fiscal system (strategic axis of the MAP)

1 - Total efficient revenue :

A: The efficient revenue represented between 90% and 105% of the revenue written down to the budget

B: The efficient revenue represented between 80% and 90% of the revenue written down to the budget

Table 4: Example of PEFA indicator suitable for an execution budget: Simulation of primitive budget example in 2020

Year	Account	Axes of the MAP / PGE	Title of the indicator	Indicatory max.	Indicatory min.	Notation
2020	6111;6113; 6211;6131; 6213;6221	To rationalize the management of the public finances and to eliminate the excessive expenses	Difference between the real total expenses of workings in relation to the initially approved expenses: Supplies, interview, carbureting and feasts and official ceremonies	105	75	D
2020	2125;2141; 2163;2164; 2158	Difference between the total real expenses of workings in relation to the initially approved expenses: Supplies, interview, carburant and feasts and official ceremonies To rationalize the management of the public finances and to eliminate the excessive expenses	Variation of the middle amounts of the monthly expenses of investments	75	50	C
2020	2011;2012; 2013; 2014;2015; 2017; 2121;2125; 2131; 2138;2141; 2143; 2151;2153;	To rationalize the management of the public finances and to eliminate the excessive expenses	Rate of execution of the investment expenses and revenue of investment	75	50	C

C: The efficient revenue represented between 65% and 80% of the revenue written down to the budget

D: The performance is lower to the one requisite to get the C note.

2 - Composition of the efficient revenue :

A: The composition of the revenue departed of the initial budget of less 5%

B: The composition of the revenue departed of the initial budget of less 10%

C: The composition of the revenue departed of the initial budget of less 15%

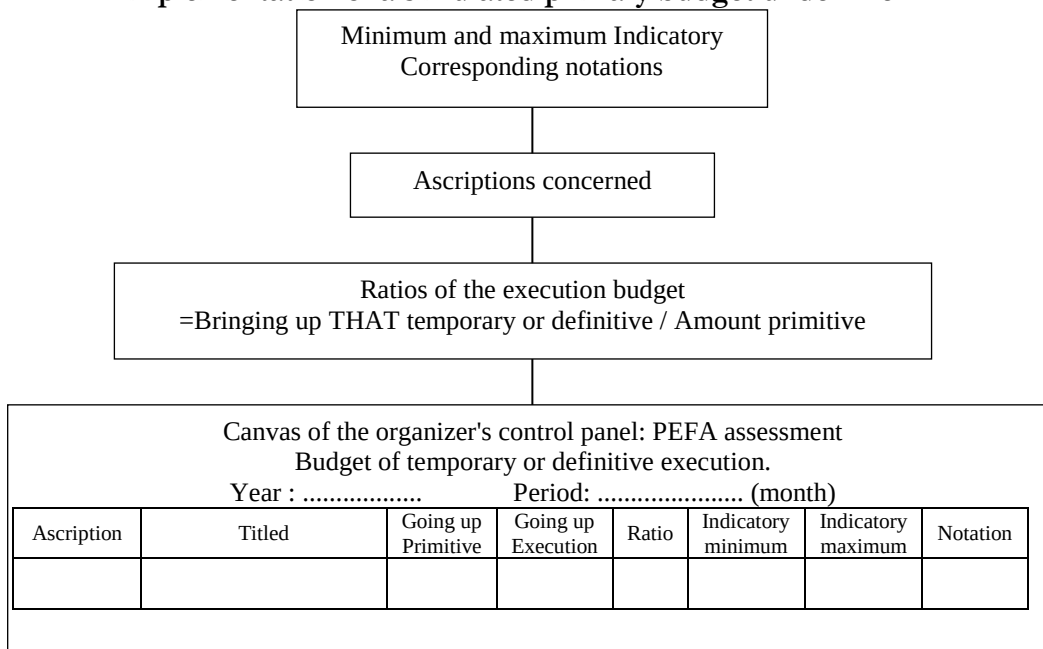
D: The performance is lower to the one requisite to get the C note.

Year	Account	Axes of the MAP / PGE	Title of the indicator	Indicator max.	Indicator min.	Notation
	2158; 2161;2163 ;2164; 2172;2178; 2223; 2618;1210; 1311; 1421;1423; 1427					
2020	2014	To develop tools of analysis and the models of forecast	Gap between cost of investment of software data processing foreseen in the budget and the realizations	105	75	C
2020	2015;6223	To develop tools of analysis and the models of forecast	Variation of the research costs and documentation foreseen and real costs	75	50	C
2020	7152;7140; 7151	To rationalize the management of the public finances and to eliminate the excessive expenses	Rate of compensation of the CTD fiscal revenue due to the loss of the revenue bound by the deletion of the TAFA: Gap between revenue of fundamental tax before 2008 and the present revenue	80	50	C
2020	7140;7151; 7152; 7020;7113; 7271; 7272;7273	To conduct a reform of the fiscal system	the late Consistent of the fiscal revenue: Gap between the rests to regain and the titles emitted	105	80	D
2020	2151	To assure the access of all the population to the drinking water.	Gap between the construction forecast of boundary-marks fountains and execution	95	75	C

Source: Simulation in Prex-B software

Thus, the PEFA evaluation indicator consists of defining in advance, in a dashboard of an interim implementation budget, during the fiscal year, the ratios (minimum and maximum) and their ratings.

Figure 11: Process of integrating the PEFA indicator into the budget for the implementation of a simulated primary budget under Prex-B



Source: Author, 2017

The PEFA scoreboard is to compare the ratio of budget execution by period (Primitive/Execution ratio) to the indicator interval (minimum and maximum). The notation is the one set in the overall setting of the Prex-B software.

11. Conclusion

The existence of many methods that the new public management or NPM recommends in the context of government reform, the most common methods in the information system applied to management, is the use of information and communication technologies or ICT tools.

The central focus on the modern information system, in this sense, is computer science and the Internet. An example of the application of this method is the SIGFP (integrated public financial management system) as an innovative and proven management mechanism results, HETRA for property taxes, which has begun reforms to renovate the management of public finances, and the financing of local communities in Madagascar. The implementation of the NPM principles will also allow for a public spending rationalization, notably through the introduction of management control in the Administration. This rationalization led to a new and better allocation of resources.

« [...] The budget's inability to provide accurate and relevant forecasts translating strategy and action plans into numerical targets and performance evaluation is one of the main criticisms. By Hopwood (1974): Businesses feel the need to budget in a complex and uncertain environment when the relevance of budget estimates rests on the condition of a stable and predictable environment. But taking into account the existing

*environment and a simulation by cyclical, economic and political parameters, the reliability of the budget forecast is reliable*⁷⁰."

Hence, the budgeting by "Prex-B" replaces manual consolidations under spreads heathy software. Above all, it brings reliability to the process, to prediction and promote better financial visibility by simulating cash management by cash type. This tool incorporates features to design various hypotheses and scenarios (cash optics, assumptions of budgetary behavior of the elected official, evaluation in ex ante desired in GAR and PEFA mode), in order to prepare you for future vagaries. It is also a great use in the preparation of fair statistical forecasts, which allow the Municipality to manage its performance expectations, and to make tactical adjustments to achieve its objectives, allowing to set up slippery forecasts, to compare projections. The benefits of using the Prex-B are many: dynamic data⁷¹ analysis, a fully centralized process and reliable collection of information, sharing information within the ordering officer and accountants via reports.

With all its budget forecasting, simulation and data collection features, Prex-B is classified as BPM (Business Performance Management) for decentralized Territorial Collectivities. While ERP (Enterprise Resource Planning) are the existing communal software packages (IFPB and PIF property tax software, software to control the cashbox of the town hall to the general treasury cash - CAM⁷², the Civil State, the payroll...). We must then be aware that the introduction of a new budget modelling tool makes budgetary management easy in the Commons, regardless of the resistance presence to organizational change.

⁷⁰ " [...] According to the school of HARVARD, the budget is a tool to the service of the managers. The managerial theory of the business underlines the importance of the professional managers, that replaces the capitalistic entrepreneur. For Anthony and Simons, the budget is a tool to the service of the managers to orient the behavior of the controlled so that they act in the sense of the strategy. The typologies of the control practices proposed by Anthony and Simons permit a classification of the budgetary practices according to the manner whose leaders use the budget.

Anthony's model : a tight or flexible control According to Anthony, the criteria on which are judged the actions of the leaders are the efficiency and efficiency (Anthony 1988). To reach this efficiency and efficiency the role of the budget is primordial because it permits :

- the piloting of the activities: transformation of the programs long-term in projects of short-term actions. Retroactive control (feedback) as well as the necessary corrective actions ;
- the coordination: the decision making and to make converge the goals of the individuals and the strategic objectives of the organization ;
- the incentive of the actors ;
- the modelling: reduction of the uncertainty and analysis of the scripts.

For Anthony (1965; 1988), the budgetary control is a tool of the system of management control that can be either narrow ("tight"), either flexible ("loose"). Narrow in the" definition retailed of the roles of their subordinates, their frequent involvement to the decision making of the subordinate managers and their follow-up of the results ". Flexible", when they allow their subordinates to decide what should be undertaken, in a large enough setting, and that themselves focus on the global results rather than on the detail of the approaches used. "This narrow or flexible degree of the control depends on the manner of which these devices are used (Anthony, 1988, p. 173) ".

Hamid Bachir BENDAOU, "Budget and budgetary control: does one have to do without it? ", Versailles academy, CREG, May 2014, p. 5-7, 22 pages. [http://www.creg.ac-versailles.to fr/Budget-and-control-budgetary-must-one-s-in-pass](http://www.creg.ac-versailles.to_fr/Budget-and-control-budgetary-must-one-s-in-pass), consulted the 11/09/2017.

⁷¹ Requiring an interconnection of the accounting data or an update of Dated it Warehouse.

⁷² Control case town hall to the treasure used of the year 2005 to 2007. Of 2008 on this day, the software SIGFP (integrated System of the management of the public finances).

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Appendix

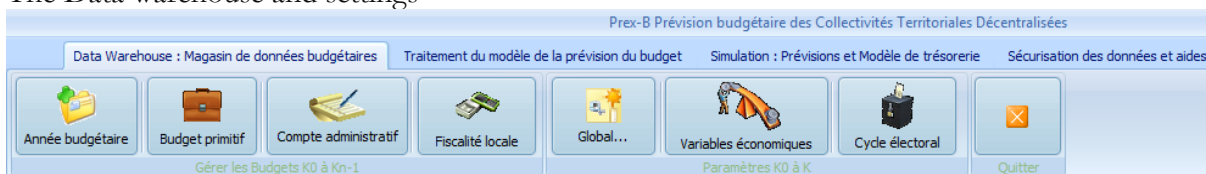
PREX-B software interface and simulation guide

1 – Installation

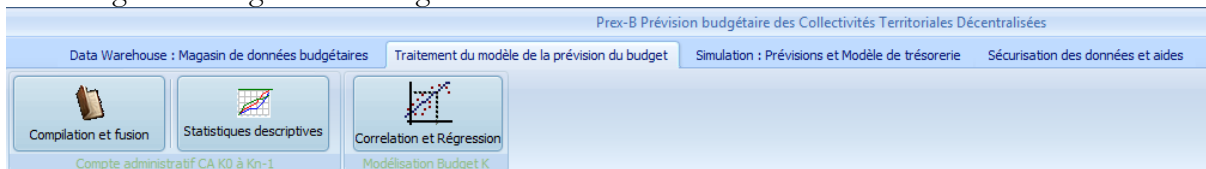
- copy the PrexB folder into your computer, preferably in the root drive [C:] of your hard drive:
 - if your system is 32 bits: in the PrexB-32 folder, copy the files '.exe', '.dll' and '.def' to the PrexB folder
 - if your system is 64 bits: in the PrexB-64 folder, copy the files .exe, .dll and .def to the PrexB folder
- create a shortcut on your prexb executable file Prex-B.exe

2 - Introducing the Prex-B window

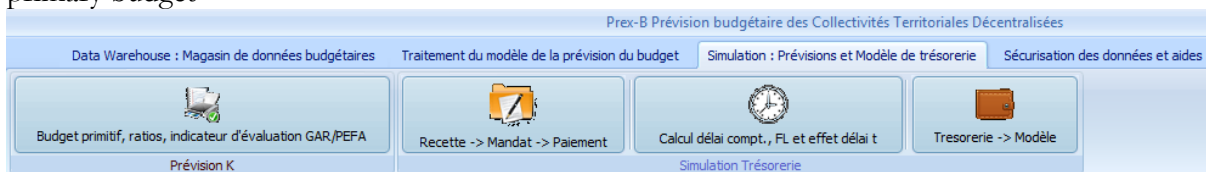
The Data warehouse and settings



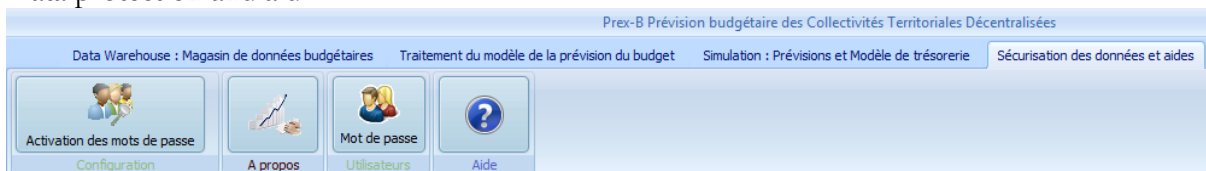
Searching for a budget forecasting model



Searching for a cash model, simulating the effect of the accounting time and forecasting a primary budget



Data protection and aid

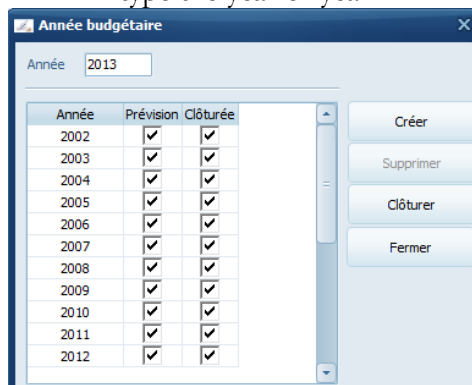


3 - Settings

Budget year:

Before you start looking for a model and simulating, you have to create the yearly budget to be expected.

- in the Data Warehouse menu group: Budget data store, click the Yearly button Budget, type the year or year

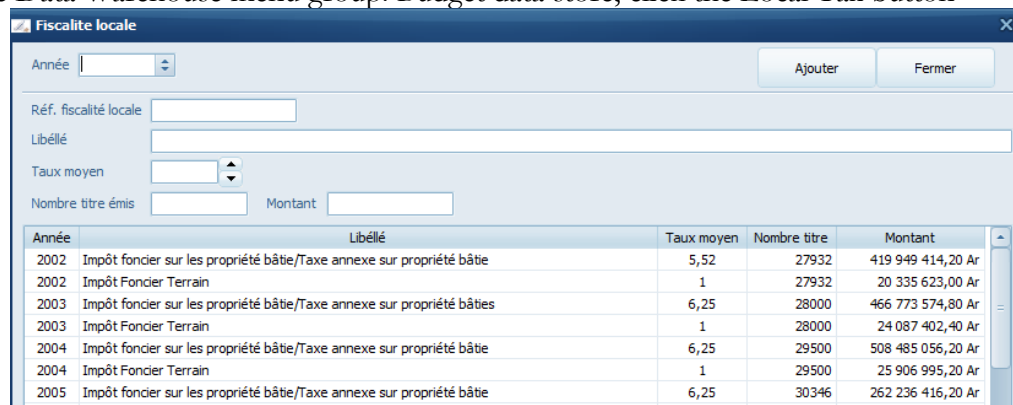


- to click on the button to Create

Other previous years must be closed (these are CA_{N-1} exercises): select the fiscal year from the list, and click the Closing button.

Direct local taxation:

In the Data Warehouse menu group: Budget data store, click the Local Tax button

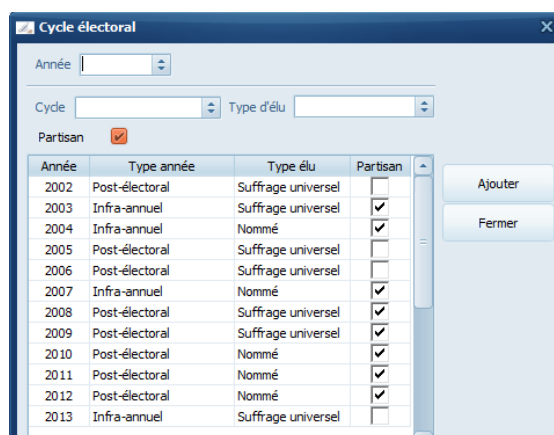


Année	Libellé	Taux moyen	Nombre titre	Montant
2002	Impôt foncier sur les propriété bâtie/Taxe annexe sur propriété bâtie	5,52	27932	419 949 414,20 Ar
2002	Impôt Foncier Terrain	1	27932	20 335 623,00 Ar
2003	Impôt foncier sur les propriété bâtie/Taxe annexe sur propriété bâties	6,25	28000	466 773 574,80 Ar
2003	Impôt Foncier Terrain	1	28000	24 087 402,40 Ar
2004	Impôt foncier sur les propriété bâtie/Taxe annexe sur propriété bâtie	6,25	29500	508 485 056,20 Ar
2004	Impôt Foncier Terrain	1	29500	25 906 995,20 Ar
2005	Impôt foncier sur les propriété bâtie/Taxe annexe sur propriété bâtie	6,25	30346	262 236 416,20 Ar

- select the year (all the average direct local tax rate for pre-forecast years must be added)
- fill in the information: reference (any identification, titled local tax, average rate applied, number of security issued and corresponding amount)
- click the Add button

Election cycle:

In the Data Warehouse menu group: Budget data store, click the Election Cycle button

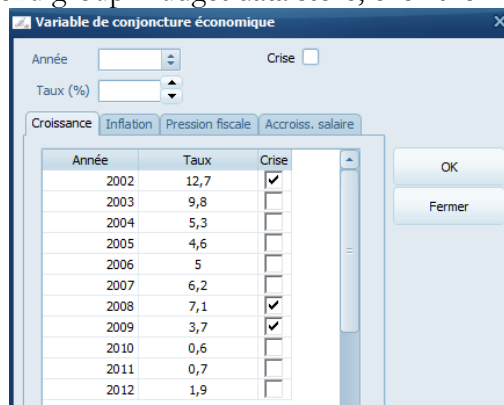


Année	Type année	Type élu	Partisan
2002	Post-électoral	Suffrage universel	☐
2003	Infra-annuel	Suffrage universel	☒
2004	Infra-annuel	Nommé	☒
2005	Post-électoral	Suffrage universel	☐
2006	Post-électoral	Suffrage universel	☐
2007	Infra-annuel	Nommé	☒
2008	Post-électoral	Suffrage universel	☒
2009	Post-électoral	Suffrage universel	☒
2010	Post-électoral	Nommé	☒
2011	Post-électoral	Nommé	☒
2012	Post-électoral	Nommé	☒
2013	Infra-annuel	Suffrage universel	☐

- select the year (all previous years)
- select the cycle: Infra-annual or Supra-annual or post-election
- select the type of elected official (appointed or elected by universal suffrage)
- check if the elected official is a supporter of the central government (in the case of an appointed ordering, he must be a supporter of the central government)
- click the Add button

Economic variables:

In the Data Warehouse menu group: Budget data store, click the Economic Variables button



Année	Taux	Crise
2002	12,7	☒
2003	9,8	☐
2004	5,3	☐
2005	4,6	☐
2006	5	☐
2007	6,2	☐
2008	7,1	☒
2009	3,7	☒
2010	0,6	☐
2011	0,7	☐
2012	1,9	☐

- in each tab (Growth, Inflation, LOLF Tax Pressure and Annual Rate of Wage Increase for Public Administration Employees):
 - select a year
 - set the corresponding rate
 - click the OK button to add

It is in the Growth tab that the feature: check or uncheck Crisis is necessary.

Administrative account evaluation criterion and ex-ante CA:

- in the Data Warehouse menu group: Budget data store, click the Global button
- select the budget year to be expected
- select the evaluation mode to be defined by GAR or PEFA

Année	Evaluation	Promesse électorale	Prévision	Indicateur	Maintenir plus	Compte
2013	GAR	Améliorer l'enlèvement des ordures ménagères	✓	85	80	6131;6213;2172
2013	GAR	Améliorer la gestion des finances locales	✓	75	50	2011;2013;6283;6225;6
2013	GAR	Améliorer la qualité des services administratifs	✓	75	70	6111;6112;6113;6215;6
2013	GAR	Améliorer la situation sociale du personnel	✓	70	65	6031;6032
2013	GAR	Améliorer les autres recettes hors fiscales	✓	75	70	7262;7263;7274;7276;7

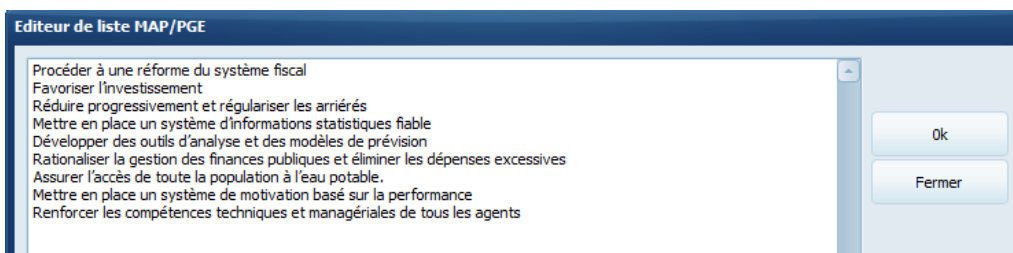
For GAR:

- to meet the reference to the electoral objective, the title of the electoral objective
- define the indicator to be reached and the corresponding period. Check progress by period if the indicator is split by year
- set the criterion for maintaining the ex-ante CA ratio
- type one by one the account number and click the add button in the list
- click the Create button

Année	Evaluation	Axe MAP/PGE	Intitulé de l'indicateur
2013	PEFA	Développer des outils d'analyse et des modèles	Ecart entre coût d'investissement de logiciels informatiques
2013	PEFA	Développer des outils d'analyse et des modèles	Variation des coûts de recherche et documentation prévue
2013	PEFA	Rationaliser la gestion des finances publiques	Différence entre les dépenses réelles totales de fonctionnement
2013	PEFA	Rationaliser la gestion des finances publiques	Taux d'exécution des dépenses d'investissement et recettes
2013	PEFA	Rationaliser la gestion des finances publiques	Variation des montants moyens des dépenses mensuelles d'

For PEFA:

- select a strategic axis of the MAP or PGE. To add to the strategic axis list, click the button, enter the new strategic axis into the MAP/PGE list editor and click the OK button

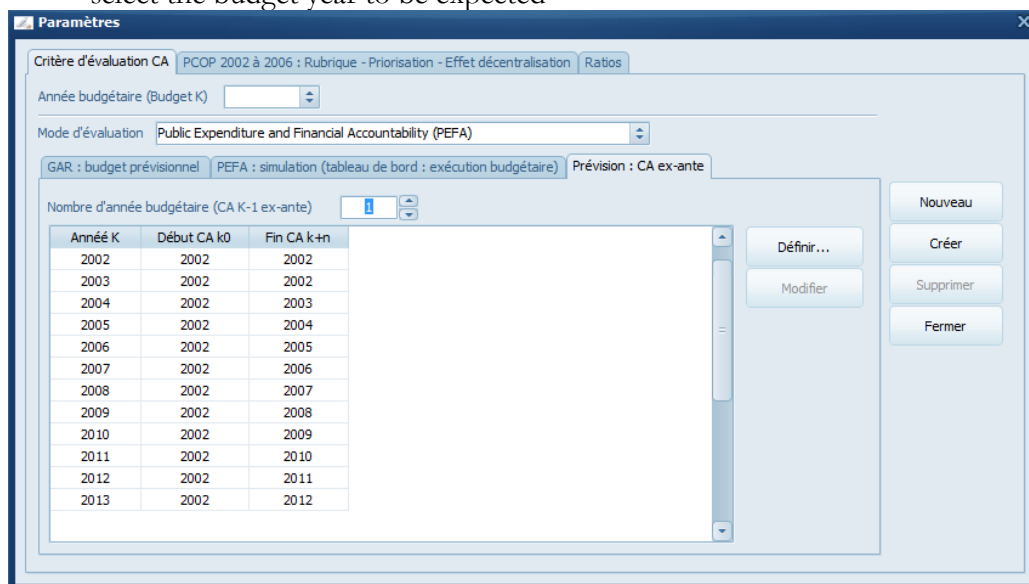


- fill out the title of the indicator to be reached
- meet the minimum and maximum component criterion (attribution of the performance budget associated with this criterion)
- define the rating required for this criterion (in the implementation budget phase)
- type one by one the account number and click the add button in the list
- click the Create button

To remove an evaluation criterion (PEFA or GAR), double click in the list and click the Delete button.

The New button allows you to start, for a new input of the evaluation criterion.

- Ex-ante CA Forecast
 - in the Data Warehouse menu group: Budget data store, click the Global button
 - select the budget year to be expected



- define the number of years of administrative accounts required for forecast analysis
- click the Set button

To edit, double click the list, change year numbers, and click the Edit button.

Public Operations Accounting Plan (PCOP):

- in the Data Warehouse menu group: Budget data store, click the Global button
- go to the PCOP tab 2002 to 2006: Topic - Prioritization - Decentralization Effect

Section	Rubrique	Compte	Libellé de compte	Oblig.	et Déce
Investissement	Recettes	1014	Fonds de travaux des réseaux électriques		
Investissement	Recettes	1210	Résultat budgétaire N-1 : Excédent d'investissement		
Investissement	Recettes	1311	Subvention reçu de l'Etat		
Investissement	Recettes	1312	Subvention reçue des province autonome		
Investissement	Recettes	1313	Subventions reçues des organismes nationaux ou internationaux		

- select the budget section of the account (operation or investment)
- select the topic (revenue or expenses)
- enter the account number (four digits) and the account title
- in the Analysis Assignment group, compulsory check (for compulsory expenditure) and Tax equalization and decentralization (for revenue: transfer, grant, endowment and financial support from the state)
- click the Create button

To edit, double click the list, change the information, and validate the Edit button.

Budget analysis ratios:

For the budget year to be expected, it defines the four ratios (the sizes characterizing its financial structure and appreciating its overall financial balance) below.

- in the Data Warehouse menu group: Budget data store, click the Global button in the group of menu Warehouse Dated: Store of budgetary data, to click on the Global button

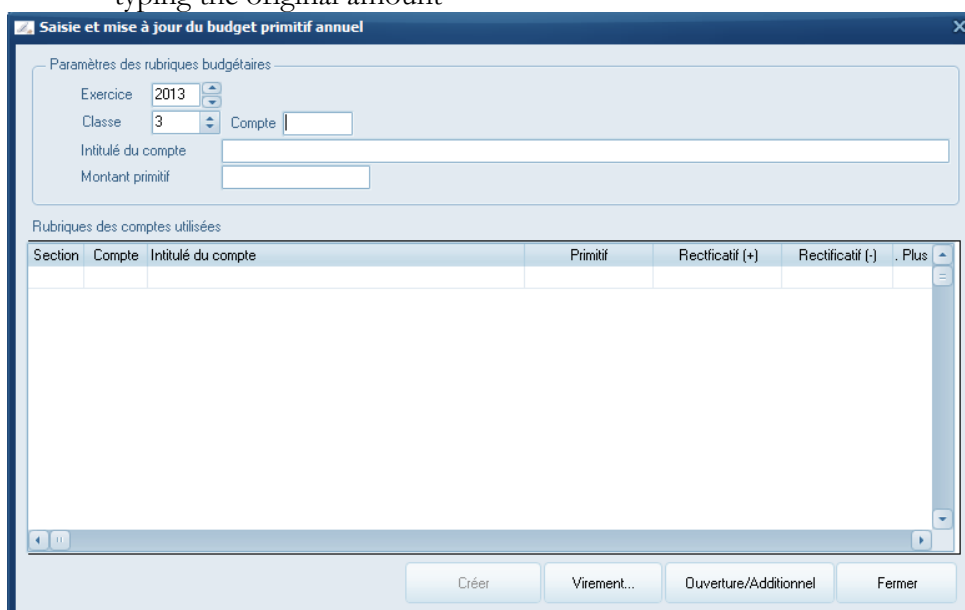
Année	Autofinancement	Seuil	Fiscale	Seuil	Rigidité	Seuil	Structure	Seuil
2013	✓	60	✓	66	✓	55		40

- go to the Ratios tab
- define the yearly budget to be expected
- for each ratio checked or chosen:
 - to add the list of imputations needed to calculate the ratio, type one by one the account number and click the add button in the list
 - set the minimum threshold for this ratio

- click the Create button

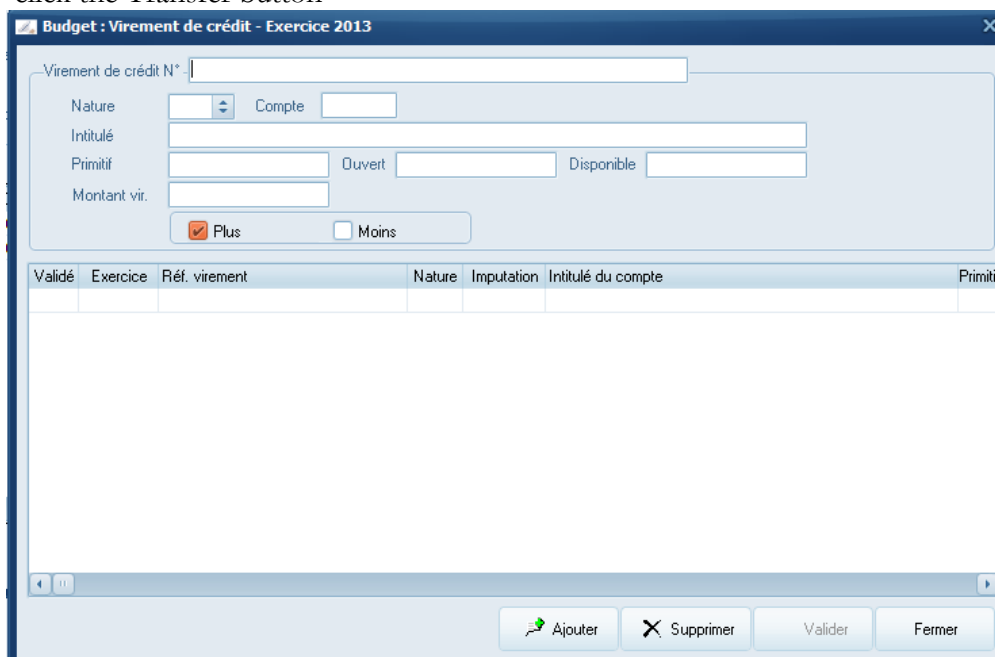
The primary budget, the administrative account, the revenue recovered and the free fund per transaction are data from the CAM software. But, a direct seizure, only for the primary budget and CAs, can be made in Prex-B:

- for the original budget:
 - click the primitive Budget button
 - defining the yearly budget
 - set the class and enter the account or imputation number (corresponding to the PCOP)
 - typing the original amount



To make a credit transfer:

- click the Transfer button



- fill out the CSM deliberation number
- fill in other information and check in Plus or Minus and click the Add button (repeat your transactions for each transfer account). The Plus amount must be equal to the amount in Less
- click the Validate button
- before validation, to delete, double click in the list and click on

To make a credit opening or an additional budget:

- click the Opening/Additional button

- fill out the CSM deliberation number
- in each column, click in the cell and select. Like what:

Nature		Count	
Nature	Compte	Nature	Compte
2		1014	
3		1210	
6		1311	
		1312	
		1313	
		1315	
		1421	

- fill in the amount
- choose the option (opening or additional)
- click the Validate button

For the administrative account:

- click the Administrative Account button

- select the budget year and account number
- fill in the corresponding amount, and the rest to be paid (for expenses) or the rest to be recovered (for revenue)
- click the Ok button

To edit, double click the list and change the information. To validate changes, click the Edit button.

- For cashing and disbursement transactions, data sources are essentially CAM software. To view:

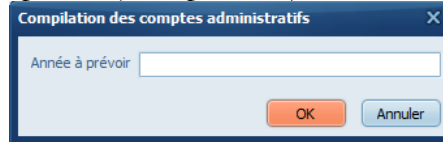
- in the Simulation menu group: Forecast and cash model
- click the Revenue->Mandate->Payment button

4 - Search for a primary budget forecasting model No.1: Multiple Regression:

Step 1 - Compilation of Administrative Accounts (CA)

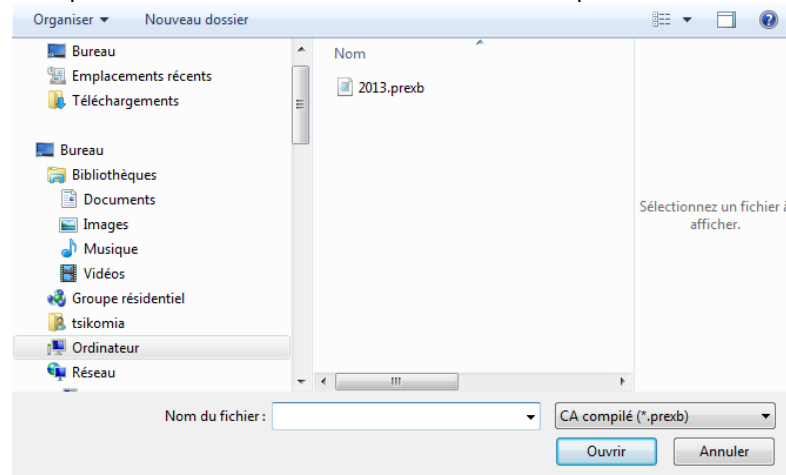
- click on the Menu Group Processing the Budget Forecasting Model

- click the Compilation and Fusion button
- type in the year to be expected (example 2013) and validate with the Entry button

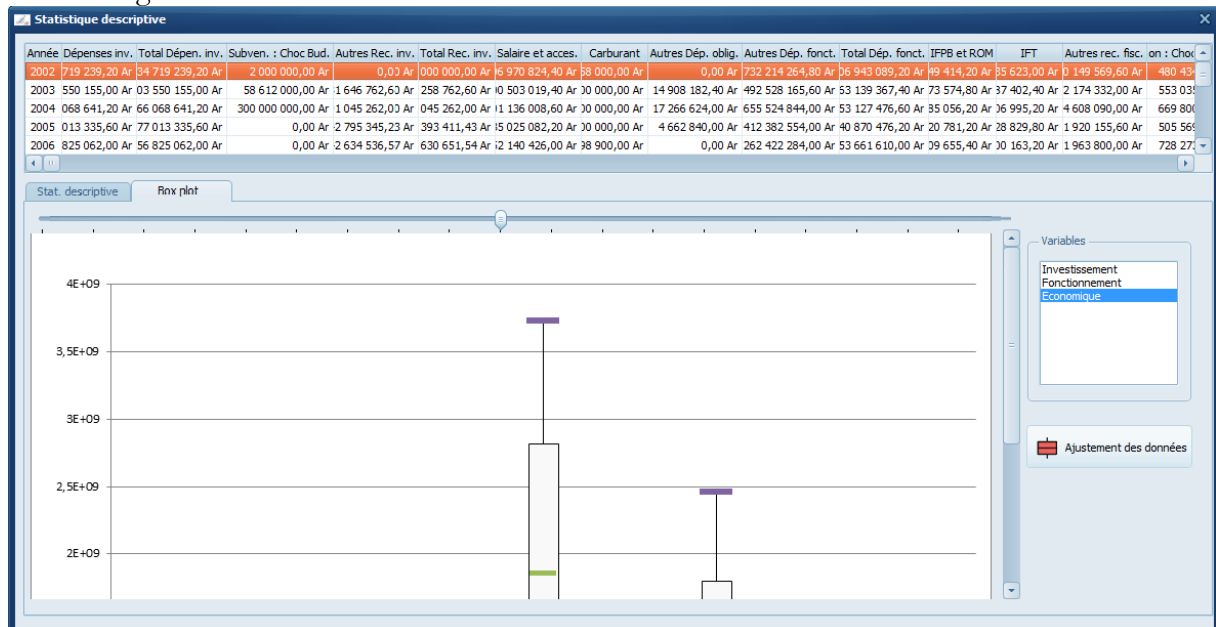


Step 2 - Descriptive Statistics

- click the Descriptive Statistics button and select the compilation file name, then open



- to go in the tab Box-Plot



You can change the Box-Plot graph by clicking in the variable zone (Investment, Operation, Economy)

- click the Data Adjustment button

Step 3 - Searching for a budget forecasting model

Step 3.1: Using all model variables

- click the Correlation and Regression button

- click the compiled CED Open button

Comptes administratifs											Régression	Résidus	Analyses points atypiques	Détection colinéarité
Année	Dépenses inv.	Total Dépén. inv.	Subven. : Choc Bud.	Autres Rec. inv.	Total Rec. inv.	Salairé et acces.	Carburant	Autres Dép. oblig.	Autres Dép. fonct.	Total Dép. fonct.				
2002	17,36 Ar	17,36 Ar	14,51 Ar	0,00 Ar	14,51 Ar	20,36 Ar	18,17 Ar	0,00 Ar	20,41 Ar	21,13 Ar				
2003	20,04 Ar	20,04 Ar	17,89 Ar	19,26 Ar	19,49 Ar	20,50 Ar	17,83 Ar	16,52 Ar	20,02 Ar	21,03 Ar				
2004	20,15 Ar	20,15 Ar	19,52 Ar	18,33 Ar	19,78 Ar	20,62 Ar	18,19 Ar	16,66 Ar	20,30 Ar	21,23 Ar				
2005	18,99 Ar	18,99 Ar	0,00 Ar	19,31 Ar	19,58 Ar	20,76 Ar	18,30 Ar	15,36 Ar	19,84 Ar	21,16 Ar				
2006	17,86 Ar	17,86 Ar	0,00 Ar	18,78 Ar	18,81 Ar	20,77 Ar	19,29 Ar	0,00 Ar	19,39 Ar	21,16 Ar				
2007	18,34 Ar	18,34 Ar	0,00 Ar	18,98 Ar	19,14 Ar	20,84 Ar	16,53 Ar	0,00 Ar	19,15 Ar	21,41 Ar				
2008	19,61 Ar	19,61 Ar	18,41 Ar	18,03 Ar	19,85 Ar	21,19 Ar	19,20 Ar	15,80 Ar	20,37 Ar	21,65 Ar				
2009	19,97 Ar	19,97 Ar	0,00 Ar	18,55 Ar	19,98 Ar	21,23 Ar	19,16 Ar	17,18 Ar	20,14 Ar	21,62 Ar				
2010	18,52 Ar	18,52 Ar	13,82 Ar	17,96 Ar	18,53 Ar	21,31 Ar	19,50 Ar	16,84 Ar	20,25 Ar	21,73 Ar				
2011	17,42 Ar	17,42 Ar	16,01 Ar	16,66 Ar	17,68 Ar	21,28 Ar	19,77 Ar	16,84 Ar	20,37 Ar	21,77 Ar				
2012	18,97 Ar	18,97 Ar	20,36 Ar	16,10 Ar	20,41 Ar	21,47 Ar	19,76 Ar	15,50 Ar	20,93 Ar	22,04 Ar				

- check a model type
- click the Fog button

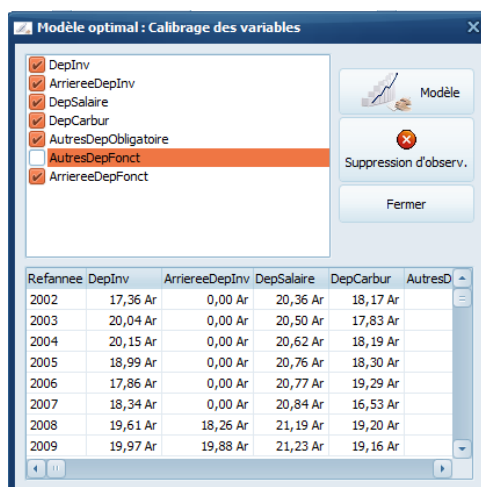
Comptes administratifs				Régression	Résidus	Analyses points atypiques	Détection colinéarité	
	Colprex 1	Colprex 2	Colprex 3	Colprex 4	Colprex 5	Colprex 6	Colprex 7	Colprex 8
Ligprex 1								
Ligprex 2		ArriereeDepFonct	AutresDepFonct	AutresDepObligatoir	DepCarbur	DepSalaire	ArriereeDepInv	DepInv
Ligprex 3	a	0,01121404781186	0,13760199813408	-0,0152278449505	-0,0194551526348	0,9031615570828	-0,0111553866646	0,05376071642384
Ligprex 4	sigma a	0,00361831713666	0,04852666567906	0,00475388009258	0,03038365927775	0,08171731389904	0,00522687640014	0,03501400045854
Ligprex 5		0,98878490968863	0,05355013996733					
Ligprex 6		37,7852473346134	3					
Ligprex 7		0,75847545298298	0,00860285247156					

</

Check all scans (by tab)

Step 3.2: Model calibration

- in the Regression tab, click the Calibration button



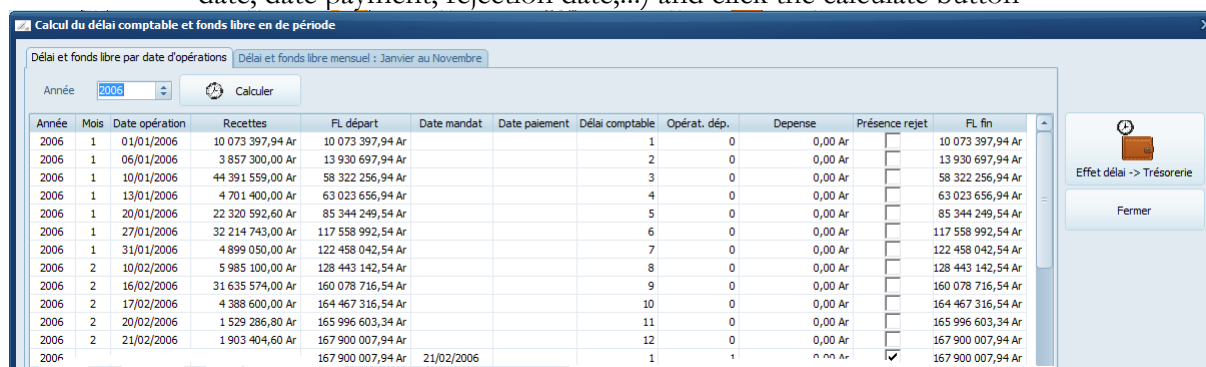
You have to uncheck the non-significant variable one by one. For atypical points, click on the observation list and click the Observation Delete button.

- click the Model button
- repeat this step until you get the best model

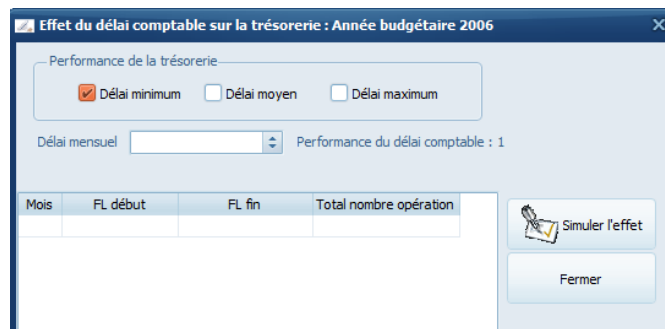
5 - Search for the cash model used by the elected official from N-n to N:

a - Simulation of the effect of the accounting period on the free fund

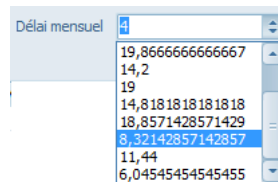
- go to the Simulation tab: Forecast and cash model
- click the Accounting Time Calculation button, free funds or FL and t delay effect
- select the year of the FL management data at the general treasury (mandate date, date payment, rejection date,...) and click the calculate button



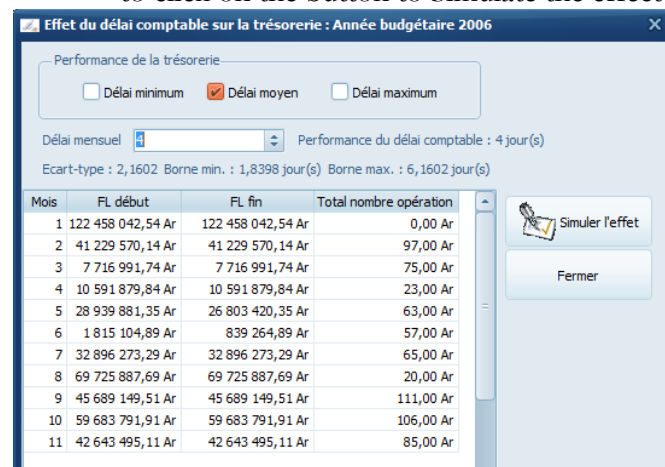
- go to the monthly Free Limit and Fund tab: January to November to check the number of transactions and the monthly free fund or net cash.



- click the Simulate check a cash performance induced by the accounting time (minimum or average time or maximum time)
- select a monthly time frame, automatically detected by Prex-B, from all time frames in the list



- to click on the button to Simulate the effect



b. Searching for a cash model

To find a cash flow model, you do not need to perform the Delay effect simulation -> Cash. If so, please recalculate:

- go to the Simulation tab: Forecast and cash model
- click the Accounting Delay Calculation button, FL and t delay effect
- go into the Time and Free Fund tab by operation date
- select the year and click the Calculate button

To search for the model:

- go to the Simulation tab: Forecast and cash model
- click the Cash -> Model button

The minimum threshold button allows you to check the minimum cash available throughout the year's budget transaction (either in value or percentage)

- completing an average accounting deadline
- choose the cash assumption (desired transaction cash or precautionary cash):
 - for the desired transaction cash, complete the minimum free fund to be retained for each disbursement transaction;
 - for precautionary cash, set the minimum threshold as a percentage of the free fund to be retained for each disbursement transaction.
- click the Fog button (the steps are the same for calibration, see Step 3.2: Model calibration of searching for a budget forecasting model).

6 - Simulation of the primitive budget: GAR method

- go to the Simulation tab: Forecast and cash model
 - click the primary budget button, ratios, GAR/PEFA rating indicator

a - Printing list of indicators

- for PEFA, click the PEFA Indicator Preview button
- for GAR, click the GAR Indicator Preview button

b - Simulation of a primitive budget

- in the Budget Forecast Dialog: GAR Evaluation, select a model

In the pre-election period, the effort for capital expenditure must be met (the structure I/F ratio will be high)

In the case where the cycle is sub-annual, regardless of (elected type and politics partisan), the amount of social recruitment must be filled:

Recrutement social (en valeur approximative) (2013 : Cycle Infra-annuel)

- check Show the budget line with no N-1 forecast in case you need to see all the budget headings used by the Municipality
- click on the Budget Forecast button: GAR Method

If the elected official is a supporter of the current political power, the amount of the investment grant must be filled. Otherwise, insert a zero value.

- in the preview window, click the Print button

Note:

- If in the regression procedure, this dialog box appears on the screen, always click the Yes button.

- If in the regression procedure, the calculation of all variable coefficients is equal to 1 or the values are almost zero, the regression will fail. The following message is displayed on your screen: *Error type 13: Incompatible Type, Execution Error 6: Capacity Overrun*. In the Visual Basic Application window, click the End button and restart Prex-B.
- The cash model cannot be used in the budget forecast.