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INMUNIZACIÓN GENERAL Y DINÁMICA CON REPLICACIÓN DE CARTERAS

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GENERAL AND DYNAMIC IMMUNIZATION WITH REPLICATING PORTFOLIOS

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1. Introduction

Immunization born in the actuarial world in 1952.

It has overcome several theoretical problems initially pending.

Now, immunization is a valid, agile and dynamic strategy to manage interest rate risk of a bond portfolio.

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1. Introduction

On the other hand…

The replicating portfolios is a way to avoid the risk of investment through continuous reallocation of assets.

It eliminates the risks arising from the change in the value of the underlying, by the passing of time and so forth.

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1. Introduction

Both methods allow, in theory, the generation of portfolios without risk...

It´s needed to compare them from an actuarial point of view, taking into account:
•the extent to which risks are eliminated in each of them,
• the expected returns offered by them, and
• how can be tried to manage them as intelligently as possible.

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1. Introduction

In the underwriters multitude of risks are assumed:
1. Some of its activity, as the risk of mortality, longevity, and so on.
2. And others linked to the above, such as interest rate risk, credit risk, and so on.
   In the latters, there have been proposed techniques linked with the activity of financial institutions, which have no so long term liabilities and, so, do not have much to do.

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2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

To meet long-term commitments is usually advised to invest in equities, but even in the medium term the share price might be falling, so only in the very long term it might make sense to consider this type of investment, especially when there is no bond that period or, if any, gives not enough income.

2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

If instead you opt for fixed income investment, since allegedly offers guaranteed performance, first titles should be chosen properly to not suffer a breach which prevents the company its own compliance.
Having made this choice so that implies sufficiently safe investment, the company has to consider what happens to the performance that will get your investment, that is, will have to manage interest rate risk.

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2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

First proposals:
•Cash Flow Matching (Haynes and Kirton, 1952)
  There is no interest risk remaining…
  More Expensive…
  Sometimes imposible to implement
•Immunization (Redington, 1952)
  No perfect hedge
  Cheaper
  Easier to implement

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2. General and Dynamic Immunization:
Applications, Advantages, Disadvantages and Impossibles

Immunization´s main theoretical restriction:

•Just valid for the mere moment of it´s implementation

No theoretical restriction since the research of Iturricastillo and De la Peña (2003) and the finished model presented by Iturricastillo, De la Peña, Moreno and Trigo (2011).

Practical check by Iturricastillo and De la Peña (2013) on a 9 years basis with no rebalancing inside the Spanish debt crisis (2004-2013).

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2. General and Dynamic Immunization:
Applications, Advantages, Disadvantages and Impossibles

General and Dynamic Immunization 3 basic features:

•Dynamic

Conditions are not maintained only at baseline but remain in time by themselves without continuous establishment of conditions of static equilibrium.

•Complete

Not only can dynamically immunize a portfolio without a surplus, but can even be applied to surplus or surplus / asset ratio immunization.

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2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

General and Dynamic Immunization 3 basic features:

•General
In the end, all the general dynamic immunizations, with or without surplus, are a generalization of Redington´s immunization.

2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

General and Dynamic Immunization unique assumption:

•Interest rates follows the hypothesis of rational expectations and the shifts (at the time in which they manifest) are parallel with respect to the rate curves that it generates in those moments.

2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

General and Dynamic Immunization conditions:

•Zero net value.

•No difference between modified duration of asset and liability.

•Positive difference between modified convexity of asset and liability.

•Set a cash flow matching period at least equal to the time with no rebalancing (better if is longer).

And it could be added a 5th one:

•The RIA (Absolute Immunization Risk) should be set lower than a set proportion of the maximum wanted to have in the whole period.

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2. General and Dynamic Immunization:
   Applications, Advantages, Disadvantages and Impossibles

Immunization´s applications:

•Interest rate risk management.

In Spain it´s even accepted to offer a technical interest rate risk higher based on immunization techniques.

And, they don´t even follow the general dynamic immunization conditions [See "Una revisión del modelo inmunizador español para los seguros de vida", Iturricastillo, De la Peña, Moreno and Trigo; Anales del Instituto de Actuarios, 19, 2013, 31-62].

2. General and Dynamic Immunization:
Applications, Advantages, Disadvantages and Impossibles

Immunization´s impossibilities:
•Not expected to manage equity risk, credit risk and so on.

   So, don´t try to.

(General and Dynamic) Immunization´s advantages:
•reduce to a minimum transaction costs that only enrich mediators / brokers, in exchange for minimal risk.

   So, it´s really interesting!!!!

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Plenty of financial literature.

Many different models, criteria, assumptions, and so on.

Probably because it is not clear what is the actual concept that follows the market, if such a concept exists and it is not all a pseudo - chaotic evolution.

As there is probably no concept that can define reality, the mere statistical truths have a great future in these areas, but always considering how far reach their potential and what issues are difficult to cover under this approach.

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Management tools based on stochastic simulation might be classified into :

1. Arbitrage free. In which the replica is perfect and unique.

2. Portfolio replication. In which replicates for most scenarios generated .

3. Portfolio optimization based on scenarios. In which tries to find the optimal portfolio depending on the client´s preference / aversion to risk, given the scenarios generated.

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3. Replicating portfolios:
    Applications, Advantages, Disadvantages and Impossibles

Initially, arbitrage free is preferable to portfolio replication, as they do not depend on any set of scenarios, and this portfolio replication would be preferable to portfolio optimization, since it would eliminate virtually completely the risk, not depending on assumptions , preferences and so on.

Even the latter would be a clear improvement of the Modern Portfolio Theory, in which instead of the static risk-return approach is used a similar approach in optimizing over scenarios.

(Obviously , as are considered the preferences in the election, it's not exactly a replica.)

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3. Replicating portfolios:
    Applications, Advantages, Disadvantages and Impossibles

1. Arbitrage free.

The no-arbitrage could in theory be applied to different areas in finance, but in the financial literature there is a great preponderance of its application to option pricing.

If you were to enter such a complex operation and the performance to get from the portfolio is the one of the riskless bond, this only makes possible to construct new financial instruments available to speculate (or to cover someone risks).

3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

1. Arbitrage free.

Black-Scholes formula´s main problem:

It does not offer proper values when local volatility is not constant (and it´s not).

•Rubinstein (1994) suggested to apply implicit binomial models

•Dupire (1994) suggested to apply implied trinomial models, and

•Derman , Kani & Chriss (1996) and Cizek & Komorád (2005-2007) continue along this road, even proposing multinomial trees.

Interesting explaining graphs in Derman , Kani & Chriss (1996)

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

2. Portfolio replication.

The portfolio replication have different utilities:

•The very hedging financial risks and, also,

•The advantage of speed in the calculations.

It´s interesting to issue that when replicating long term bonds, the portfolio got usually is very similar to a immunized one or a matched one.

So, the old methods,
not based in mere statistcs,
are not so bad!

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3. Replicating portfolios:
Applications, Advantages, Disadvantages and Impossibles

3. Portfolio optimization based on scenarios.

It is an approach that overcomes the Modern Portfolio Theory, as it is an optimization but based on a stochastic approach which overcomes the static version represented by this.

Dembo & Rosen (1999): Optimization looks for the portfolio that best replicates one of the attributes of the target (usually value and cash flow) on a specified date under all scenarios.

They look for a optimization with multiple target at several different times ensuring that errors are minimized first in an attribute before attempting to minimize a second attribute.

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3. Replicating portfolios:
Applications, Advantages, Disadvantages and Impossibles

3. Portfolio optimization based on scenarios.

The optimization takes into account risk aversion , which directly implies that it is not a replica (question that sometimes many confuse) but an optimization.

Dembo (1991): "Optimization scenarios is not all science."
So, it should be always and in any case added an analysis of extreme cases, even those who think a priori that are unthinkable at present.

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

3. Portfolio optimization based on scenarios.

Contributions have been numerous. For example:
- Gondzio et al, (2000: transaction costs, stochastic volatility and so on; and
- Zhao & Ziemba (2000): they raise the basic question of (almost) guaranteeing the survival of the company.

But, as in most cases, it all depends on how realistic price movements are expected / scenarios generated / ... in this case a geometric Brownian motion in a complete market to ensure that payment order "almost certainly " is required..

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Advantages:
1. It has a great scope in the financial risk management of different investments. In fact, it can be applied to manage virtually any investment.
2. It will provide generally reasonable control risk, except if there are terrible market developments.
3. The speed in the calculations, although that depends on whether we are in a case in which we apply a closed formula or one in which we have to simulate many scenarios. Indeed, the issue of dimensionality is always present.

3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Disadvantage:

1. It needs an ongoing monitoring and rebalancing which obviously causes some major costs (transaction among others).

Impossible:

1. Even this system, as agile on the other hand, cannot generate a replicating portfolio if no market in which financial assets are traded appears appropriate.

   (For example, interest rate risk to an extremely long period.)

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3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Impossible:

2. In this cases, it may be optimized a portfolio that is closest, but you won´t replicate and it shouldn´t be used as collateral coverage.

3. Usually is noted that the actuarial risks cannot be managed with this system. This could be solved by means of derivatives based on actuarial risks, but instead arise counterparty risk.

3. Replicating portfolios:
   Applications, Advantages, Disadvantages and Impossibles

Critics of modern portfolio theory :

There are many, but we recommend to see (at least)
Clarkson´s at several AFIR colloquia.

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4. Conclusions

1. The replication is usually even show in the financial literature as the method to ensure a portfolio.
    But also often noted that guarantee in a relatively short time.
    As the term is never reached, you can always ensure going step by step, but you run the risk of not finding this security if the market changes abruptly.
    Allows hedging of interest to a very long term, virtually eliminates transaction costs, and enables making rebalances only when there is a benefit and not as a imperative to maintain coverage.

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4. Conclusions

2. It would be advisable a mandatory separate of the assurance pensions from other businesses in which could be understood to take more risky positions as generating options or synthetic derivatives: They could fall plans pensions of thousands or millions of people with the immense social cost generated.

    And this, although it is understood that the replication portfolios can be useful, if managed intelligently, in order to manage some financial risks .

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4. Conclusions

3. Replication is designed to be fighting in every day to achieve specific objectives, and may suffer badly to sudden changes.

The dynamic general immunization is designed to establish the strategy and make a very light control, no need to make portfolio changes over long periods, but can be made when it can ensure a minimally relevant benefit with the change of an immunizing portfolio other.

They are different worlds:

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4. Conclusions

I. The first (replication) is the daily struggle of the best samurai today.

II. The second (general dynamic immunization) is the strategy of a General that, once secure to gain, decides to start a war if interested.

In fact, the latter is what Sun Tzu advised, when he said that "the best victory is to win without fighting", "and that is the distinction between the wise man and the ignorant."

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