

# **Structured Products in the Swiss Financial Market**

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## EXECUTIVE SUMMARY

The first structured product has been issued in Germany by HSBC in 1990. One year later, the Schweizerische Bankverein (today UBS) issued a capital protection product called GROI (Guaranteed Return on Investment). Strengthened by the growth of the derivatives market, the market for structured products developed rapidly and led in 1997 to the introduction of EUWAX, a trading segment for structured products at the exchange in Stuttgart. Traditionally, a structured product is a combination of a financial asset and a derivative. In the beginning, structured products were fairly simple and consisted, for example, of a zero-coupon bond (financial asset) and a call option (derivative). In the Swiss market (Schoach Switzerland), products with exotic features are very popular. Particularly the reverse convertible family with barrier reverse convertibles and barrier reverse convertibles worst of basket.

The question of valuation of structured products was and still is of particular interest. There exist many studies that investigate the issuer's pricing policy by comparing the market price to a theoretical value. A first study about the Swiss market was published back in 1996 by Wasserfallen and Schenk. They find that banks significantly price in their favor at issuance (primary market), but a tendency of undervaluation (in the investor's favor) in the secondary market. The pattern that the overpricing declines with relative age of the product repeats itself along different studies. However, subject of interest of these studies is not only the product's life cycle and primary versus secondary market, but also differences among issuers or complexity of products. A recent article by the Swiss newspaper NZZ suggests that market inefficiencies are still present in the Swiss market.

Main goal of this thesis is to evaluate and analyze if overpricing exists in the Swiss market for structured products and which factors can explain it. Overpricing is in this case defined as the relative deviation of the observed market price (quote of the issuer) and the theoretical model value. This thesis shall also indirectly show differences between the application of different volatility concepts and valuation methods. Based on a comprehensive analysis it is attempted to exhibit discrepancies between the market and theoretical value from different perspectives. It is thus required to consider product specific and product unspecific factors. To cover product specific factors, multiple product types, that differ regarding certain criteria (for example complexity), are taken into account. This shall show whether structured products are equally fair or unfair priced or if there exist differences between product types. The explication of overpricing with the aid of product unspecific factors shall show differences, for

example, among issuers or the product's life cycle. Additionally, the overpricing in this thesis is computed using two widespread valuation methods. Another sub-goal of this thesis is to provide a contrast of an analysis on daily data and high frequency data. Due to the rapid IT development over the last few years, high frequency trading became an important and powerful instrument. It is thus interesting to see, whether the overpricing varies intra-daily and certain patterns stand out.

The focus of the empirical analysis of this thesis lies primarily on five different structured product types of the yield enhancement product category: Discount certificates (DC), barrier discount certificates (BDC), reverse convertibles (RC), barrier reverse convertibles (BRC) and barrier reverse convertibles worst of basket (BRCWOB). The theoretical price is computed by duplication (analytical) or Monte Carlo (simulation) method. The LIBOR rate is used as interest rate input and is assumed to be equivalent for all issuers. Tax effects in case of foreign issuers are not taken into account. Generally, four volatility values are used as input: Historical volatility of the last 30 and 90 days as well as implied volatility at strike and, if the product embeds a barrier option, at barrier level. The model values that are closer analyzed are based on the duplication method with implied volatility at strike level in case of DCs and RCs and at barrier level in case of BDCs and BRCs. In case of the complex BRCWOBs the model values base on the Monte Carlo method with volatility at the barrier level. If not specifically mentioned, the following results and statements base on these volatilities. For the whole dataset, which consists of 2121 products, 371'291 relative price deviations per volatility input and valuation method are computed.

The findings suggest, on average, that issuers price their products to the investors' disadvantage in case of each product type, although the extent is quite different. The overpricing is only 0.39% and 0.25% for the plain types DC and RC, whereas it is clearly higher for the exotic types BDC (2.33%), BRC (1.88%) and BRCWOB (2.43%). Statistical tests further prove that an increasing level of complexity positively impacts the overpricing. It is also evidently confirmed that the overpricing is dependent on whether a product pays coupons or not.

The comparison of the primary and secondary market confirms the findings of previous studies that the overpricing is significantly higher in the primary market than in secondary market. Within the secondary market, the life cycle plays an important role, which has been confirmed by statistical and graphical analysis. The explanatory power of the regression

model (short model), which only consists of the life cycle variable relative age, ranges from 16% (DC) up to 35% (BDC). Adding product trading data variables like spread, number of trades or turnover to the short model (full model) apparently increases the explanatory power. It is nevertheless doubtful whether these variables actually improve the model for two reasons. First, those kinds of structured products (yield enhancement) are rarely traded and second, the coefficient of determination only slightly increases. The effect of adding underlying trading data to the full model (extended model) is similar as the explanatory power slightly improves for all product types. However, the results are at some points rather questionable and thus raise doubts whether there actually exists a dependency.

Another interesting statement, that can be concluded from the results, is that there actually exist discrepancies among issuers. Some banks like Vontobel or ZKB, which belong to the top group regarding number of listed instruments, are relatively cheap, whereas for example Banque Contonal Vaudoise is rather expensive. It is though very difficult to draw an evident conclusion, because the product portfolio is not equivalent.

As extension to the analysis of daily data, a brief introduction to high frequency data regarding structured products is given. For one BRC over a period of one month, a model value has been computed for each underlying tick. The result-set showed no specific intraday pattern, but rather many random-like paths. To explain the overpricing, various determinants have been included to a regression model. Although the coefficients for the time period, option and product spread are significant, the explanatory power of the model is very low with less than 2%. It thus seems that there is quite some room for improvement for future research and it is arguable whether the chosen approach is optimal.

It becomes obvious that the daily and high frequency dataset don't substitute but rather complement one another. Analyzing daily data allows making a statement about the general overpricing like primary versus secondary market or the development depending on the product's life cycle. High frequency data on the other hand facilitates predications about time lag effects, arbitrage opportunities or intraday liquidity and overpricing patterns.