Testing Contingent Immunization: Evidence from the Spanish Treasury market

1. Introduction

The aim of this research is to test the effectiveness of bond portfolio contingent immunization techniques. The pioneer works in this field (Leibowitz & Weinberger 1981, 1982, 1983), developed contingent immunization as midpoint in a risk-return framework between pure immunization strategies and active bond management strategies. According to these authors, these strategies allow to take advantage of investor expectations about future movements of interest rates and so to undertake an active bond portfolio management but limiting the potential losses derived from a wrong forecast of interest rate changes. Basically, contingent immunization consists in building up a bond portfolio with a duration bigger or smaller than the investor horizon depending on interest rate expectations. If investor thinks interest rate are going to rise over market expectations he would buy a bond portfolio with a duration smaller that his planning period and vice versa. However, if interest rates move in a way different from that expected by the investor and portfolio value fall below a given limit then he should immunize and guarantee a lower limit for the eventual portfolio return. This strategy gives contingent immunization an option like feature: limit the losses but the gains are not bounded if interest rates movements are favourable.

However, despite the initial interest, there is a lack of empirical work concerning the effectiveness of these strategies. In this sense, this paper is, to the best of our knowledge one the few works where these strategies are tested and compared with classical immunization and active bond portfolio management.

2. Data and portfolio design

The data used in this paper consist of mean daily bonds, bills and repo prices of actual transactions in the Spanish Public Debt Market over the period from January 1993 through January 2003. These data are provided by *Banco de España*[1] and comprise information about 29 to 33 default free bonds for each day comprising more than 66 different assets during the whole sample period. Bills are also included in this study as well as repo market operations in terms to maturity ranging from one week to 12 months.

We specify a planned holding period of three years dividing the sample period into twenty nine overlapping intervals each one starting the first trading day of January, April, July and October from January 1993 to January 2000.

Initially, the opportunity set within which bonds are chosen to build up immunized portfolios consists of six default free bonds with the highest liquidity[2]: two bonds with maturity before investor horizon, a three year bond, a ten year bond and two more bonds with maturity longer than three years.

[1] See www.bde.es/banota/series.htm

[2] Liquidity is measured by its trading volume. For a more detailed analysis of the liquidity of the Spanish Treasury bond market and other related institutional issues see, for instance, Díaz, Merrick and Navarro (2006).

These contingent immunization strategies are modelled through the following linear programming problem:

$$\text{Min} \sum_{j=1}^{N} \omega_j^2$$

subject to
$$H - \sum_{i=1}^{N} \omega_j \cdot D_j = dif$$
$$\sum_{j=1}^{N} \omega_j = 1$$
$$0 \le \omega_j \le 1$$

Where N is the number of bonds available, D_j is the Fisher&Weil duration of bond j, ω_j is the weight of bond j in the portfolio (short sales are not allowed), H is the investor horizon and *dif* is the difference between the investor horizon and the portfolio duration (H-D). In this paper, we have considered six values for "*dif*": -1.5, -1, -0.5, 0.5, 1, 1.5 years. The first three ones would be applied if a fall in futures interest rates is expected and the three last ones if the investors forecast consist of a rise of interest rates. The bigger the value of *dif* the bigger the investor's expected return and the risk assumed.

For each of these six strategies we consider three different lower bounds for losses derived from unexpected interest rate movements: 50, 100 or 150 basis points below the target return of a pure immunization strategy (the three year spot rate at the beginning of the holding period). Periodically, the portfolio selection model is applied except if investment value falls below a given limit which depends on the mentioned lower bound. If portfolio value reaches this limit then the portfolio is immunized consolidating the losses but eliminating the possibility of larger losses.

Additionally, two more sets of data are employed to test contingent immunization: theoretical zero coupon bonds portfolios obtained from term structure estimations of the Spanish Treasury market and to zero coupon bonds derived from Vasicek (1977) term structure model.

Finally, we have also developed active strategies modelled through the same linear programme, the difference being that no lower limit for portfolio return is required.

4. Results

In Figure 1, the means (over the 29 subperiods) of the differences between the return obtained with each strategy and the target return of a traditional immunization strategy are represented.

These strategies are the six contingent immunization strategies with dif equal to -1.5, -1, -0.5, 0.5, 1, 1.5 years and the Fisher & Weil's traditional immunization strategy where dif is equal to zero. We have considered for each of these strategies three lower bounds for bond portfolio losses.

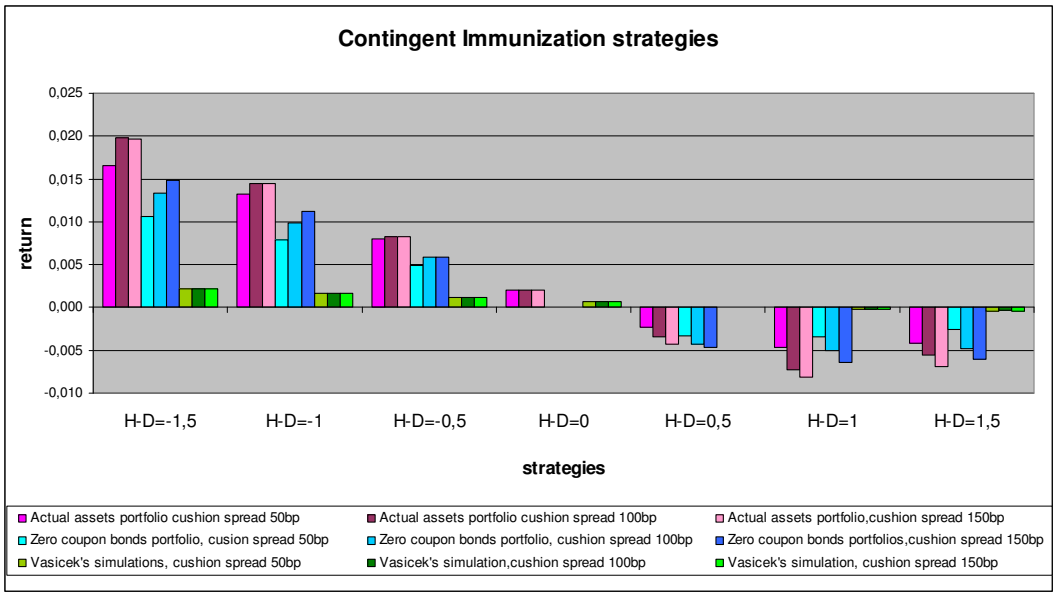

Figure 1. Contingent immunization strategies and Fisher & Weil's traditional strategy in actual, theoretical and simulated portfolios.

The main result is the high effectiveness of these strategies: if interest rate move in the adequate direction investors can obtain an extra return allowing him some degree of active management meanwhile the losses derived from adverse term structure movements are limited to those imposed by portfolio manager.

References

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