Securitization of future credits in a Public Administration's tax-collection process: a System Dynamics approach.

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Abstract

The distinctive role of a delocalized peripheral Public Administration, also called a Local Government Unit, is nowadays commonly acknowledged to be mostly consisting in providing services to its community of citizens. In order to accomplish this mission, the local administration has the evident and constant need of a certain cash amount, which should be basically ensured by incomes due to taxes imposed on citizens and that should hopefully require a regular and continuous cash flow. The last aspect represents a condition which usually is absolutely important and even necessary in order to properly and effectively schedule and manage the services that are then to be provided. Thus, in a complex and evolving legislative and administrative context such as the Italian one, this paper will try to state and show, by means of a system dynamics modelling approach, how a financial operation like the securitization of collectable credits performed by LGUs may constitute an efficient, effective and reliable tool in order to support proper and strategic decisions concerning the operation structuring as well as help reduce the collection delay. In this way the organization is granted with that sufficient cash liquidity which will be necessary to manage the actual services to the citizens and to program the provision of new ones on a larger time horizon.

Introduction

Many articles may nowadays be found in the literature which describe the main benefits of credit securitization, most of them concerning in detail with the risk analysis, the quality of credits portfolio and even forecasts on cash flow. Notwithstanding the existence of several probabilistic models on this topic, as well as on credit evaluation, we have found clear evidence that no one until now has been researching or developing models that may help in decision support on a securitization operation. The model proposed in his paper, on the contrary, not only allows to structure and manage a securitization operation but also allows to do it "dynamically" (with the flow of time), that is based on the real data acquired during the evolution of the same operation.

The innovative topic of this paper will be centred on the demonstration of the convenience for a Local Government Unit (LGU) in performing a *Securitization of its Future Revenues due to Taxes* (FRT-Sec). Such a purpose thus makes our model someway different from the already published economical-mathematical-financial models on Securitization and according to the authors it is to be considered as a reference and starting point for this kind of operations: that is structuring, assessing and dynamically managing an FRT-Sec inside a LGU.

It is however certain that this work will be surely worth some future development, which in first place should be taking into account a more accurate risk analysis [1],[2], [3] , the latter bringing into play a more precise, extensive and complete analysis of the topic, especially concerning with those peculiar financial issues into Public Administrations. In particular , the authors are already working on a forthcoming more detailed technical report that will follow this paper and which will be dealing more extensively with the legislative issues underlying this financial operations in the Italian Public Administration, as well as with a more complete modelling process explanation, model description, model validation, historical data, risk analysis and model optimization.

1 – Credit securitization: an answer to the needs of Italian LGUs

With the law n. 337 dated 09.28.1998, the concept of "uncollected for collected" (with this term the Italian Government meant to interpret those uncollected credits as being already collected because someone else was anticipating them to the LGU: accordingly to this technique, an external debt collector - usually a bank - could anticipate the due credits to the LGU) has been abolished and the LGUs have not received anymore, on a regular base, those revenues coming from taxes paid by citizens; their main revenues have, from that moment on (and yet until today), been deposited directly into the LGU cash only "*after*" the tax-collection, thus postponing in this way those cash flow revenues that in the past were usually seen as incomes "before" the real collecting moment.

The main effect of such a reform has been that the financial cash-flows of LGUs drastically reduced (because tax-incomes did not anticipate anymore the moment in which they were really collected), thus evidencing a previously ignored element in a Public Administration environment: that is *proper cash management*. Such a situation, has consequently determined first a need and then the birth of a new approach, which may help in better observing the development of dynamic financial events as well as consequently allowing the rise of a new planning method in Public Administration

[1] Tien F. Sing, Seow E. Ong, G. Fan, C. F. Sirmans (2004) "Analysis of Credit Risks in Asset-Backed Securitization Transaction in Singapore" *Journal of Real Estate Finance and Economics, 28:2/3, 235-253, 2004*

[2] E.Di Tommasi, Cartolarizzazione: strutture e rischi (2001)

[3] Szegö G. –Varetto F., *Il rischio creditizio. Misura e controllo*, UTET 1999

Management. The underlying dynamical hypothesis in such events also determine, in turn, the probabilistic behaviour of the risk connected to the Collection-Activity (the only true risk component, among the typical Enterprise Risks, which may be found in a Public Administration Environment), and hence help to understand (and limit) those situations of instability given by events which thus influence in a decisive way the LGU financial policies.

It is then evident in such a context how an FRT-Sec may constitute a truly valid tool in order to limit the tax-collection delays and thus allowing LGUs to have a good cash amount at hand; this last aspect is especially important because LGUs are then enabled and further empowered to accomplish their role, mission and tasks, with particular respect to the citizen relationship management and toward a gain of consensus from the citizenship.

2 – What is a Securitization

The term "securitization" usually refers, in the current financial technical language, to a technique by means of which companies/enterprises/corporations decide to sell some assets (usually, but not necessarily always, also a certain amount of credits) in order to acquire (almost) immediate cash liquidity.

This means:

1. performing the sales of existing or even future credits, sometimes also deriving from other, non-negotiable, financial activities or assets, able to generate certain cash flows over time and for a specific amount of years (thus remunerating in the following years those who buy the stock titles issued at the time of acquisition of those assets)
2. the conversion of such credits in negotiable financial titles to be issued and placed on the financial market

If compared to other similar and innovative financial operations, a securitization distinguishes itself, for the sale of the LGU credits to a third counterpart, the so called *Special Purpose Vehicle* (SPV), a company exclusively and purposely created in order to acquire those credits which are then paid back by means of the incomes due to the issuing of special financial titles connected to them and called "*Asset-Backed Securities*" (ABS). The reimbursement of ABS and the payment of conventional accrued interests, incorporated in the price of the issued titles, are basically guaranteed by the cash flows generated by the underlying credit collection process.

The most qualifying aspect of such an operation resides in the separation, or *segregation*, of the relative cash flows: this means that, for every operation performed, the overall income due to the issue of the titles connected to certain assets is then "destined" to pay back the securitized assets themselves, while the cash flows generated by the same assets (note, again, that an asset may also well be the future income due to a certain tax collection) are every time used to reimburse and remunerate the ABS buyers.

The basic procedure of a securitization may then be summarized as follows:

- Selection of a portfolio (*pool*) of activities/assets able to produce periodically determined cash flows, which are aggregated on a basis of homogeneity between them (taxes with taxes, and so on…)
- The sale of such a pool of assets from the original owner (*Originator*) to a purposely constituted company which is external and independent from the Originator itself (that is, the already mentioned Special Purpose Vehicle – SPV)

- The issue by the SPV of financial titles (ABS) and the placement of such ABS, relative to the acquired activities, on the market
- Parallel to the servicing activity (realized with the role of the *Servicer*, which is the stakeholder who performs the credit collection), there will be a process implying the reimbursement of titles (plus interests) from the SPV

More in detail, the main subjects involved in this operation are:

1. ORIGINATOR: the credit-seller, in our case, the LGU which, after having selected the credits which will compose the pool of active assets/activities undergoing the securitization operation, then effectively sells them

2. SPECIAL PURPOSE VEHICLE (SPV): it's the *ad-hoc* constituted contractor acquiring the credits sold by the LGU (Originator), and then aggregates them into financial titles to be put on the stock market

3. ARRANGER: this subject plays the role of the consultant which structures, performs and manages the whole operation. In our case studies, it usually coincides with the LGU Head of Treasure Department (in Italian, called "Tesoriere", that is the *treasurer*). After the bond subscription, the Arranger may place back on the market only part or even all of the acquired titles.

4. SERVICER: it is the effective responsible of the credit collection process, thus managing and controlling the correct dynamical development of cash flows, and ensuring in the process the transferral of such incomes to the SPV

The roles of these players are represented in a simplified scheme reported in Figure 1, except for the Servicer, whose activities may be executed by the Arranger.

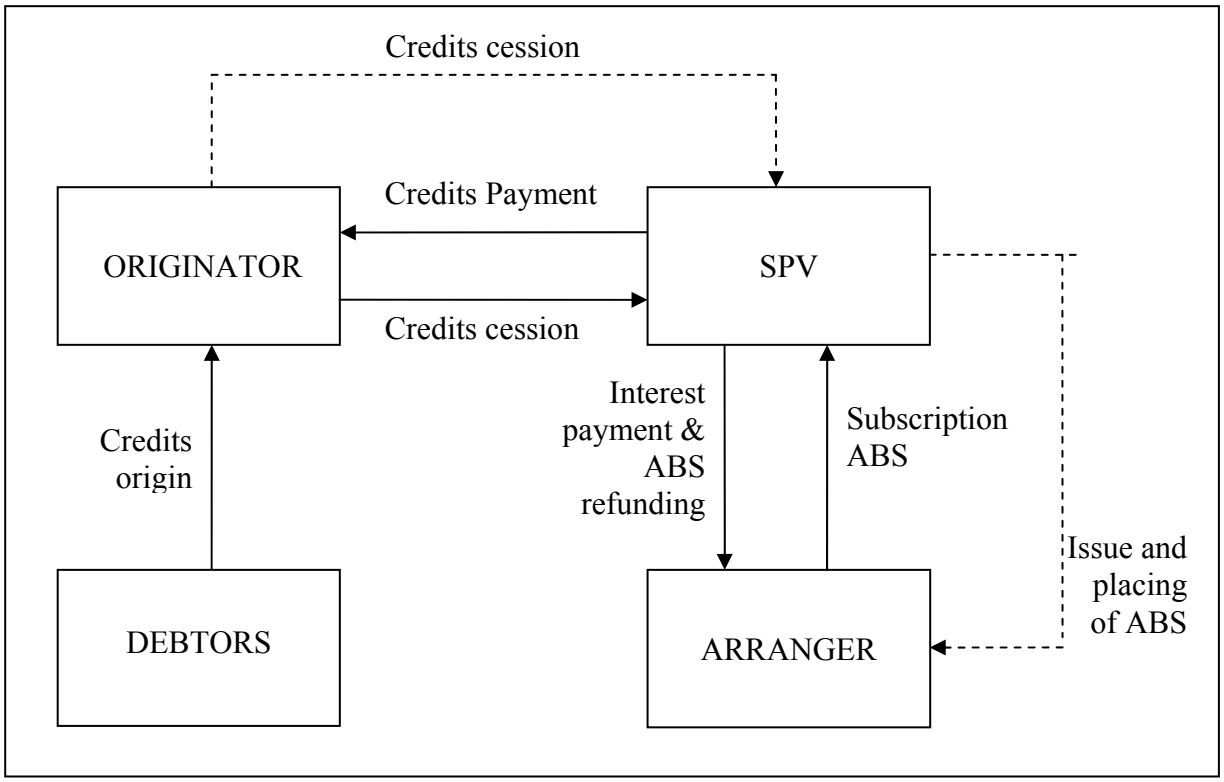

Figure 1 - A simplified scheme of LGU Securitization

Apart from these stakeholders, there may also be some other ones, as shown in the organizational scheme reported in Figure 2; some of the described functions may also be performed by different actors in the process, constrained of course to respecting the Italian legislative issues on this topic[4] (for details, see Chapter 3 and the forthcoming technical report from the same authors of this paper).

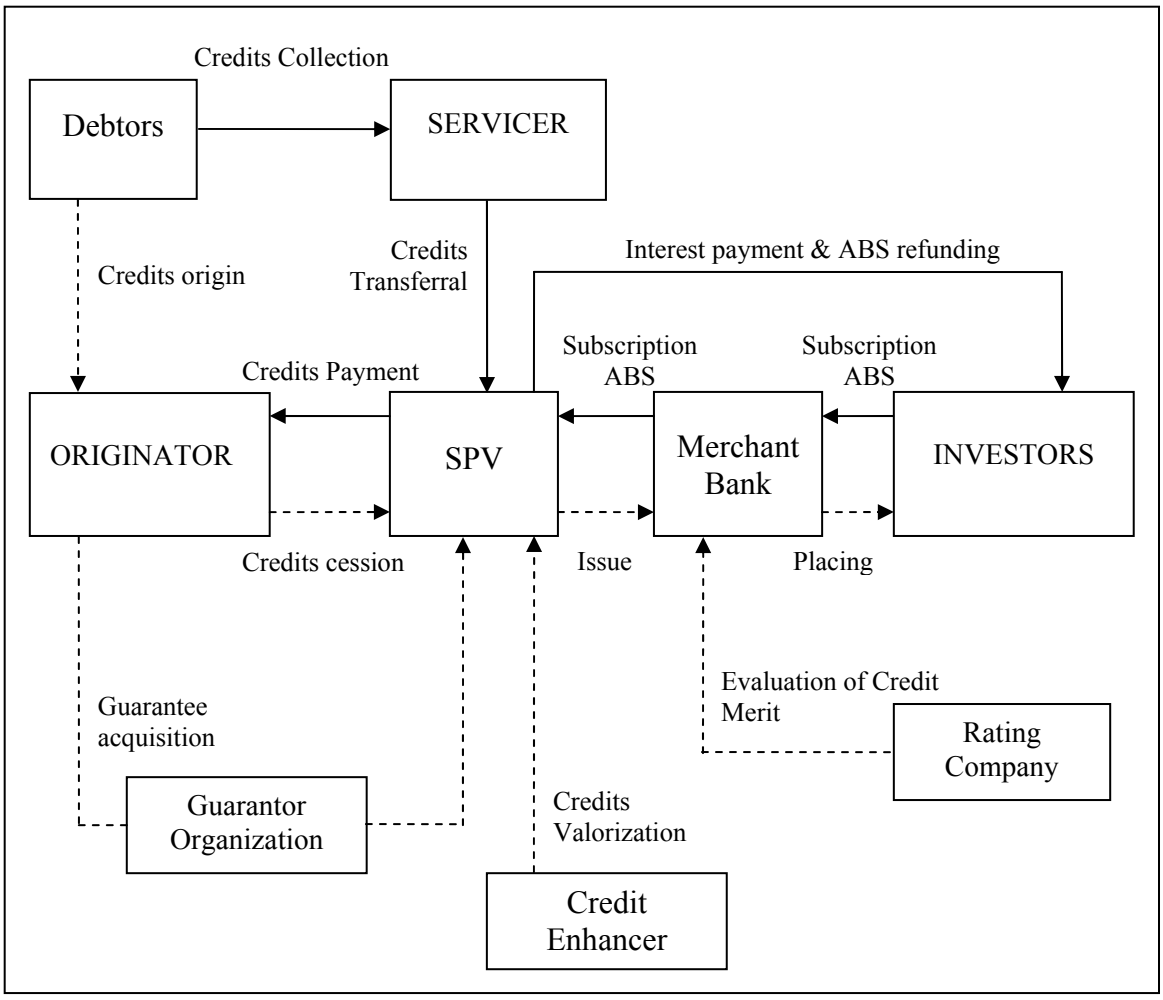

Figure 2 – The general Organizational & Functional Scheme of a Securitization

So, in our case study, the role of the Arranger (which, as said, effectively structures the operation, subscribes the bond, and manages the resulting patrimony) will be normally intended as a general one that involves various functions, as those performed by the Servicer, and whose distinctive characteristic is that he will earn the accrued interests on the obligations (bond). Both the Credit Enhancer and the Rating Company, in the case of Local Public Administrations is to be considered as not directly necessary towards the goal of the operation. In fact, an LGU rating already exists for those privileged public credits (that is, taxes which of course *have* to be collected), also because it strictly connected to the financial rating of its "treasurer" (which is often physically constituted by a bank!). For all these reasons, our Securitization reference scheme from which we will start our analysis, and on which we will base the following modelling, will then be the simplified one depicted in Figure 1.

[4] MARCHETTI F., *La cartolarizzazione dei crediti in Italia: aspetti fiscali*, in Bancaria n. 3/1999;

3 – The Italian situation and legislative constraints

In the past, without an *ad hoc* regulation, the rare operations of securitization were realized through the creation of complex structures, most of the times recurring to the support from experts in foreign law. There was then the need of a legislative intervention from the Italian Government in order to overcome such obstacles, and to facilitate the use of securitization, even through an effective system tending to guarantee a certain risk minimization for the investors.

We will then now introduce the main milestones (described as "steps") which have led to the actual Italian legislative scenery.

Step1:

Following to the coming into effect of the Law no. 130, dated April 04, 1999 and titled "Dispositions on the securitization of credits", in Italy, similarly to other European countries, it has then been made possible to perform securitization operations. On this, see the Appendixes of the forthcoming technical report from the same authors where all the constraints and ties imposed by the Italian Government on the operation will be reported in detail.

However, in order to clarify a bit more what is the context we are moving into, the art.1 of this law outlines its environment of enforcement, with exclusive reference to those "securitization operations realized by onerous assignment (sale) of actual and future credits, identifiable in block if it's a credit plurality"; also, if the nature of the seller is not specified, the buyer will have to be a financial intermediary, having as a "social exclusive mission" the performance of one or more securitization operations, to which do not apply the following dispositions:

- Limitations on minimum equity capital (it may be a Ltd. Company): art.106 par. 3/c
- Limitations on the amount in the bond issue: art 2410-2420 c.c.[5]
- Prohibition in the collection of public savings: art.11, par. 2, TUB[6]

The so called "institutional actors" involved in the operation were also left quite a wide discretion on selling credits: the law, in fact, doesn't establish if the credits sale must be intended as:

- pro-soluto: the seller transfers to the contractor both the rights on credits collectability and the corresponding risk of a missed payment at the credits expiry

- pro-solvendo: the seller offers to the contractor a certain warranty on the collectability of the credits that he's selling , but the latter maintains all the same the corresponding risk responsibility.

Therefore, the decision on the assumption from the buyer (SPV) to assume himself or not the risk of a missed payment, at the expiry of credits, is left to the buyer himself. The ABS titles are comparable to obligations issued by corporations (Inc. companies) and the rating is compulsory only for non- professional investors.

[5] c.c.: civil code
[6] TUB: Testo Unico Bancario, that is a sort of "Unique Compendium on Banking Operations and Dispositions"

Step 2:

With the emanation of Law n° 342, on November 21st, 2000, also Local Government Units have been allowed to sell their tributary and contribution credits.

The results of such a disposition are of remarkable importance: in this way, in fact, it was also possible to sell the incomes due to interests, sanctions and penalties connected with the sold credits; in this way the LGU itself guarantees the existence of the sold credits but it is not responsible for any debtors insolvency, thus the acquisition of credits from the buyer automatically grants him both the same privileges and guarantees that assist those credits, without any need of formalization; moreover, the credit sale is free from any registration taxes, and every other indirect tax.

Step 3:

In June 2002, in the context of a study on Securitizations performed in the Public Sector, EUROSTAT[7] noted and established that:

- A securitization must concern with credits already written in the Financial Statement of a LGU
- The absence of any form of public grant in favour of the investors;
- The starting price paid to the Originator must not be lower than the 85% of the overall value of the reference market.

Step 4:

With Law n.350, December 24th, 2003, receiving some other Eurostat advices, the Italian Government established that the LGUs and their connected "collective public organizational forms", which are mainly public companies emanating from them, can recur to debt only in order to finance local investment expenses, and only if they observe the European Community limitations imposed on securitization operations, with the exception of those public companies which were created by LGUs in order to provide public services for the following specific areas:

1. securitizations of future income flows not connected to a pre-existing patrimonial activity;
2. securitizations with a starting value lower than 85 percent of the market price (evaluated by an independent and specialized unit) of the asset securitized;
3. securitizations accompanied by guarantees and grants provided by public administrations;
4. securitization of credits claimed towards other public administrations;
5. the credits sale claimed towards other public administrations.

Thus in relation to these legislative measures, LGUs can benefit from many advantages such as obtaining a determined (and certain) financial income flow, avoiding the need of performing themselves the recovery credits activity, and acquiring the possibility to reduce the expected staff only to the tax office operators; in other and more simple words, they get the chance to shift and transfer the risky fiscal recovery actions on another subject who will do it for them.

[7] EUROSTAT: it's the Statistical Office of European Community.

4 - The model

In the context of financial engineering, the modelling of a complex process like the securitization, , particularly lends itself, for his intrinsic nature, to a holistic and systemic approach. It may then be by means of a System Dynamics model that we may reach a complete vision of the system in his complexity, also understanding the connections and interrelations between the various processes and side-processes. By showing all the connections between the many variables which may be evidenced in such an operation , we can build a model which may then be simulated, thus helping us to analyse the effects of some variables of interest on the whole system (on its outputs of interest), also allowing us to quantify the relative weight on the output of the process. In this way it will be easier to perform new system analysis and model developments, like for instance a deeper risk analysis. The latter especially will be the main topic of a next more detailed work.

This approach represents a starting point in providing effective simulation tools, implemented in order to understand the fundamental structure of a system as well as also to understand its dynamic and complex behaviour over time.

The central idea of the entire SD is characterized by the concept of Stocks & Flows, besides the concept of feedback. The **Stocks**, represented by rectangles, are accumulators that charapterize the state and information of the system, and they are the memory of system; their values aren't instantaneously calculated, because they're accumulated, creating an implicit delay effect on the system. Every stock has variations due to **Flows**, that can increase (Inflows) or decrease (Outflows) the stock level.

Mathematically, a Level is the integral of a Flow (in System's Theory, Levels are State Variables):

$$\text{Flows} = d(\text{Level})/dt$$

The complex behaviours of a system are thus due to the presence of differential equations but also to the interaction between various feedback processes, each one often presenting non-linearities (especially found in those relations describing some "soft" aspects of the system which most of the times are not fully described by analytical/mathematical techniques) and critical delays.

For further information about this methodology, see the references on System Dynamics at the end of this paper.

According to the System Dynamics modelling approach, the model has been built on a preliminary way by developing a qualitative causal map, which describes the main relations and interconnections between the various parts of the system. In order to have an easier diagram readability and easiness of variable representation, in the CLD represented in Figure 3 we only showed some of the main auxiliary variables of the whole model (for further details, again ,see the forthcoming technical report).

Similarly to the situation depicted in Figure 1, we find reported in our simplified main causal map, all those main actors which interact in the process of a securitization operation (Originator, SPV, Arranger). In particular, they are represented by their liquidity level and their cash flows, or in other words by the behaviours shown by these typical SFD elements (levels and flows). Also notice that the full arrows in the process scheme of Figure 3 have been transposed into money flows among the various interacting financial actors. In particular, the outflow from the '*Debtors*' variable (as

depicted in Figure 1) has been designed as entering directly into the SPV cash: this simplification is due to the fact that, by selling credits, the Originator effectively sells to the SPV also the right to collect them.

By analyzing the resulting causal maps, it has been possible to verify the presence of some feedback cycles, which describe some of the dynamical complexity of the system.

Particularly evident is the reinforcing positive feedback loop acting between the SPV cash and its related interests accruals. We could also identify two more main negative feedback loops, that are respectively constituted by the reinforcing effects that both '*sanctions*' and '*interests accruals on delayed payments*' have on the collected credits during a financial exercise: as the former ones increase, the debtor would have all the interest to respect the payment due-dates in order not to incur in further costs, thus lowering the percentage of uncollected credits and then increasing the overall amount of credits that get collected in the year by the SPV. The quantitative mathematics involved in these relationships are however quite complex and needs thus further study. For this reason, and since the obtained results showed a satisfying overall behaviour though in a worst-case situation (given by the above considerations), we didn't include the two negative feedback loops in our actual model but plan to do it in our future research on this topic.

The model was built and assembled for a maximum of three financial years, corresponding to three emissions of ABS titles; therefore it is capable of supporting a maximum of eighteen different credit values/characterizations. However this doesn't of course really constitute a true limit, and the model will be enhanced in future works, depending also on the availability of a more heterogeneous set of cases.

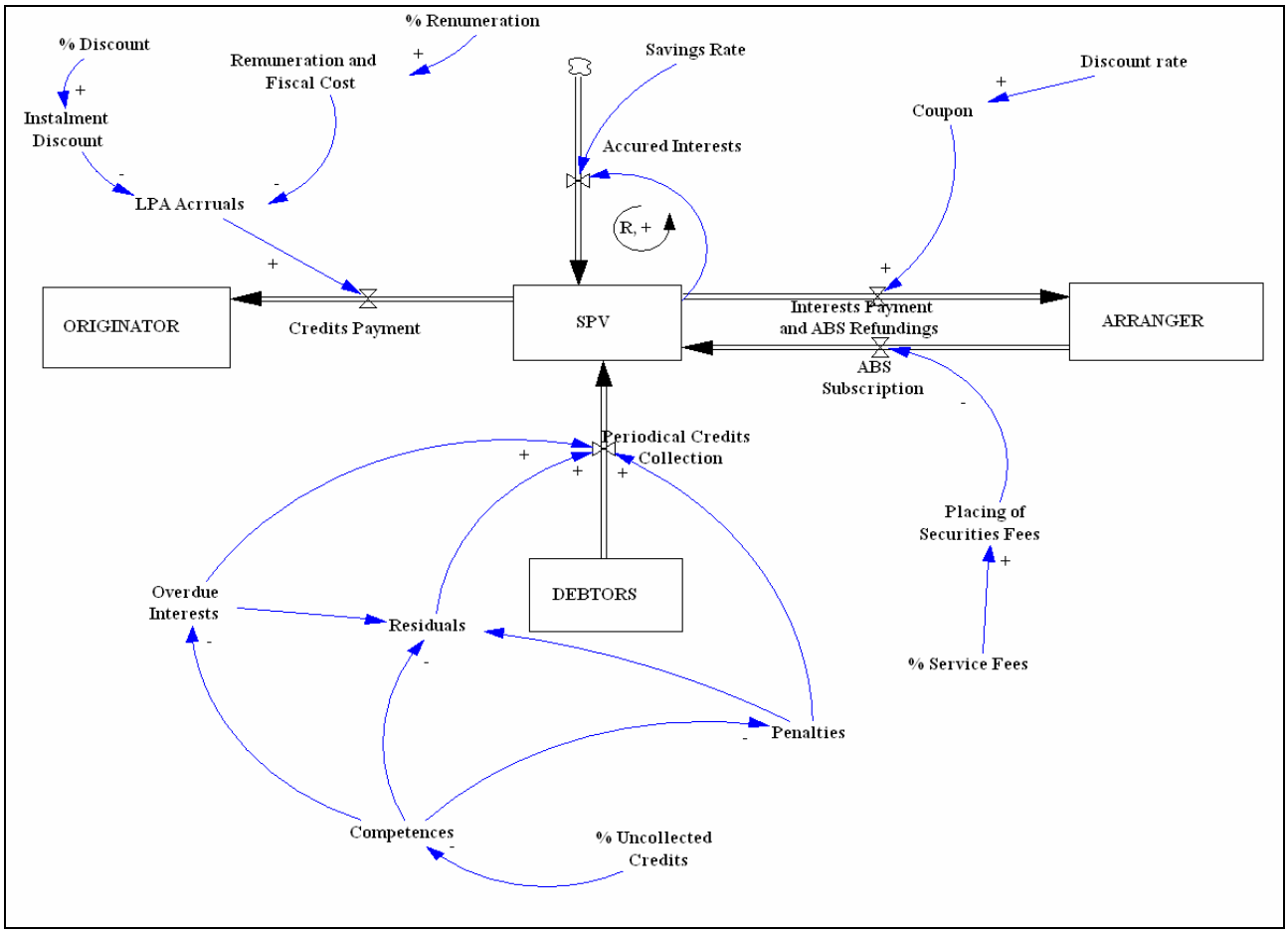

Figure 3 – A first qualitative Causal Map

From this qualitative causal map, developed by means of the System Dynamics approach, it has been possible to develop the connections between the players of the securitization, simulate the behaviour of the resulting model and quantify all the implied and resulting cash flows. Let's now analyse separately the structure of each of such players' submodels:

4.1 - ORIGINATOR

The disinvestment of his credits to obtain liquidity, allows the Originator to see an incoming flow (*LPA accruals*, which stands for the interests matured by the LGU), caused by the SPV, net of rewards and fiscal costs related to the sale. In the model, furthermore, we included the opportunity for the LGU to preventively make an agreement with the *Vehicle* so as to undertake the risks of missed payments from the debtors; also, if the uncollected residuals were greater than the offered *discount*, the LGU will then be responsible for refunding the SPV of a sum which is equal to their difference (LGU or LPA actions).

Supposing that the SPV had been exclusively created *ad-hoc* by the Originator in order to perform the securitization, at the end of the simulation, the final surplus of the SPV is moved back to the cash of the Originator. By comparing such a cash with the initial state (when the Originator was still owning the credits as its assets) we may then have a better comprehension of how the operation generally performed: it will thus be the cash of the Originator to represent the benchmark of the good or bad performance of the operation, as we will see more in detail in the next chapters.

4.2 - SPV

This player is considered to be the main actor of the operation, and from/to him come/converge almost all the main financial flows of the other involved subjects, according to the different situations. The most important part in its structure is constituted by the *Cash* and by its relative income and outcome flows. The incomes of the SPV are obtained both from the bonds underwritten at the chosen nominal value, and from the credit collection deriving (at a slower flow rate) from the payments of the debtors (the payments due in the exercise plus those credits that were not collected in previous exercises); these incomes are further increased due to possible sanctions, overdue interests and LPA direct actions. The outcomes, on the other hand, are due to bonds refunding (plus the relative accrued interests), to the payment of credits to the LGU and to securities placing fees and various service commissions.

These financial flows will be further integrated by accrued interests on the final SPV cash value, according to the reinforcing positive feedback cycle, as shown in Figure 3. It's worth to point out how, at the end of the optimization process, and according to input parameters defined at the initialization of the system, it will also be possible to find out what is the minimum interest rate according to which a securitization operation becomes convenient. In other words, a Decision Support System for this kind of financial operations has been built.

The model also includes a parameter that allows to take into account the possibility of a discount on the LGU instalments, in relation to the interest rate applied to every credit collection activity. The SPV will thus be able to pay a lower price due to the instalments, in exchange for a regular and anticipated payment (the latter, again, being the fundamental reasons why the LGU decides to undergo a FRT-Sec). It may seem a contradiction to find out that the LGU discounts the credit instalments that it has to collect, given an implicit maximization objective; however it must again be

remembered that the SPV is an *ad hoc* created vehicle-company, and that its final cash value will be incorporated in that of the LGU at the end of the operation. Lower outcome flows in the current exercise will in fact imply the chance for the SPV of a better liquidity management, and thus, in the end, a better final result for the Local Government Unit.

Concerning the underwriting of the securities (the subscription moment of which, should exactly coincide in time with their issue), such an operation will involve a certain income (which may logically be associated with a unique one for every issue) for the SPV, which is equal to the nominal value of the bond, according to the desired and chosen issuing flag. In our model, it is possible by means of a switch control panel, to discern among three possible issue types for the bond:

1. PURCHASED CREDITS: a nominal value bond based on the total acquired credits value
2. COMPETENCE: a bond whose value is based on the overall value of the credits in the exercise,
3. RESIDUAL: a bond whose value is based on the credits residual amount.

Note that the bond will be completely underwritten by the Arranger; the Arranger itself will then decide whether to "turn" the securities to other investors, or keep them as a private investment form. The bond issue type selected at the start of the simulation, will imply a relative stock redemption plan, including accrued interests, whose relative repayment will then be taken from the SPV liquidity.

We have implemented three different redemption forms in our model, all of which may be selected, in a mutually exclusive fashion, by means of a switch control which corresponds to the different types of issue:

- FRENCH ISSUE: since the issue of the first coupon, the Special Purpose Vehicle sees both to the interests payment and to the return of part of the stock capital, so that the overall amount of the overdue interests will decrease as a function of the repaid capital; the latter increases in the case of constant instalment (that is, by keeping constant the instalment value, including interests), while it remains unchanged in the case of a variable instalment value (also this choice has been made available through a parameter switch control).

- BULLET ISSUE: it implies the redemption of the whole amount at the expiry of the loan bond, with the constitution of a sinking fund of amortization, increased yearly by a determined share of the capital to be returned (in this situation, the overdue interests will weigh on the total capital amount during the whole duration of the bond loan).

- ZERO COUPON ISSUE: in this case the rate of return is exclusively given by the gradual growth of the security value until its expiry date, it does not imply a periodical note/coupon payback and pays the due interests in a single solution at the time of the reimbursement. It’s an obligation which is issued below a certain par value, and whose rate of return is therefore exclusively given by the difference between the nominal value, repaid at the expiry date, and the underwriting fee.

By selecting one of these three hypothetical issue forms, the simulation will return the amount of the redemption sum and the correspondent interests; however we will not give, in this paper, detailed calculations on this subject since we did not deem it necessary towards the main paper goal which instead mostly concerns with an overall theoretical understanding of the model and of the securitization operation.

4.3 - ARRANGER

Under an economic point of view, the incomes of the Arranger are typically and mainly consisting in a cash flow constituted by the interests due to accruals related to the issued securities, which change according to the credits amount and the issue type through the various financial exercises, as already said in the previous paragraph. Also, a further income derives from the commissions due to the placement of the securities on the market, (*Placing of Securities Fees,* see Figure 3) one kind of fee for every bond issue and calculated on the basis of the security nominal value; in addition, by further exploring the model, we may also notice that there are incomes and outcomes of almost equal and negligible value (thus not so relevant for the Arranger, as it can be seen at the end of simulations) respectively due to Structuring and Professional Consultancy Actions. Because of such irrelevance of these flows, we didn't explicitly represent them in Figure 3.

The model was implemented in Powersim Studio® 2001 Demo. It is subdivided into several main sections (diagrams), each referring to a specific issue of the simplified process (again, see Figure 1) and in accordance to the characteristics of a securitization operation. This helps to better understand the various interactions in the real process as well as, by operating in a modular way, also leaves the system open to further and future improvements and developments.

5 - Some characteristics of the model

In order to let the model return significant and consistent outputs, we should take into account, by trying to evaluate them whenever possible, the underlying operation's risks (as previously also stated). Thus, in simulating a securitization operation as for any other system, we need to account for the presence of probabilistic elements which may change, also greatly, the regular and predictable results of a deterministic value. In fact "who guarantees that Mr. Jones will surely pay a certain municipal tax?". In this sense, our model is able to take into account this kind of problems since, whatever the behaviour of Mr. Jones will be, it will have already been accounted for, given the use of random variables which describe this event as an independent, possible and unpredictable phenomenon. In other words, account for probabilistic situations. Thus, the presence in the model of the variable *% collected on residual*, corresponding to a Gaussian function whose parameters are easily modified through a control panel is then legitimated.

It will then be possible, by simulating the model and acting on standard deviations and mean values of the Gaussian functions, to observe as said the effects due to the presence of probabilistic phenomena. In order to further extend our model, note that also the variables *residual % competence*, *Duration Residual Takings*, and other ones were also parameterized and given a lower value with respect to the historical value collection in the exercise; with this, we mean to show that, in such a stress situations, an outcome of convenience (for the operation to be performed) will most likely mean success in every other situation.

In summary, the model will allow us to choose among:

- 3 different issue-types (French, Bullet, Zero-coupon) for every issue
- 3 different nominal values (overall amount of the acquired credits, competence, residuals) for every issue

as well as the chance to use:

- a constant instalment
- discounts
- sanctions
- LGUs (or LPAs) interventions
- anticipated Incomes
- probability functions

6 – Case study and simulation

Our case study concerns a FRT-Sec operation performed by the LGU of a small town in the province of Rome, Italy. The pool of credits taken into consideration, which constituted our reference starting point, includes future incomes deriving from municipal taxes; it's very important to note that these credits are basically homogeneous and certain as it should be clear from their intrinsic tributary nature. Such a pool consists of six different credit types with respect to every financial exercise, which are in practice equivalent to as much municipal taxes (the overall amount of which is reported in the following table).

Let's now analyse the simulation data results shown in the following table, also differentiating between historical data and issue parameters; for the former, we could refer to real data taken from a small town administration as well as from its real credit collection procedures as performed in the past, also accounting for a "stress" (a percentage reduction percentage) in collection rates; the latter have been chosen on the basis of typical values of bonds, with particular reference to a graphical function curve reporting the behaviour of interest rates over time.

Transferrable Municipal Incomes	***Assessment (€)***	***% Insolvency***	***Purchased credits (€)***	***% Residual competences***
Total amount of 6 credits	6.179.136,35	4,3%	5.943.441,81	20,43

Issue parameters	**1°Issue**	**2°Issue**	**3°Issue**
Issue duration	12	5	10
Issue flag	Purchased credits	Residual	Residual
Start of issue	01/01/2006	01/01/2007	01/01/2008
% Service Fees	1,5	1,5	1,5
Yearly N° of Coupon Instalment	3	3	1
Issue Spread	0,5	1	1,2
Issue Type	Bullet	French	Bullet
Constant Instalment	-	YES	-
Euribor 6m		2,216%	
Application of penalties		YES	
& penalty		10%	
% overdue interests		3%	
Anticipated credit collection	NO	NO	NO
Delay residual collection	5	5	5
N° LPA instalment	10	10	10
LPA actions	YES	YES	YES
Discount on LPA recovery debt	YES	YES	YES
% average residual collectability	85%	87%	86%
% remuneration	4%	4%	4%

Table 1

The data in Table 1 constitutes a sort of initialization of some of the characteristic parameters of the model. So, in this first example, the parameter values are only indicative and serve the only purpose to show which are those inputs that have been then used in the following example simulations, except for the values that will be changed in the optimization phase (see the following Table 2).

Under a more quantitative point of view, in this first example, we can notice that at time t =0, the LGU (Originator) sells to the SPV, for an amount of 5.943.441,82 €, the first pool of credits (and their relative "rights"), which were previously held in balance with a value of 6.179.136,36 €. The selling value corresponds to the credits overall amount value, net of insolvency, also called "net credits", whose relative periodical payments from the SPV to the LGU will be modulated, over a year period, on the input dates to the model.

Instalment payments will be then curtailed both of fiscal costs and rewards for the sale, further discounted of a value which is equivalent to a percent of the discount rate on the credits income. Parallel to the credits repayment to the Originator, the SPV will have to manage the cash flows exchanged with the Arranger.

7 – Output results and analysis

In order to better analyse the results of the simulation, we will use the point of view of the Originator (the one performing the operation in order to earn a better liquidity) and we will economically compare the initial and final states of the system.

As previously shown, in our case study, the LGU sells three pools of credits for a total net value of 17.830.325,46 €, but collects for the first three years a lower value of 15.904.194,55 € , including the discounts granted to the SPV. The notable difference between the two amounts, that is 1.926.130,91 €, could at first make us draw some hurried conclusions, since generally the advantage of an operation of securitization could be demonstrated starting by the necessary condition that such a difference is zero. However, in order to draw consistent conclusion, we should wait until the expiry of the bond loan, which usually coincides with the end of the simulation, at which moment the Originator will have accumulated an income equivalent to the surplus generated by the SPV, that is 1.221.791,62 €, as highlighted by the output graph in Figure 4.

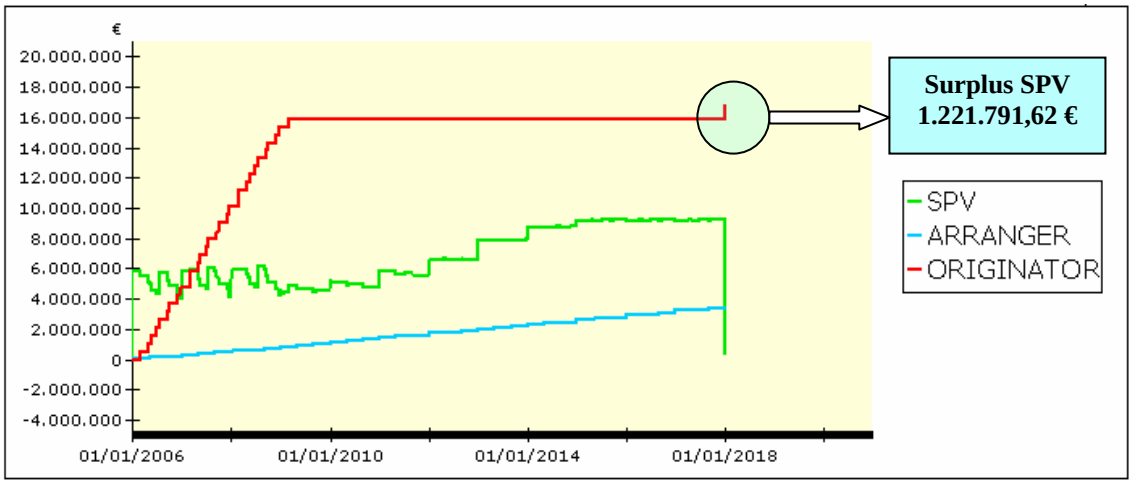

Figure 4 – The three players cash flows over time

Only at this point it will be possible to draw a line in order to evaluate results:

The LGU collects a total of 17.125.968,18 €, with a calculable loss of 704.357,28 €; this value may be questionable, as it doesn't allow to cover the administrative costs (713.213,02 €), that are the 4% of net credits in this specific example of simulation. So, even if it seems that we are not recovering the costs of the securitization operation, it must be considered that the actual activity of credit collection also has a cost, to which the LGU is anyway not indifferent at all, and which most of the times is not less than the 6-7% of the verified credits. Usually, this activity is performed by external operators which collect taxes, the so-called "*collectors*"; they can receive the collection activity either as a special concession (so usually they are Banks) or in outsourcing as private companies, and their remuneration is constituted by the above mentioned overall verified credits percentage. In securitization operations, the remuneration for the sale is determined, upstream the operation, and directly written on the contract, within a *due-diligence* among Originator (LGU) and SPV, especially if the latter is the responsible for the collection, and mainly depends on how the LGU has historically been collecting its credits.

By extending our considerations to a dynamic analysis of the SPV behaviour, we may notice that, during the whole simulation, its liquidity cash constantly remains beyond a certain value, and precisely beyond 4.000.000 euro during all the duration of the simulation (in this experiment, it was a 12 years run), even reaching up to above six millions during the last 4 years of the simulation. This fact is quite interesting and important, since such a final sale may allow the SPV, after having preventively studied and examined the operation's outputs, to invest most of the incomes, that, as seen, would never decrease under a certain threshold, thus allowing the SPV to "count" on them, in order to cover the costs of the operation.

More in detail, analysing the dynamics of the credit collection, it is interesting to note the cash flows behaviours, as shown in Figure 5, deriving from the payments to the SPV of municipal taxes for the three financial years, and with particular reference to the variables *% residual competence* and *% Collected on outstanding*, as also reported in the model data input, in Table 1.

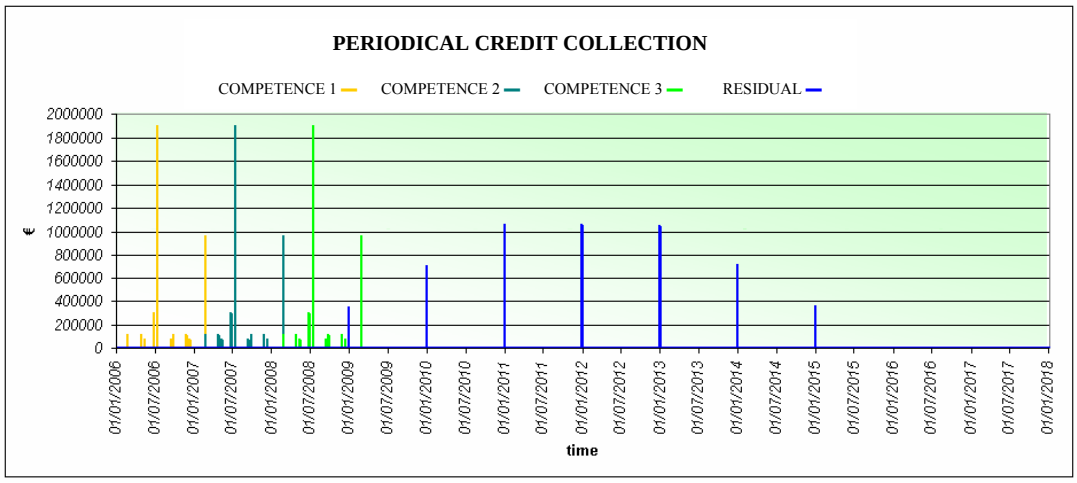

Figure 5 – Effective Credit incomes representation

It is also worth to notice in Figure 6, the payments dynamic evolution concerning the instalments flows paid by the SPV to the Local Public Administration (LPA, or LGU), correspondingly to the input payment dates. The graph's peaks in the figure show a coincidence of the last instalment of the first exercise, with the date of the first payment of the second exercise.

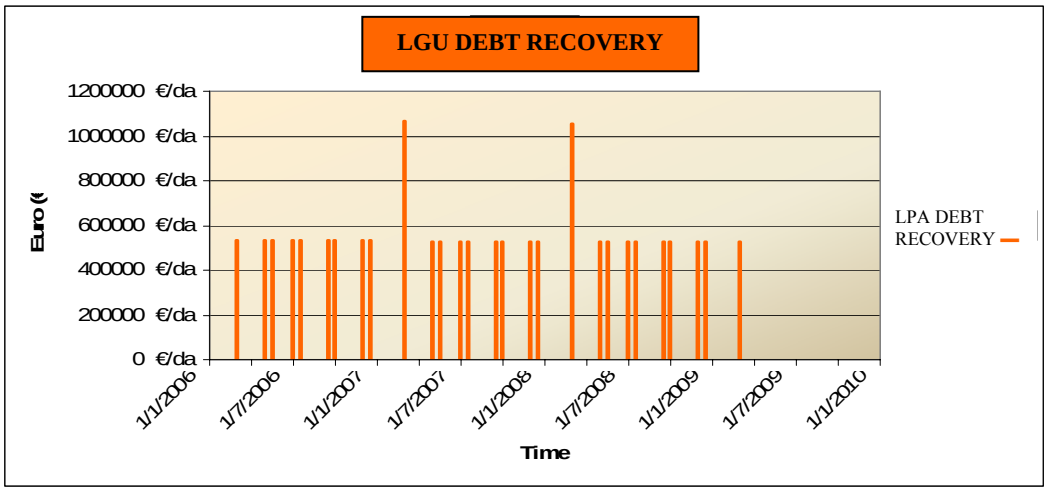

Figure 6 – Instalments to be paid to the LGU

8 – Model optimization with an SPV cash liquidity constraint

We will now analyze the model by experimenting with it and trying to find out evidence of situations that may point out any disadvantage in such securitization operations. In order to do it, we will impose a constraint on the SPV liquidity final value. That means that we will try to optimize the model in order to find any possible values in the parameters allowing the minimization between the overall amount of sold credits, net of insolvency, and the final Originator cash liquidity value, at the end of the simulation (and thus after that the Originator receives the SPV final sale). In other words, by imposing such constraint, we mean to try to minimize the loss due to the sale of such credits. An orthodox best-practice would point out that in order to achieve such result one would need a proper management of the SPV income and outcome cash flows by trying to maintain always a positive difference between incomes and outcomes. However in practice, even if the SPV should face some loss over a short period (if compared to the whole simulation time), this would not prevent the operation's overall performance and good outcomes, mainly also because most of the times such important financial operations have an insurance coverage by means also of bank loans which get underwritten right in order to be able to bear the operations risks.

In order to optimize the model, we used the Powersim® Solver which is able to generate multiple simulation runs in each of which only some of the parameters are varied, according to the concept of sensibility analysis. Some of these parameters represent decisions that may be taken during the simulation or even at its start, in order to reach the final desired and specified optimization goal. It is thus necessary to specify which decision parameters the Solver is allowed to vary in order to reach one or more specified goals. In our situation, the decision parameters, that the Solver could use in order to satisfy the imposed constraint, were concerning:

- the type of issue,
- its duration,
- the number of instalments for every bond issued,
- the possibility to have fixed or variable instalments,
- Sanctions,
- LGU interventions,
- Discounts on the LGU instalments.

In the next table we show in more detail the optimal decisions "taken" (found) by the solver.

Possibile Decisions	**Range of Decision Value**	**Optimal Decision Value**
1°Issue duration	From 5 to 20 years	12
2°Issue duration	From 5 to 20 years	13
3°Issue duration	From 5 to 20 years	19
1°Issue Type	French or Bullet	French
2°Issue Type	French or Bullet	French
3°Issue Type	French or Bullet	French
1°Issue flag	Purchased credits - Competence – Residual	Residual
2°Issue flag	Purchased credits - Competence – Residual	Residual
3°Issue flag	Purchased credits - Competence – Residual	Residual
Yearly N° of Coupon Instalment 1°	From 1 to 4	1
Yearly N° of Coupon Instalment 2°	From 1 to 4	2
Yearly N° of Coupon Instalment 3°	From 1 to 4	3
Constant Instalment	YES or NO	NO
LPA actions	YES or NO	YES
Discount on LPA recovery debt	YES or NO	YES
Objective:		**Final results**
Min (Purchased credits – Originator Cash)[8]		-114.318,94 €
Constrained to: SPV Cash > 0		YES

Table 2

After the optimization was run, the Solver found out an optimal combination of the previously cited parameters values, representing the decisions taken at run-time, which essentially brought to a final positive margin of 114.318,94 €, thus allowing the LGU with a full financial coverage of the whole operation's costs.

It is interesting to note, in Figure 7, how in this situation the SPV cash liquidity constantly remains positive, for the whole duration of the simulation, thus bringing to an *active* final sale. Thus we may infer that the imposed constraint is important in the sense that it allowed to have a better management of the operation as well as lesser risks, also avoiding running into a passive sale.

[8] It means that we want to maximize the Originator cash!

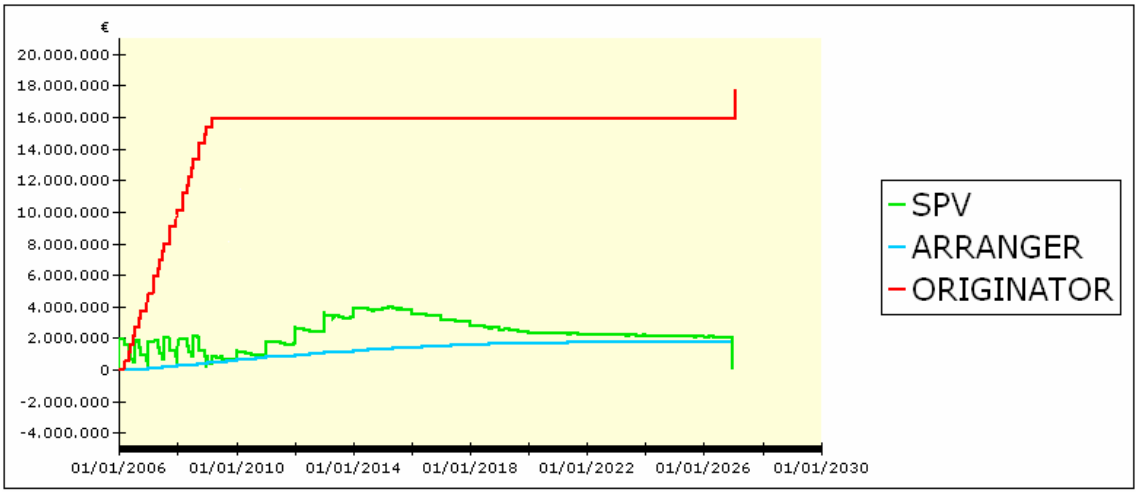

Figure 7 – Optimized cash-flows

Moreover, we also performed some analysis on the minimum SPV investment interest rate requested in order to allow an overall equilibrium of the operation (that is, "zero-sum" results), thus searching for a result equal to zero in minimizing our objective function. It is possible to see, in Figure 8, how the minimum equilibrium interest rate found was 3,144%, a value which is lower than the interest accrued on the bonds issued by the SPV. This puts in evidence once again the convenience of credits securitization, since all the actors involved will generally have an economic return on investments from which they can benefit.

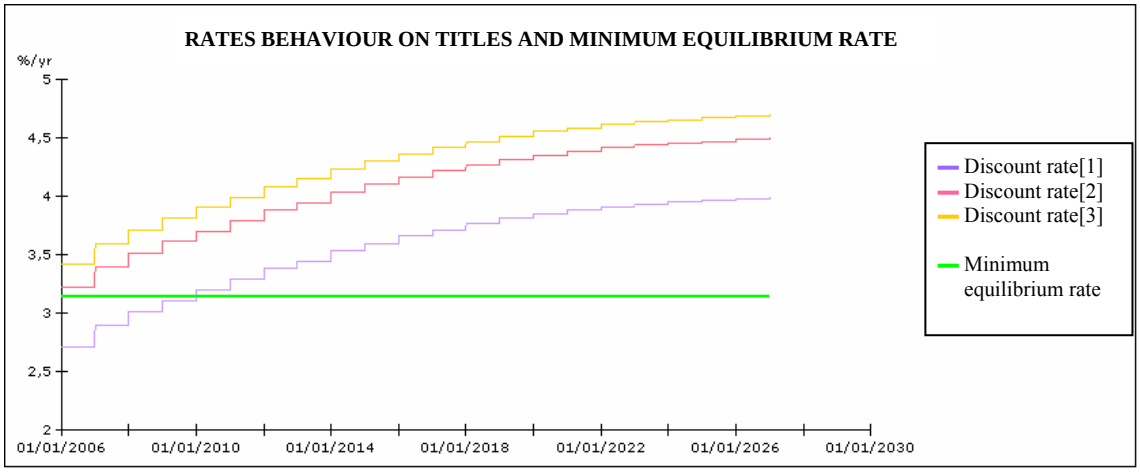

Figure 8 – Minimum equilibrium rate

Turning back again to the *optimal decisions* previously evidenced in the optimization process, and according to those parameter values that, in a second set of simulation runs, were set as the initial configuration for our case study, it is interesting to find out the following optimal (or, in someway, "preferred") policies for the credits securitization:

- a French issue, with variable rate
- a securities nominal value equal to the residual credits overall value
- a certain discount on the instalments due from the SPV to the Originator (LGU)

However, a uniquely optimal policy does not exist since, in a real situation, the initial parameter values would always have different characteristics. For instance, the choice of a particular issue flag on residuals would in fact be a function of a percentage amount of its own value if related to the nominal credits value. Thus, a particular caution is needed before structuring and performing a future credits securitization, especially in the preliminary study on the credits income modalities, even if the presence of historical series, in order to take into account potential risks or even probabilistic events that should be addressed before performing the operation would allow for some confidence.

Thus every solution will be different and it's not possible to determine only under numerical considerations on its final value whether a solution is good or not. In fact, will it be more convenient to have a very high liquidity at the end of a twenty years period or is it better to have a discrete one on a ten year period? This of course only depends from the contingent needs of every LGU and from the objectives determined in the planning phase of the political exercise

9 – Conclusions and future work

In this paper we tried to address the interesting issue of credits securitization, in a particular context like the one of the Italian Local Government Units credits collection activities. Research has shown us that such a subject hasn't been sufficiently addressed until today. After having reviewed what the literature states on Securitization, and after having addressed also some of its legislative peculiarities in the Italian context, we developed a simplified framework and a System Dynamics model which we experimented with, also implementing a tool able to support decisions even in presence of probabilistic processes (which is somehow intrinsic in the environment of the securitization operation), which may be used to assess the operations risks and possible outcomes, as well as the best policy that may produce the best final outcomes.

By tuning the model on real data, fed to the model at run time, it would also be possible to transform the tool into a true dynamic Decision Support System, which in the end may be definitely helpful even in managing the operation during its evolution.

We showed in fact how the model brought to excellent results in the case of a Future Credits Securitization of a small italian LGU, allowing a *proper* credits collection that may be more remunerative than collecting the same credits with a certain delay on a long time horizon, over which the LGU would also run the risk of loosing interest in collecting such credits over the years.

In a context such as the Italian one, where the Governmental fundings destined to LGUs are facing a trend of reduction, the securitization of future credits may represent a safe anchor for many of those little-to-average (in terms of citizens) Public Administrations, which aren't able any more to collect sufficient capitals in order to reinvest them in public works, also towards a wider consensus from the citizenship.
Some of the examples we presented in this paper, clearly explain instead how a *proper* credits collection may be more remunerative than collecting the same credits with a certain delay on a long time horizon, over which the LGU would also run the risk of loosing interest in collecting such credits over the years.

But why a LGU should then Securitize its future credits rather than just collecting them over time and by the usual means (through the so called "collectors")? And why the collecting agencies should find it interesting to collect the LGU credits (even worse if uncollectible or in someway "frozen" due to some legislative procedure on them)? In the latter case, the LGU would probably either loose the credits or would at least have to pay too much for their recovery. The Future Credits

Securitization (FCS) instead, since it directly involves all of the collection process stakeholders, would optimize the outcome of the credits collection operation with some reward margins for everyone involved. That is, in the end, a WIN-WIN approach or framework which would see for instance the collectors collecting for their own interests (because they make profit out of it).
On the other hand, one of the most used approaches in Public Administration Finance is concerning with the certainty of the incomes at the beginning of the tax year and on its cash flow. If there's not a proper balancing in the cash flows, the LGU may not be able to financially sustain many important milestones in its political planning over time. The simulation of our model has instead shown to be capable of properly regulating the LGU cash flows.

In this paper we didn't delve into great details of the model equations, which will instead be one of the goals of our forthcoming technical report. This will extensively cover in detail our study on the Securitization of Future Credits in Local Government Units, both under a legislative point of view and under the point of view of the modelling process that we followed while building our simulator.

Some of the actual limitations of the model proposed are relative to the missing of an extensive risk account as well as to accounting for the possibility of underwriting insurances on the credits, which will be part of our future works on this argument.

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The software used to build, simulate and optimize our model is *Powersim Studio® 2001 - Demo*