"BABES –BOLYAI" UNIVERSITY

THE FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

SUMMARY OF DISSERTATION

„FINANCIAL DERIVATIVES AND THE STRUCTURED BOND MARKET"

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1. Introduction

My motivation of writing about structured products is based upon the fact that I consider them an important topic of academic and economic interest. As it is a new theme on capital markets, I identified strong interest regarding this topic, especially as structured products also raise many question marks. Although some market participants heard about the appearance, these financial instruments still are a “Black Box “ for the majority. My intention is to analyze and present this topic for an audience as large as possible and to provide as many answers as possible regarding their appearance, functioning, structuring, pricing and management of these securities. The fact that I worked 5 years in this field of the capital market (Fund Company C-QUADRAT Investment AG, Vienna), gave me the opportunity to obtain a deep insight into the possibilities and advantages of these products, but also into the risks associated to them.

The scientific methods of research are based especially upon analyzing financial markets, Monte Carlo simulations, financial algorithms, stochastic processes, statistical data from EU and USA, but also conclusions from specialized literature.

The investors’ market for structured products has traversed an impressive evolution during the last fifteen years. The diversity of the offerings reached previously unimaginable dimensions: Structured products are being “structured” by traditional investment products like fixed income bonds and derivative instruments. They enable investors to change and optimize their risk-return profile by ***asymmetric*** pay-off cluster. In other words the investment universe enlarges by the appearance of these new types of investment opportunities. These new-generation products all serve a single purpose: to meet every aspect of a user’s requirements. But more importantly, they are astonishingly diverse instruments that continually push back the boundaries of a possible exposure to underlying asset classes and the limits of financial markets.

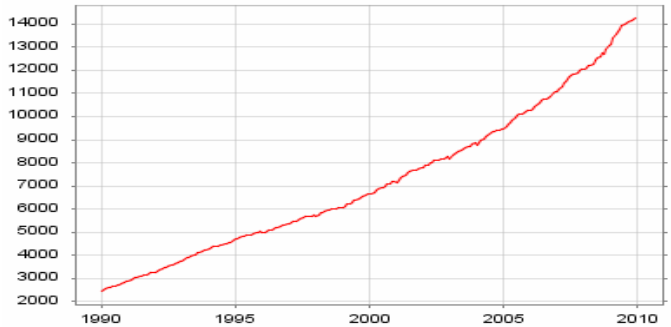
The economic benefit of such products has different aspects: On the one hand embedded derivatives become accessible for investors that otherwise might be unable to trade such financial instruments. As derivatives allow a very efficient risk transfer, they also ease the investors’ risk and asset allocation. Advanced structured products are often based on underlyings – like commodities – that usually cannot be easily bought by private investors. Thereby structured products fulfill a market completion and generate additional diversification potential. As market standard these products are issued as capital guaranteed bonds, thereby minimizing the

downside risks for the investors. Compared to a simple investment into the underlying, certain risks are being transferred from the buyer to the seller or from the seller to the buyer. Their variety and flexibility in generating different risk positions for investors is one of the reasons for their success on the capital markets.

In general structured products have over-the-counter (OTC) characteristics even if there are exchange-listed. The buyer of structured products has a claim against the issuing entity, but not against the exchange. This is a significant difference compared to the standardized derivatives that can be traded on specialized exchanges like EUREX – in this case the Clearing House of the exchange is the counterparty guaranteeing fulfillment of the contract.

2. The structured bonds market

With corporate bond issuance having grown at a fast pace in recent years, bonds have become firmly established as a *pillar of the financing structure* of the corporate sector. Bond financing allows companies to diversify their financing sources and to broaden their creditor base beyond the banking industry. A bond is a debt instrument issued by a financial or non-financial corporation in return for which the investor receives interest and the promise that the capital will be repaid. Investment in bonds offers two advantages: (1) known amount of interest income and, unlike other securities, (2) considerable pressure on the company to pay because the penalties for default are drastic. The major disadvantage is that the amount of income usually is fixed and may be eroded by inflation, currency prices etc. The principal force behind the increasing relative size of the corporate bond market is the process known as “disintermediation”: it means that corporations needing (borrowed) funds, bypass banks and go directly to the capital market.



Debt securitie issued by euro area residents / Amounts outstanding – All maturities – All currencies
(EUR billions; end of period; nominal values)

Fig. 2: Outstanding notional amount European Bond Market according to ECB

The main consequence is that the requisite credit evaluation previously performed by banks must now be done by the investors themselves. According to European Central Bank statistics the outstanding notional amount of the European Bond Market sums up to 12.000 billions EUR (including corporate and governmental sector), whereas the market capitalization of all quoted European stocks sum up to 7.000 billions EUR. Therefore the European Bond Market almost doubles the size of the Equity Stock Market.

Structured bonds are part of the fixed income market, but very different from traditional bonds with fix coupon payments, as investors now have the possibility to engage in totally different risk/return profiles. A structured bond is a combination of a conventional fixed income instrument and / or one or more derivative instruments. Derivatives allow users to tailor strategies to their specific needs - by modifying or adapting one or several features of the embedded instruments (e.g. the value of the coupon, the amortization of the bond or the derivative product). For reasons of simplicity I will refer to *a structured bond as an EMTN (European Medium Term Note) issued by a financial service provider like investment banks that offers exposure to underlying stock markets and a capital protection of 100% at maturity*. The degree of the principal protection can vary from 0% to over 100% at maturity and the underlying markets may also be fixed income, currencies, commodities, real estate, hedge funds etc. or a combination of them at the same time. Structured products significantly enlarge the accessible investment horizon and in general the construction of a structured bond is return enhancing: By giving up a part of the fix and risk-free market returns (treasury bonds returns or index returns) investors receive the chance to generate above market level returns if their market view turns out correctly. The European Market for structured bonds (private and public issues) has a size of beyond 1 000 bln Euro (ca. 7% of the fixed income market), what already shows the impressive size and potential embedded in those kind of structured financial instruments.

Common mechanisms and pay-off Profiles of structured bonds: Structured bonds ***without capital protection*** have in common, that the invested capital is completely at risk in certain market scenarios and can be lost until the maturity of the bond (even if the bond's issuer doesn't default). Normally these structures can be duplicated by market-traded options. The most common unprotected bonds are:

Participation Bonds, Bonus Bonds, Express Bonds, Discount Bonds, Outperformance Bonds.

But the main focus of the dissertation is on structured bonds ***with capital protection***. In this case the invested capital is not at risk and cannot be lost if the bond is held to maturity due to a capital guarantee given by the issuer.

The general functioning is as follows: The notional amount is split into a zero bond, that will deliver the capital guarantee at maturity, and the difference between the zero bonds' value (=present value of the guarantee level at maturity) and the notional amount is used for structuring the performance component with options which deliver the agreed pay-off profile of the structured bond. The options give exposure to the selected underlying and allow the implementation of a strategy that reflects the expected market development of the investor. For example a structured bond notional of 100 EUR can be split into a 5-year-to-maturity zero bond which costs 80 EUR and therefore 20 EUR are left for option structuring purposes.

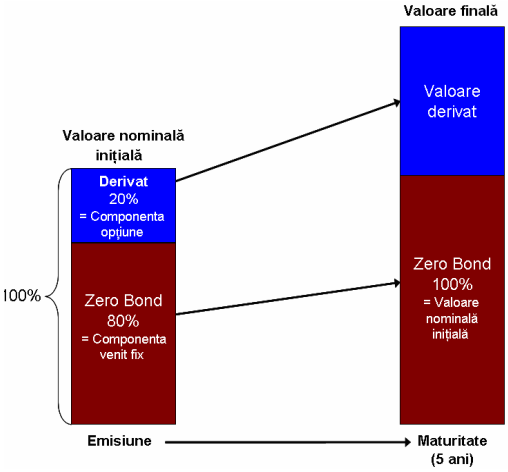


Fig. 13: Components and Functioning of a capital guaranteed structured bond

Some of the most traded payoff-profiles – presented in detail in the doctoral thesis – with capital protection are: **Bull Bonds, Asian Bonds, Lookback Bonds, Best Entry Bonds, Correlation Bonds, Alpha Bonds**

3. Pricing of structured bonds with capital protection

As liquid markets should offer no "free lunch" and no arbitrage possibilities, *the price of every bond or option can only be its discounted and probability weighted expected return*.

The first component of any capital protected structured bond is the ***"fixed income***

component", which is constituted by a zero bond. A zero bond is a bond that pays no yearly coupons and will be redeemed at 100% of its notional value at maturity. Therefore its value at the issue date must be *below* 100% of its notional and should represent the risk-adjusted and discounted value of the redemption amount at maturity. Fundamentally the price of a bond is the sum of the present values of all expected coupon payments plus the present value of the notional value at maturity, which means discounting the known future cash flows. The pricing of zero bonds can be done by standardized arithmetic means, as they represent a transformation of payment flows over different time periods. Their price mainly depends on: **Interest rate curve, Credit spread of the issuer, Maturity.**

The second component of structured bonds is the ***"option component"*** which offers the potential additional pay-off and exposure to the chosen underlying equity markets. Derivatives are financial instruments, including futures, options and swaps, whose value is based on an underlying asset, index or reference rate. The true challenge is to price complex options for structured bonds when no liquid "duplication" options are available at the market. The price of complex options is therefore generated by numeric methods, stochastic methods or highly sophisticated Monte Carlo Simulations. But as an option pay-off at maturity depends on the development of the underlying, its final value is uncertain *today*. Therefore we have to make assumptions about the development of the underlying until maturity in order to be able to discount the possible pay-off amounts of the option and thereby determine its actual price.

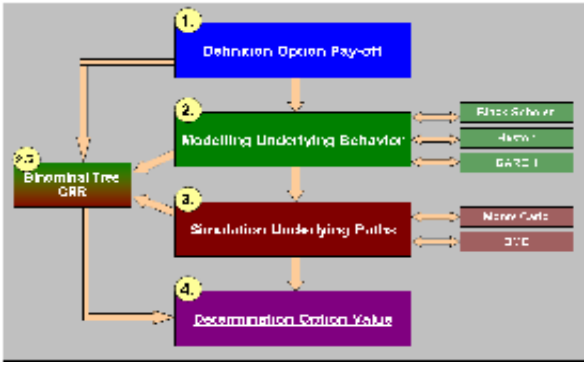


Fig. 29: Models Setup and Environment

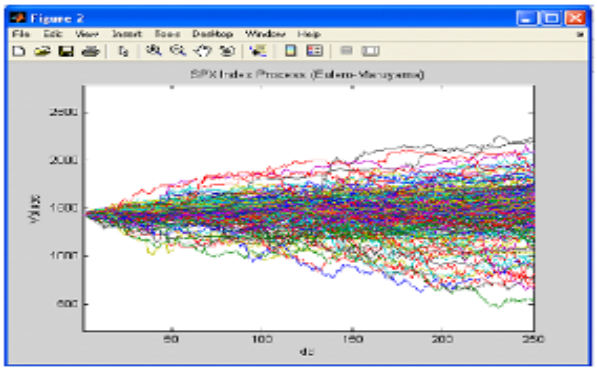


Fig. 41: Example Monte Carlo Simulation

The main uncertainty and reason for the complexity of options pricing thereby is the *unknown future and the possible development of the underlying*! As a result to solve this problem all following methods have in common, that they try to simulate the *future* development of the underlying. The option component thereby is priced with

the help of Monte Carlo simulations based on an assumed underlying behaviour according to the Black-Scholes Model, Heston Model or GARCH Model.

Even if the modelling environment was correctly set up, the option price heavily depends on the chosen values for the underlying's ***volatility, dividend yield and correlation***. These parameters strongly influence the outcome of the simulated paths for the underlying and thereby the expected option values at its expiration date.

Additionally to the conducted pricing of the bond for certain input parameters it is also very interesting to see which impact the variable input parameters have upon the trading price. In other words, how does the trading price of the structured bond change, if for example the dividends yield and volatility changes? This sensitivity analysis is also very important for issuers as it gives a better understanding of the variables driving the structured option price.

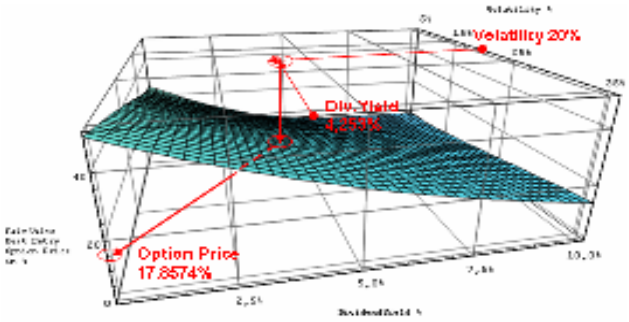


Fig. 58: Sensitivity analysis for Best Entry Option issue price

Another interesting sensitivity analysis which is often applied by the issuer is how the option or bond price behaves *after* the issue date (on secondary market). The most common sensitivity analysis for structured bonds is to calculate how the option value changes with different underlying prices (*"Delta"*) and the time running towards the maturity date (*"Theta"*).

4. Bond portfolio management

This topic is of very high importance for typical bond investors like pension funds, fund managers, public institutions, foundations as well as private investors. In the 1950s the bond market was considered a safe, conservative investment and a buy-and-hold strategy often was sufficient. But times changed and interest rates as well as inflation became more volatile. Thus, with more volatile interest rates, there was a higher profit potential and higher implied risk with bonds. Two main bond portfolio management strategies are to be found at the market: ***passive (accepting market***

returns) and ***active (outperforming market returns) management*** styles. With respect to market behavior there are, at the extremes, two views. At one extreme is the well-known *efficient market hypothesis* which says that the prices are always fair and quickly reflective of information. At the other extreme is what's called the *market failure hypothesis*. According to this view, prices react to information slowly enough to allow some investors to systematically outperform markets and most other investors. Additionally to the choice of a passive or active management style there are ***risk factors*** that affect both approaches. Due to the nature of debt capital especially two types of risk can be identified which have to taken into account - *systematic risk factors* and *non-systematic risk factors.* Systematic risk factors are forces that affect all securities in a certain category of the bond market – it is also referred to as "market risk". Non-systematic risk factors are risks that are not attributable to the systematic risk factors. They are linked to a particular issuer or particular issues and are additional risks to the market risks.

Risk Parameters of Duration and Convexity: ***Duration*** of a financial asset measures the sensitivity of the asset's price to interest rate movements, *expressed as number of years*. The price of an asset with long term cash flows has more interest rate sensitivity than an asset with cash flows in the near future. Duration only measures only the results of parallel shifts of the interest rate curve. ***Modified Duration*** of a financial asset measures the sensitivity of the asset's price to interest rate movements, *expressed in %*. For example the Modified Duration is the approximate percentage by which the value of the bond will fall for a 1% p.a. increase in market interest rate. So a 15-year bond with a Modified Duration of 7 would fall approximately 7% in value if the interest rate increased by 1%. ***Convexity*** is a measure of the curvature or 2nd derivation of how the price of a bond varies with interest rate, i.e. how the Duration of a bond changes as the interest rate changes. Duration can be formulated as the first derivative of the price function of the bond with respect to the interest rate in question. Then the Convexity would be the second derivative of the price function with respect to the interest rate. The Convexity calculation, therefore, accounts for the inaccuracies of the (linear) Duration.

If a bond investor seeks to hedge and protect himself against risks resulting from shifts of the interest rate curve, he can achieve this goal by the help of the Duration – this process is called "***immunization***". The question now is: How long does it take for

the bond investor to have the same financial cash flow position, like the one he had *before* the interest change? With Duration set equal to the buyer's planned holding period, a fall (rise) in the reinvestment rate is completely offset by an increase (a decrease) in the bond's market price.

5. Financial derivatives and the international liquidity crisis

The main question is whether the unregulated derivative contracts of the huge OTC market provoked the global financial instability. It might also be a point of view that financial institutions gave birth to the crisis and the derivative market tumbled as a result of afterwards events. Derivatives were initially designed to minimize risks, especially as the demand for risk minimizing instruments was overwhelming. Later on the instruments became more and more complex and investment banks discovered an immense playground for additional revenues and perverted the idea of protecting against financial risk into the dangerous domain of unregulated financial speculation.

The Bank for International Settlement monitors the value of all derivative products introduced on the international financial markets. The recent BIS figures show the following size of the international derivatives market as of December 2008:

OTC Derivatives:	$ 591,963,000,000,000
Exchange-traded derivatives:	$ 57,859,000,000,000
Total BIS monitored Derivatives:	**$ 649,822,000,000,000**

All values shown are the *Notional Value* of the contracts outstanding.

The next calculation shows that the current world derivatives exposure is approximately **10.4** times the Gross World Product for the year 2008.

$$\frac{\text{Total 2008 Derivatives (est.): } \$\ 649{,}822{,}000{,}000{,}000}{\text{Gross World Product (est.): } \$\ 62{,}500{,}000{,}000{,}000} = 10.4$$

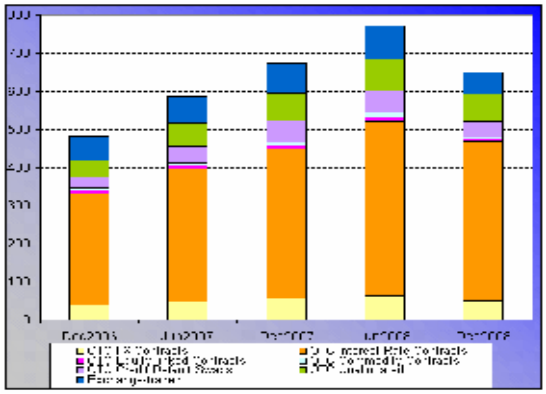


Fig. 71: Total BIS monitored derivatives by category in $ trillion

This is all about a new economy that unfortunately has become dangerously dependent on credit. With credit growing faster than the economy as a whole, and with a large amount of credit creation happening outside of the banking system, the ability to slow the economy through monetary policy has been. By their very nature, the use of derivatives in this new era allows credit creation to move well beyond what would be considered normal. Never before in an economic and financial market expansion have financial derivative contracts/securities played such a significant role.

Emergence of the international liquidity crisis: The press shows the crisis by many single stories about misbehavior, fraud, greed etc. which show multifaceted human abysses. Contrary to this, economic researcher should see the problems not on the level of individual human mistakes, but in the light of system defections that should be repaired. The laws and market standards must be analyzed in order to find and eliminate the errors of the system. It is definitely not a question of capitalism, as it brought immense wealth for many parts of the world. But the financial crisis is a crisis of the Anglo-American capitalism that mutated to a kind of casino-capitalism with many copyists also in Europe. The crisis is built on systematic errors, and especially the following can be identified: **US national debt, US real estate market, limitation of liability, missing market regulation.**

But the fundamental cause of the global financial crisis was excess global liquidity, which fuelled, among other things, a housing market bubble, driven by a complex combination of regulatory, market and policy failures. Proposed **solution statements for the actual liquidity squeeze** are especially linked to: *governmental bailout packages*, *identification and separation of "toxic assets"*, *harmonization of regulatory rules* (Basel III), *limitation of liability* (increasing banks' equity capital), *accounting rules* (IFRS vs. HGB Germany), *hedge funds*, and *rating agencies*.

6. Conclusions

- ***Structured Bonds = high flexibility*** and ***tailor made*** redemption profiles
- Huge field of ***structuring possibilities*** and portfolio ***optimizing*** potential
- Mixing ***upside potential*** and ***downside protection***
- Structuring option prices = selling off exposure to unlikely scenarios while retaining the exposure to more probable scenarios
- Enlargement of the investment universe

- ***Multi-variable complexity*** and ***sensivity*** when it comes to pricings
- Consolidation of ***real economy*** / reforming *financial*, *political* and *regulatory* framework
- Financial markets did **not** fall because of structured bonds, but as a result of a very dangerous mix of *reduced liquidity*, *missing regulation*, *lack of counterparty trust*, and especially due to *high risk exposures*.

  ➡ ***Bond defaults*** were a ***result of the crisis***, and **not** its initiators.
- Structured products improve risk / return profiles, and thereby the economic wealth of financial markets. But if the basic regulatory conditions do not stabilize limits for the use, regulatory capital requirements and supervision of structured products, speculation, misconduct and finally losses are the results.
- ***Important: Case by case differentiation of structured product's quality***

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