

# The Risk–Return Relationship for Structured Products and Risk Free Bonds: is the direct link really correct?

Francesca Pampurini<sup>a,\*</sup>

<sup>a</sup>*Dep. of Economic and Financial Institutions  
University of Macerata  
via Crescimbeni 20, 62100 Macerata, Italy  
Phone: +39.3398624387*

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## Abstract

This paper analyses structured bonds from a new perspective: the ex–post return of structured products is compared to the return of risk free bonds in order to test if the paradigm "*the riskier the product the greater the expected return*" holds. This question is relevant since in Italy structured bonds are issued by banks and sold out to retail customers with huge implicit premiums with respect to their fair value. The work is based on a unique data set based both on information provided by Borsa Italiana (Italian Stock Exchange) and from each single prospectus. The study reveals a striking advantage of risk free bonds over structured products: although the latter carry a higher level of risk they show lower returns. This work offers another contribute to current literature: it provides a classification of the products issued by Italian banks on the basis of the derivative instrument embedded in the bond. The Italian market is characterized by a huge fragmentation; each issue has its own underlying and its own indexation rule, the nominal value is often very low and the secondary market suffers from a lack of liquidity. As a consequence structured bonds do not seem suitable for retail investors that are not able to understand the real risk–return profile of the instrument.

*Keywords:* structured bonds, return, risk free bonds

JEL classification: G11 G12 G21

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## 1. Introduction

Structured bonds are financial products that combine the features of a straight bond and one or more derivative instruments resulting in a quite complex risk/return profile. These securities appeared on the US market in the 1980 and came up to Europe, and Italy, during the next decade. In a few time they spread among retail investors who were looking for new investment products characterized by higher returns. Structured products are issued and sold by banks which benefit from an increase of funding with a medium maturity. The

development of new financial engineering techniques enabled banks to develop financial products with complicated payoffs, characterized by the combination of a bond (with or without coupons) with one or more options; usually the option embedded in the structured product is an exotic option and its valuation is not straightforward.

Structured bonds reveal several problems concerning the bank-client relationship and the protection of the retail investor. First of all there is a problem of transparency: the issuer bank sells its structured product to retail investors which are unable to understand the real risk/return profile associated with the investment because of the presence of exotic derivatives with odd payoffs. In addition, this situation shows a problem of conflict of interest (which should be illustrated to the client) and a problem of suitability since our law states that the bank must be sure that the customer has understood the characteristics of the product and that this product is really suitable for him. Second, there is a problem of pricing since these products are sold at par, but their theoretical initial value is often less than 100. The bank takes advantage from the fact that structured products are tailor made so it is impossible to make any comparison with other bonds. Third, there is a liquidity problem because (in Italy) the majority of these bonds is not listed on a regulated market and the banks act as market makers. By the way not only OTC products, but also listed structured bonds suffer from a lack of liquidity because the quoted bid-ask spread is often too wide and the number of trades is very small (on the Italian market we can observe many days without any trade). Moreover these bonds are listed on the market some months after the issuing date and usually by that time all the bonds are owned by the bank's customers.

Despite the large size of the actual market of structured bond, the literature about these products is not very wide and it is concentrated on the problem of pricing. This work takes into account for the first time, at our knowledge, the problem of return: we want to analyse the suitability of structured bonds for retail investors by comparing the ex-post return of matured products with the return of other bonds either issued by banks or government.

The remainder of the paper is organized as follows: section 2 presents a brief literature review, section 3 illustrates the technical characteristics of these products and tries to organize them into standardized categories, section 4 describes the dataset, section 5 describes the results and section 6 shows the conclusions.

## **2. Literature Review**

Structured products entered the European market during the Nineties and in a few time they became one of the most popular investment instrument for the retail sector despite the problems associated with the fast growth of these bonds. Academic literature about structured bonds is quite recent: it takes inspiration from financial engineering and option pricing and it focuses mainly on the problem of mispricing. Some authors develop a pricing technique that takes the implied volatility of traded options as an input for the evaluation of the theoretical value of the structured product. Chen and Kensinger (1990) and Chen and Sears (1990) compare the price and the implied volatilities of two structured products traded in the US market called MICD (Market Index Certificates of Deposits) and SPIN (S&P 500 Index Notes), and find important differences with respect to their theoretical values. Similarly Wasserfallen and

Schenk (1996) analyze structured products and options traded in the Swiss market and find that the formers are sold at a price which is always above the theoretical value. Another work by Wilkens, Erner and Roder (2003) takes into account a set of structured products traded in the German market and finds that these products are overpriced too.

Other works focus on the primary market and deal with the issue price. Baubonis et al. (1993) analyze the cost profile of a product issued by Citicorp to demonstrate that there is an evident mispricing in favour of the issuer so that the bank earns a fee that lasts from 2.5 to 4%. The same mispricing is shown by Burth, Kraus and Wohlwend (2001) with respect to reverse convertibles and discount certificates issued in the Swiss Market. Stoimenov and Wilkens (2005) and Stoimenov and Wilkens (2007) analyse the pricing of equity linked structured products issued in the German market and find that the overpricing increases as the product become more complex. In the US, Benet, Gianetti and Pissaris (2005) study the pricing of reverse exchangeable securities traded on the AMEX and find the same mispricing in favor of the issuer.

Otherwise there are a few works that deal with structured products focusing on problems other than pricing. Bethel and Ferrel (2006) illustrate some policy issues raised by the growth of structured bonds focusing on the level of protection of individual investors. Bernard, Boyle and Tian (2007) discuss the optimal design of these products and their payoffs from the point of view of the issuer bank. Henderson and Pearson (2007) combine the analysis of structured bonds with some principles of behavioural finance and find striking patterns in the payoffs which characterize products issued by banks. At the same time Fisher (2007) using a survey among German investors concludes that the majority of them show irrational or inconsistent strategies. Also Hens and Rieger (2009) deal with the best design of the structured products but they look at the problem from the point of view of the investor; they analyse the most common products spread on the American, German and Swiss market and find that none of the structured bonds is optimal for a perfectly rational investor.

### **3. Structured Products: description and classification**

One of the main problems associated with structured bonds is the lack of standardization. The issuer is free to assemble the product as he likes and each issue is very different from the others in terms of maturity, underlying, indexation, etc. The result is that the Italian market counts a variety of structured bonds which are difficult to compare: this high fragmentation contributes to reduce the transparency for retail investors and so the mispricing. This work suggests a classification of structured bonds based on the main features of the derivative instrument incorporated in the bond and tries to discover similarities among different products. We adopt the general definition of Stoimenov and Wilkens (2005) which identifies structured bonds as those products (i) issued by a bank and (ii) combine two or more financial instruments of which (iii) at least one is a derivative.

All the products issued on the Italian market will be divided in two main classes with respect to (a) the underlying or (b) the indexation. The underlying is represented by interest rates, stocks, currencies, goods, credit rating, inflation and indexes. The indexation refers to the formula used to evaluate the final or the periodical coupons received by the investor. Most of the structured bonds

are principal protected so that at maturity the investor receives at least the same amount (face value) he paid to buy the bond; however there are also a few products whose principal is protected in real terms, in the sense that the amount received at maturity is increased by inflation<sup>1</sup>. In the remainder of the paragraph we deal with separately the bonds whose underlying is an interest rate or a different financial parameter.

### 3.1. Floating Rate Notes

Floating Rate Notes are structured products with a long term maturity and periodical coupons whose value is linked to a particular interest rate. The indexation rule can be a direct or inverse function of the underlying; in the first case an increase of the parameter causes an increase of the coupon value while in the second case an increase of the parameter generates a reduction of the same coupon. From the point of view of the underlying we can distinguish two parameters: short term interest rates that characterize Floaters, Reverse Floater and Superfloaters and long term interest rates that characterize Constant Maturity Swaps.

The Floater is a bond whose coupon is directly linked to a monetary interest rate and is paid annually or semi-annually according with the following rule:

$$C = NV \times r_v \quad (1)$$

where  $C$  is the coupon,  $NV$  is the nominal value of the bond and  $r_v$  is the underlying interest rate.

The Reverse Floater has the same structure but the coupons have an inverse link with the underlying. To evaluate the coupon the variable interest rate must be subtracted from a fixed interest rate indicated in the contract:

$$C = NV \times [R - n \times r_v] \quad (2)$$

where  $R$  is the fixed rate and  $n$  is the multiplier, also known as participation coefficient<sup>2</sup>. From a technical point of view a Reverse Floater is the combination of a bond (with fixed coupons) with an interest rate swap that is sold by the issuer to the investor and that represents the source of variability of the coupons. Since the multiplier is often greater than one, the derivative instrument is called "non par" swap.

The Superfloater is another structured bond whose coupons are directly linked to the underlying and with a leverage greater than one. Its coupon is

$$C = NV \times (n \times r_v - R) \quad (3)$$

The Constant Maturity Swap (CMS) is a bond similar to the Floater with annually or semi-annually coupons but differs from it since the underlying is a long term interest rate. Because of this fact the CMS has a theoretical value

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<sup>1</sup>This work does not deal with structured products without principal protection such as reverse convertibles because they were issued on the Italian market only in the period 1998-1999 with a very short maturity (at least one year).

<sup>2</sup>During the Nineties the issuers used to set the parameter  $n$  equal to 2 in order to increase the leverage of these bonds. By this way, in fact, a small increase (decrease) of the underlying generates a larger decrease (increase) in the coupon.

greater than its face value, so the issuer institutions usually set a participation coefficient lower than one in order to decrease its price. The coupon becomes

$$C = NV \times n \times r_v \quad (4)$$

All of the instruments presented above usually have a very long maturity (up to 30 years) and the issuer, in order to make them more appealing, plans a number of initial coupons whose value is known and not subject to variability. So it is possible to classify the Floating Rate Notes with respect to the different indexations of the initial coupons.

The most common mechanisms are the step-up or step-down (where the initial known coupons increase or decrease with time) and the mirror (where the coupons first increase and then decrease, or vice-versa, as time passes). On the other hand, with respect to variable coupons, we can distinguish some rules that restrict the interval in which the coupon can vary; these mechanisms are known as cap (up limit), floor (down limit), collar (up and down limit) and dual rate (when the underlying exceeds the limit, the coupon takes a value that is higher or lower than the limit itself).

### 3.2. *Equity and Index Linked*

Linked bonds are structured products characterized by the combination of a bond and an option which can be either call or put<sup>3</sup>; it is also to be noted that mostly the embed derivative is an exotic option. If the underlying bond is a zero coupon then the investor receives the principal at maturity (at par) plus a unique coupon whose value depends on the indexation parameter; on the contrary, if the underlying is a coupon bond then the investor receives periodical variable coupons linked to the parameter. Also linked bonds can be classified with respect to the indexation rule or to the underlying security.

#### 3.2.1. *Indexation Rule*

The indexation rule is strictly connected to the underlying option and it represents the formula whereby the variable coupon is calculated. As in the case of Floating Rate Notes, the indexation can be direct or reverse according to the fact that an increase of the underlying asset generates an increase/decrease in the coupon received by the owner. In addition to the indexation rule there are two other elements that affect the risk-return profile of the whole investment: the participation coefficient and the frequency of observation of the underlying parameter.

The participation coefficient represents the portion of the return of the underlying which is paid to the investor. Of course, given the same underlying, the smaller the participation coefficient, the smaller the expected return. In the last decade a great number of linked bonds issued on the Italian market shows coefficients smaller than one.

The observation of the underlying indicates the number of times that the underlying asset's price is observed in order to evaluate the coupon(s). For the first generation of linked bonds issued on the Italian market the coupons

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<sup>3</sup>When the underlying derivative is a put option there is a lack of principal protection. This work does not deal with these kind of financial products.

received by the investor were evaluated with respect to the difference between the initial (strike) price of the underlying asset and a single observation of the same price at maturity. Later on, in order to reduce the impact of extraordinary events that might occur at maturity, the issuer used to observe different prices of the underlying asset during a few days before maturity and to evaluate the coupon with respect to their average. On the contrary, during the last decade a great number of issues shows a coupon whose value depends on a set of prices (instead of a single price) of the underlying collected at different times during the life of the bond; the frequency of these observations is considered regular if each observation is evenly spaced across the whole period, the frequency of observation is considered increasing (decreasing) if the time between successive observations decrease (increase) as time passes so that the prices collected in the first period are less (more) numerous than the ones collected in the period near to maturity. Both the participation coefficient and the frequency of observation of the underlying are elements that help the issuer to refine the risk-return profile of the linked bond.

One of the most important characteristic of the linked bonds is the method used to evaluate the performance of the underlying asset: historical return or average return. Plain vanilla linked bonds's return depends on the absolute performance of the underlying asset during the life of the bond; their payoff is the result of the combination of a bond with a European call option which is implicitly sold by the issuer to the owner of the structured product. The coupon(s) can be written as:

$$C = NV \times \max[r; qR] \quad (5)$$

where  $r$  represents the floor (minimum guaranteed return),  $q$  is the participation coefficient and  $R$  is the performance of the underlying evaluated as

$$\frac{P_T - P_0}{P_0} \quad (6)$$

with  $P_T$  being the final price of the underlying and  $P_0$  its initial price (strike).

Average linked bonds draw their name from the derivative embedded in the bond: an average option. This option is an exotic derivative instrument whose payoff depends on the difference between the average price of the underlying asset and its initial price (strike). The average is calculated from a set of prices of the underlying asset observed during the life of the structured bond according with the frequency of observation. The coupon(s) can be rewritten as:

$$C = NV \times \max[r; q\bar{R}] \quad (7)$$

where  $\bar{R}$  represents the average price.

Structured bonds with more intricate payoffs can be obtained when the underlying is represented by a basket instead of a single asset. The majority of the linked bonds issued on the Italian market are linked to exotic derivatives like these and the fragmentation of the market is very high because the instruments are not standardized and the issuers are not bound to any rule. We want to offer a classification of these exotic structured bonds taking into account the criterion adopted to observe and to select the assets in the basket, the direct/indirect link with the underlying and the presence of limitations such as barriers. The denomination of such structured bonds seems sometimes odd, but it often comes from the name of the option embedded in the bond.

The first class of linked products we want to analyse refers to structured bonds called *Best Of-Worst Of*, *Rainbow*, *Altipianos* and *Himalaya*. All of these products are linked to an underlying basket, but the return paid to the owner does not depend on the performance of the whole basket. In the case of *Best-Of/Worst-Of* linked bonds the asset that showed the best/worst performance must be taken into account to evaluate the coupon(s); moreover, if there are many coupons, the asset with the best/worst return is removed from the basket so that it does not participate to the evaluation of the future coupons. The indexation rule is identical to equation (5) but the term  $R$  can be calculated in two different ways with respect to *Best Of* or *Worst Of*:

$$R = \max_i \left[ \frac{P_T^i - P_0^i}{P_0^i} \right] \quad R = \min_i \left[ \frac{P_T^i - P_0^i}{P_0^i} \right] \quad (8)$$

In the case of *Rainbow* structured bonds all the assets in the basket contribute to the evaluation of the coupon but with different weights; in particular these weights are set up at maturity so that the assets with the best performances are assigned the higher weights. The formula for the evaluation of the coupon is the same as (7) but the term  $\bar{R}$  becomes

$$\bar{R} = \frac{1}{N} \sum_{i=1}^N \omega_i \frac{P_T^i - P_0^i}{P_0^i} \quad (9)$$

where  $N$  is the number of assets in the basket and  $\omega_i$  is the weight assigned to the asset  $i$ .

Eventually, the structured bonds called *Altipianos* and *Himalayas* are similar to the *Rainbow* but the underlying basket has a dynamic composition that changes during its life according to some rules defined by the issuer. In addition, when a coupon is paid to the investor, the asset characterized by the best performance exits the basket. The formula for the calculation of the coupon(s) is the same as the *Rainbow* in fact the unbundling of this structured product reveals a combination of a bond with a strip of rainbow options.

A different category of structured bonds is the one that includes *Cliquet* and *Reverse Cliquet* instruments; they are the combination of a bond with a set of cliquet (also known as ratchet) options<sup>4</sup>. Their indexation mechanism shows that the return for the investor comes from the sum of many periodical performances of the underlying asset: so there is not any average to evaluate as in the cases illustrated before. The main difference is that the price of the underlying asset is observed at regular time intervals and each value is compared to the previous one and not to the initial strike. The coupon(s) of the structured bonds with the cliquet option embedded are evaluated according to the equation (5) where the term  $R$  is

$$R = \sum_{t=1}^M \max \left[ 0; \frac{P_t - P_{t-1}}{P_{t-1}} \right] \quad (10)$$

and  $M$  is the number of observations.

The return for the investor is given by the sum of the periodical positive returns

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<sup>4</sup>The cliquet option is made up of a strip of forward starting call where each strike price is the underlying price at the maturity of the previous option.

of the underlying asset. Similarly the coupon(s) of the reverse cliquet structures are represented by the difference between a fixed rate and the sum of the negative periodical returns of the underlying according to the following formula

$$C = NV \times \max [r; X + R^-] \quad (11)$$

where  $R^-$  is

$$\sum_{t=1}^M \min \left[ 0; \frac{P_t - P_{t-1}}{P_{t-1}} \right] \quad (12)$$

Another category of structured bonds that shows an exotic option embedded in the bond is represented by the class of *Digital*, *Sticky*, *Knock-in* and *Knock-Out* linked bonds. The first instrument is a combination of a bond with a digital option also known as *bet* or *call-or-nothing*. The peculiarity of this bond is that the coupon(s) is equal to a fix rate that is paid to the investor if the underlying price at maturity is greater than the strike (its value at issue). This payoff can be written as follow:

$$C = NV \times \begin{cases} r & \text{if } P(T) > x; \\ 0 & \text{otherwise.} \end{cases} \quad (13)$$

where  $P(T)$  is the price of the underlying at maturity and  $x$  is the strike price. The class of *Knock-in* and *Knock-Out* structured bonds combines the characteristics of a bond and a barrier option; the final value of this option is different if the price of the underlying crossed or not a defined threshold (almost once) during the life of the bond. Barrier options can be classified either as knock-out or knock-in options; the former is cancelled when the underlying price reaches the barrier, on the contrary, the latter comes into existence just when the underlying price reaches the barrier. If the barrier level is below the initial price of the underlying (strike), the knock-out option is called *down and out* while the corresponding knock-in option is called *down and in*; otherwise, when the barrier level is higher than the strike the knock-out option is called *up and out* while the corresponding knock-in option is called *up and in*. Combining these different options it is possible to obtain 4 different structured bonds. The last indexation structure is called *sticky* (also known as *lock coupon*) and it states that each (variable) coupon received by the investor cannot be smaller than the value of the previous coupon: so the last coupon acts as a floor for the following coupons.

### 3.2.2. Underlying Parameter

From a theoretical point of view the underlying of a structured bond can be any asset with an official price; by the way, the most common assets are stocks, indexes, mutual funds, commodities, interest rates or exchange rates. It is also possible that the underlying is a combination of the previous assets (basket) whose weights can be fixed or variable: in the first case the assets within the basket have the same weights until maturity, while in the second case the assets that compose the basket assume different weights with respect to a precise rule set by the issuer. Nowadays the majority of linked bonds issued on the Italian market belongs to three main categories: (i) equity linked, index linked, fund linked, basket linked; (ii) commodity linked, inflation linked, forex linked and (iii) credit risk linked, rating linked, event linked.



The first category (the most popular because the investors have good familiarity with the assets underlying the option component) is the one of linked bonds (that have underlying assets such as equities or indexes), basket linked bonds (that have a basket as underlying whose composition is fixed until maturity) and fund linked bonds (that have a mutual fund or a SICAV<sup>5</sup> as underlying whose assets are different activities with a dynamic composition).

These bonds were issued on the Italian market during the second half of the Nineties after a long period of bear market in order to allow retail investors to profit from the diversification of the mutual fund assets. Compared to other linked bonds, the main differences of these instruments regard two aspects: first of all the return depends on the net asset value of the fund which is evaluated at the end of each trading day and it is not quoted on a regular market; second, in many cases, the underlying is not a real fund whose quotes are sold to a variety of investors, but it is a nominal account managed by the issuer according with some rules illustrated in the Prospectus.

The second category concerns bonds linked to the value of a commodity, or the value of an inflation index or an exchange rate. Inflation linked bonds are the most important within this class; they are characterized by the fact that the coupons are the sum of two components: a first component indexed to the value of a financial activity and the second component linked to the value of an inflation index. The category of the forex linked is also known as quantos (like the option embedded); its characteristic is the fact that the underlying asset is valued in a different currency than the bond itself. The difference between the internal and the foreign interest rate, combined with the movements of the exchange rate represents an additional source of risk for the owner of this product.

The structured bonds belonging to the third category represent a narrow share of the Italian market, probably because of the difficulties for the retail investors to understand the real risk profile of these products. The common characteristic of these bonds is the fact that the coupon is linked to a particular event that may occur to some institutions (different from the issuer) during the life of the bond: if this event actually happens the return for the owner decreases proportionally. For the credit risk linked bond the event is represented by the default of the third institution, for the rating linked bond the event is represented by the downgrading of the third institution and for the event linked bond it is the issuer that determines what is the particular event which the coupon is bounded to.

#### 4. Data and Methodology

The aim of this work is to compare the ex-post return of structured bonds issued on the Italian market and listed on the MOT<sup>6</sup> with the return of plain vanilla bonds issued by the Italian Government in the same period with similar

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<sup>5</sup>Società di Investimento a Capitale Variabile.

<sup>6</sup>The MOT is the Italian regulated market in which Government bonds are traded. It is managed by Borsa Italiana and named "Mercato Obbligazionario Telematico".

maturities in order to understand if the investor may really gain a greater return by investing in structured bonds with respect to less risky debt instruments. We constructed a sample of structured bonds issued by banks and listed on the MOT during the period 1997–2010; the sample takes into account only expired instruments (with a maturity date before 31-dec-2010) so that it is possible to know the whole cash flow profile since all the coupons and the principal had been paid to the owner<sup>7</sup>. The ISIN code of each issue was provided by Borsa Italiana while the cash flow stream for each issue was collected from Bloomberg and Datastream. In cases of difference between the data coming from the two providers, we manually calculated each cash flow on the basis of the information given in the prospectus. Also the classification of each structured bond according to the classes discussed in the previous paragraph was conducted from the information provided in the prospectus regarding the indexation formula and the underlying asset. The sample accounts for 177 issues of structured bonds with different indexation rules and different underlying assets. Table 1 illustrates the composition of the sample with respect to the underlying asset and the indexation rule. About half of these instruments has only one coupon (premium) paid to the owner at maturity together with the principal. With respect to the underlying asset basket linked products are the most numerous with 84 issues followed by index linked structured bonds with 52 issues. These two categories represent about the 77% of the whole sample. With respect to the indexation rule there are four categories of structured bonds that prevail covering about the 79% of the sample: average bonds with 38 issues, digital bonds with 32 issues, plain vanilla bonds with 35 issues and reverse cliquet with 34 issues.

Figure 1 shows the distribution of the sample in terms of nominal value and we can see the high level of fragmentation of this market: there are only 3 issues with a nominal value greater than 1 billion of Euros while 133 issues out of 177 show a nominal value smaller than 300 million of Euros. The most important issue, in terms of nominal value, is worth 1.3992 billion of Euros while the smallest is worth 5.75 million of Euros<sup>8</sup>.

The sample seems homogeneous in terms of maturity: 101 issues out of 177 have a maturity of 5 years (Figure 2). The issues with longer maturity are not very numerous but partially this is due to the fact that the sample only accounts for expired bonds: so in the last years we can only observe instruments with a shorter life.

To evaluate the ex-post return of structured products we constructed the cash flow profile of each bond (coupons and principal) and the internal rate of return was calculated<sup>9</sup>. This IRR was compared with the swap rate available on the market because it is similar to the interest rate paid by banks on plain vanilla debt instruments; otherwise the IRR was also compared to the risk free

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<sup>7</sup>We discarded some structured bonds whose underlying was a sicav or a particular basket with a dynamic asset allocation and whose values were not available ex post on any data provider.

<sup>8</sup>The size of each issue was provided by Borsa Italiana; we decided not to refer to the information written in the prospectus because in many cases the amount indicated by the issuer was not entirely sold out, so the total amount outstanding is lower.

<sup>9</sup>The coupons stream and principal payment of each bond was created starting from the information illustrated in the prospectus regarding the indexation formula and the underlying asset. These data were compared with the ones taken from Bloomberg and Datastream – if available – to be sure of their goodness. All the bonds were issued at par.

Table 1: Composition of the sample - number of issues

<b>Underlying</b>		<b>Indexation rule</b>	
Basket linked	84	Average	38
Fund linked	5	Average cliquet	1
Index linked	52	Average reverse cliquet	1
Inflation linked	17	Cliquet barrier	1
Interest rate linked	19	Constant maturity swap	6
		Digital	32
		Exotic	1
		Floater	3
		Floater digital	3
		Floater sticky	2
		Plain vanilla	35
		Plain vanilla sticky	1
		Rainbow	7
		Reverse cliquet	34
		Reverse cliquet digital	2
		Reverse cliquet sticky	1
		Reverse floater	4
		Transformable	1
		Worst of	2
		Worst of sticky	2
	177		177

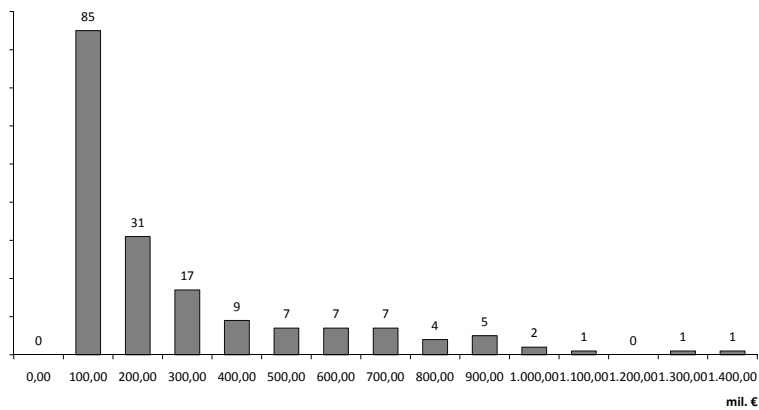


Figure 1: Distribution of the issues with respect to nominal value

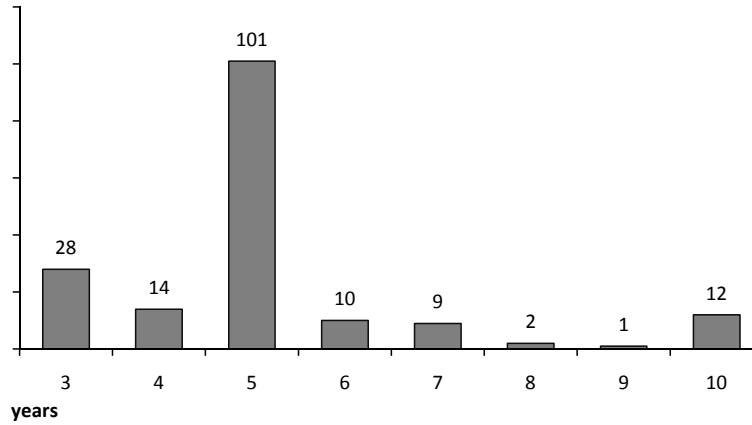


Figure 2: Distribution of the issues with respect to their maturity

interest rate represented by the *Rendistato* which is a parameter calculated by the Bank of Italy<sup>10</sup>. The well known risk-return rule states that there is a direct relationship between the level of risk embedded in the bond and its expected return, so the investor knows that in order to obtain a higher level of (expected) return he should choose a riskier product; but, if he does not want to bear too much risk he must choose a bond with a low (expected) return such as Government bonds. In this framework structured products issued by banks are not risk free products since they bear different kinds of risk: interest rate risk (which characterizes also Government bonds), market risk (coming from the fluctuations of the price of the underlying asset) and credit risk (which is often measured by the rating of the issuing bank). So, the investor who buys structured bonds is willing to obtain a greater return as a consequence of its higher level of risk; this means that on average the internal rate of return of structured bonds, calculated after their maturity, should be higher than the internal rate of return of other risk free instruments.

After the evaluation of the IRR of structured products and its comparison with the swap rate and the *Rendistato*, we tried to discover if there is a relationship between the extra return of these bonds and their morphological features. We are interested in the extra return and not in the IRR because the latter is a time dependent parameter; it means that two bonds with the same features that are issued during different periods show different expected returns because their return is related to the level of the yield curve (which varies as time passes).

First of all we divided the sample in two parts with respect to the coupon type: 80 issues belong to the category of one coupon bonds while 97 issues out of 177 represent multiple coupon bonds. It is interesting to remember that in the case of one coupon bonds the investor does not receive any cash flow during the entire holding period; only at maturity he receives the principal together with a single coupon named "premium". The value of this coupon is always linked to the time varying price of the underlying asset so the investor does not

<sup>10</sup>The parameter *Rendistato* is the average internal rate of return of a sample of Italian Government Bonds listed on the MOT.

know this amount until maturity and, if the market had a negative performance, this premium is worth zero. Although the risk profile of a structured bond only depends on the type of derivative embedded in it, we know that the uncertainty that characterizes the premium until maturity could keep off the investor from buying the bond. According to this idea, we expect to observe a positive or at least a null difference between the extra return of one coupon bonds and multiple coupon bonds.

Second, we analysed the relationship between the extraperformance and the maturity of structured bonds. It is known that securities with longer maturities should pay higher return so we tested this hypothesis on our sample. Of course we expect to see an increasing (positive) difference in the extraperformance of bonds as maturity increases.

At last, we looked for a relationship between the extraperformance and the size of each issue. It is known that small issues are characterized by high illiquidity and this fact has a strong negative impact on the price (and the return) of the security. Even if we evaluated the IRR of each bond with respect to the issue price, anyway we expect to see this phenomenon in our sample because the initial mispricing is worth different if the issue is addressed to a great number of retail and institutional investors and if it is expected to have a narrower or a wider secondary market.

## 5. Results

The results of the analysis of the internal rates of return of the structured bonds of our sample is summarized in table 2 which shows the ex-post return of the whole sample and the ex-post return of the subsample of bonds that expired with a positive return. The internal rate of return (IRR) of the whole sample lasts from zero to 10%, with an average value of 3.274% and a median value of 2.985%.

It is quite interesting to underline that 22 bonds ended with a zero return, which means that the investor received only the principal (equal to the initial investment) without any coupon. On average the internal rate of return of this subsample of structured bonds with a positive result is 3.738% (table 2) which is not very different from the IRR of the whole sample (which was 3.274%)<sup>11</sup>.

As stated before, we compared the IRR of the whole sample with the swap rate and the *Rendistato*. The results of this analysis are summarized in table 2 which shows the IRR and the extraperformance of the whole sample and of the sample of bonds that expired with a positive result and in table 3 which compares the ex-post return and the extraperformance of "good" issues and "bad" issues.

First of all we observed that the extra-performance of the structured bonds is negative (table 2): the average difference between the IRR and the swap rate

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<sup>11</sup>As regards the whole sample, the distribution of the IRRs counts 6 outliers. We assume as outliers those values in the distribution that exceed the average plus/minus two standard deviations. All of the 6 outliers have a return higher than this threshold showing values that range from 7.931% to 10.243%. Despite this fact we decided not to eliminate these outliers from the analysis because the results obtained with or without them are pretty much the same. In fact, the average IRR evaluated without the outliers is 3.529% which is not very different from the IRR of the whole sample (3.274%) and the IRR of the positive subsample(3.738%).

Table 2: IRR analysis: whole sample and subsample of structured bonds with positive return - percentage data

	Whole sample (177 issues)			Positive return subsample (155 issues)		
	Extraperformance			Extraperformance		
	IRR%	swap rate	<i>Rendistato</i>	IRR %	swap rate	<i>Rendistato</i>
average	3.274	-0.863	-0.707	3.738	-0.322	-0.171
median	2.985	-0.877	-0.779	3.511	-0.400	-0.330
st.dev.	2.148	2.467	2.471	1.879	2.132	2.145
max	10.243	6.659	7.106	10.243	6.659	7.106
min	0	-5.440	-5.332	0.662	-4.758	-4.653

is  $-0.863\%$  which becomes  $-0.707\%$  compared to the *Rendistato*. The result is somewhat different if we observe only the subsample of structured bonds that expired with a positive return: the average extraperformance is still negative but the absolute value is smaller; in particular, the difference between the IRR and the swap rate or the *Rendistato* is  $-0.322\%$  and  $-0.171\%$  respectively. This means that, on average, a rationale risk averse investor should choose a risk free instrument (like Government bonds) or, at least, a plain vanilla debt instrument in order to obtain a better result.

Then we divided the whole sample into two groups in order to observe separately the results of the extraperformance analysis with respect to the subsample of the "good" structured bonds, that accounts for the issues that ended with a IRR greater than the swap rate or the *Rendistato*, and the subsample of the "bad" bonds which accounts for the issued that ended with a IRR smaller than the swap rate or the *Rendistato* (table 3).

We observed that 110 issues out of 177 ended with a return smaller than the swap rate or the *Rendistato* and this means that more than 60% of the structured bonds listed on the Italian market in the observed period underperformed plain vanilla and risk free investments so that the owner ended with a real loss. On the other hand, the structured bonds that revealed a positive extra-performance with respect to the two benchmarks didn't show very high values since the average difference is only 1.692% and 1.845% compared to the swap rate or the *Rendistato* respectively (table 3).

In order to provide a deeper examination of the extraperformance of structured bonds, we provide some other results according to some technical features such as the coupon type, the maturity and the issue size (table 4). Each one of these aspects was analysed by dividing the whole sample into two or more groups with homogeneous characteristics; in particular the analysis based on the coupon type was done on two subsamples, the analysis based on the maturity was done on three subsamples and the analysis based on the issue size was done on four subsamples.

Regarding the subsample of one coupon structured bonds, our analysis revealed a strong underperformance (on average  $-1.946\%$  and  $-1.786\%$  with respect to the swap rate or the *Rendistato*) while the instruments with multiple coupons showed, on average, a better result (a small but positive extraperformance of about 0.029% and 0.183% respectively). Table 4 shows these results. We studied the relationship between the type of bond (one coupon vs multiple coupon) and the extraperformance with a simple econometric model (linear regression) and we find that this link does exist and it is statistically signifi-

Table 3: Extraperformance analysis of "good" and "bad" issues

<b>Whole sample</b>										
<b>"good" bonds - 67 issues</b>					<b>"bad" bonds - 110 issues</b>					
	IRR %	Maturity years	IRR-swap %	IRR- <i>Rendistato</i> %	Face value mln. Euros	IRR %	Maturity years	IRR-swap %	IRR- <i>Rendistato</i> %	Face value mln. Euros
average	5.380	5	1.692	1.845	254.73	1.991	5	-2.420	-2.261	206.13
median	5.067	5	1.491	1.598	83.67	2.241	5	-2.169	-1.973	110.00
st.dev.	1.488		1.327	1.377		1.313		1.523	1.513	
max	10.243	10	6.659	7.106	1,399.20	5.231	10	-0.000	-0.177	926.00
min	3.234	3	0.027	0.131	5.75	0.000	3	-5.440	-5.332	10.96
<b>One Coupon subsample</b>										
<b>"good" bonds - 21 issues</b>					<b>"bad" bonds - 59 issues</b>					
	IRR %	Maturity years	IRR-swap %	IRR- <i>Rendistato</i> %	Face value mln. Euros	IRR %	Maturity years	IRR-swap %	IRR- <i>Rendistato</i> %	Face value mln. Euros
average	5.905	4	2.077	2.210	103.03	1.311	5	-3.378	-3.209	170.68
median	5.625	5	2.085	2.177	35.62	0.990	5	-3.593	-3.394	100.00
max	8.379	5	5.649	6.212	726.80	4.837	9	-0.345	-0.313	926.00
min	4.478	3	0.550	0.591	11.35	0.000	3	-5.440	-5.332	13.50

Table 4: Extraperformance analysis (average values) - percentage data

	ex-post return IRR	Extraperformance	
		swap rate	<i>Rendistato</i>
<b>Coupon type:</b>			
one coupon bonds (80 issues)	2.517	-1.946	-1.786
multiple coupon bonds (97 issues)	3.898	0.029	0.183
<b>Maturity:</b>			
<3 years (28 issues)	3.217	-0.364	-0.182
3 - 5 years (115 issues)	3.284	-0.782	-0.655
5 - 10 years (34 issues)	3.285	-1.549	-1.318
<b>Issue size:</b>			
<300 mil (133 issues)	3.210	-0.971	-0.801
300 - 600 mil (23 issues)	3.416	-0.532	-0.409
600 - 900 mil (16 issues)	3.240	-0.857	-0.739
900 - 1,400 mil (5 issues)	4.404	0.452	0.528

cant<sup>12</sup>. These outcomes are not in line with our expectations; as stated in the previous paragraph we expected to observe a better performance in the case of one coupon bonds, due to the fact that the investors has to wait until maturity in order to know the exact amount of the premium and he should be compensated for this wait. A significant difference between the extraperformance of one coupon bonds and multiple coupon bonds is also shown in table 3: on average the absolute value of the difference between the IRR and swap (or the *Rendistato*) rate is greater for one coupon bonds either for the subsample of "good" or "bad" issues. This means that in case of positive extraperformance one coupon bonds behave better than multiple coupon bonds, but in case of negative extraperformance it is just the reverse. In addition we have to point out that the number of "good" one coupon bonds is only one third than that of "bad" one coupon bonds.

Proceeding with the analysis of technical aspects summarized in table 4, we pointed out some results about maturity. We divided all the issues into three subsamples: the first group includes all the bonds with a maturity up to three years, the second group includes the bonds with a maturity from 3 to 5 years and the last group includes the rest of the sample. In particular we observed that as maturity increases also the underperformance increases changing from -0.364% to -0.782% and to -1.549% as maturity lasts from 3 to 5 to 10 years (table 4) in case of the swap rate and changing from -0.182% to -0.655% and to -1.318% in case of the *Rendistato*<sup>13</sup>. In order to provide a clearer view of the relationship between the maturity and the return of structured bonds we also evaluated the internal rate of return of the three subsamples mentioned before. This analysis revealed that the average internal rate of return does not change significantly: in fact we observed that it is worth 3.217% for the maturities up to 3 years, 3.284% for the maturities between 3 and 5 years and 3.285% for the

<sup>12</sup>We regressed the IRR on the dummy variable: 1 = one coupon and 0 = multiple coupon and the result is a beta equal to -1.975% with a p-value equal to 0.00000004.

<sup>13</sup>Also this relationship was studied with a statistical test that confirmed the result. The regression reveals the existence of a negative relationship between the maturity and the extraperformance that is significant at the 5% level.



other maturities (table 4). This means that the well known relationship between maturity and expected return is violated: the average return of structured bonds does not increase with maturity.

At last, in order to analyse the extraperformance with respect to the size of each issue, we divided the sample in four subsamples regarding to the amount issued (table 4). The first group is represented by the issues smaller than 300 million of Euros; it is the more numerous since it accounts for 133 issues (of which 83 are smaller than 100 million of Euros) and it gives a further confirmation of the great fragmentation and the level of (il)liquidity of this market: for these bonds the extraperformance with respect to the swap rate is on average  $-0.971\%$  while the same result with respect to the *Rendistato* is  $-0.801\%$ . For the next subsample (23 issues) the size varies from about 300 million of Euros to about 600 million of Euros and the extraperformance with respect to the swap rate and the *Rendistato* is  $-0.532\%$  and  $-0.409\%$ . The group for which the issue size varies from about 600 million of Euros to about 900 million of Euros is made up of 16 issues and it shows a similar result to the first group: the extraperformance is  $-0.857\%$  with respect to the swap rate and  $-0.739\%$  with respect to the *Rendistato*. The last class includes issues from 900 million of Euros to about 1,400 million of Euros but it counts only 5 observations; the extraperformance now becomes positive and it is equal to  $0.452\%$  with respect to the swap rate and to  $0.528\%$  with respect to the *Rendistato*. Even if this analysis shows quite clearly the high fragmentation of the Italian market (the number of issues decreases with size), the comparison between the internal rate of return of structured bonds and the swap (or the *Rendistato*) rate gives a result which is in line with our expectations: the average extraperformance increases with the size of the issue. This means that the biggest issues, which are expected to have a more liquid secondary market, also enjoy a better pricing at issue and a combination of technical features that is aligned with the characteristics of the market.

In order to underline that the issue size is a critical factor that affects either liquidity or return we also analysed the variations in the average size of our structured bonds with respect to the goodness of the ex-post return: table 5 summarizes these results. We grouped all the issues into three categories with respect to their final return and we observed the average issue size for each group. The first subsample takes into account the bonds that expired with an internal rate of return greater than the swap rate; in this case the average issue size is about 260 million of Euros. The second subsample includes the issues for which the ex-post return was positive, but the extraperformance at maturity was negative: the average size now is about 200 million of Euros. Eventually, the last subsample includes all the bonds that expired with a null return; in this case the average issue size is only about 135 million of Euros.

## 6. Conclusions

This paper explores the Italian structured product market in order to analyse the characteristics of the structured bond listed on the MOT and to compare their ex-post return with other risk free bonds available to Italian investors. First of all we show that the market accounts only for products issued by banks; these bonds are characterized by very small dimensions, in terms of issue size, and by a high differentiation in terms of underlying and indexation rule. Another

Table 5: Issue size analysis. Mil of Euros

<b>Whole sample</b>	
max	1,399.2
min	5.75
average	238.8
median	110
<b>Subsamples - average size</b>	
issues with IRR > swap rate	259.1
issues with IRR < swap rate	200.4
issues with IRR = 0	135.4

peculiarity of this market is that the structured bonds are sold directly by banks to retail investors through their own agencies; only a small fraction is listed on the regulated market but the listing usually takes place some months after the private placement, when the issue is almost entirely sold. The fragmentation of the market is very high due not only to the issue small size, but also to fact that each issue reveals a different indexation rule and different underlying asset so that it is very difficult for a retail investor to make a comparison among different structured bonds. Regarding this point we offer a classification of the structured bonds listed on the Italian MOT based on the indexation rule (i.e. the type of derivative instruments hidden in the bond itself).

Second, we study the ex-post return of a sample of structured bonds listed on the MOT and now expired in order to compare their profitability with respect to other risk free bonds issued by the Italian government. This analysis reveals that, on average, the ex-post return (measured as the internal rate of return) of structured bonds is smaller than the swap rate and the *Rendistato*. We extend our analysis in order to discover if there is a particular relationship between this negative extraperformance and the most important morphological features of these bonds such as the coupon type, the maturity and the issue size. Our results (which are statistically significant) reveal that multiple coupon bonds show, on average, a better performance than one coupon bonds; the ex-post return worsen as maturity increases even if we expected to see the reverse; and, at last, we noticed that, according to our expectations, the extraperformance increases with issue size. As we pointed out in the introduction, the aim of this study is to understand if the level of risk which characterizes structured bonds is justified by a higher (average) return with respect to risk free bonds. Our analysis shows that this expectation is not satisfied since a great part of structured bonds ends up with a smaller return than risk free bonds (or other plain vanilla bonds) so we think that structured bonds are not suitable for retail investors for at least three reasons: first of all the embedded derivative is characterized by odd payoffs very difficult to be evaluated; second, they bear a huge level of risk which does not seem to be compensated by a higher expected return; third, they are characterized by a high illiquidity on the secondary market.

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