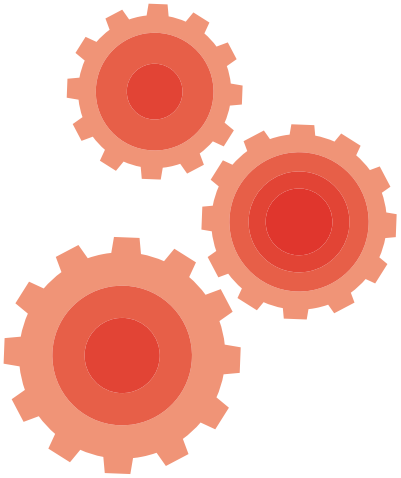
Zurich, June 2015

Structured Products: Performance, Costs, and Investments

White Paper



swiss:finance:institute

ACKNOWLEDGEMENTS

The editorial board thanks Dietmar Maringer, Walter Pohl, and Paolo Vanini for researching and writing this White Paper and the peer reviewers for their helpful comments. The authors would like to thank Derivative Partners AG and SIX Swiss Exchange & SIX Structured Products Exchange for providing access to the relevant data for this study and the representatives of the various banks for sharing background information for the investment case studies. Financial support from the Swiss Structured Products Association is gratefully acknowledged.

SFI White Papers
The SFI Knowledge Center publishes White Papers that give new stimulus to relevant topics, raise knowledge standards, and contribute to ongoing discussions or initiate debate on matters of particular relevance to the Swiss financial services industry.

Disclaimer
Any opinions and views expressed in this document are those of the authors, and the authors alone are responsible for the document's content. The authors are responsible for the statistical methods selected and for the accuracy of their data and calculations. The findings and conclusions presented do not necessarily represent the views of Swiss Finance Institute, the institute's staff, or the Swiss Structured Products Association. Swiss Finance Institute grants its researchers unrestricted academic freedom and preserves the scientific independence of research and the researchers' freedom of publication.

Structured Products: Performance, Costs, and Investments

Dietmar Maringer, Professor of Computational Economics and Finance, University of Basel
Walter Pohl, University of Zurich
Paolo Vanini, Head of Knowledge Transfer, Swiss Finance Institute; Adjunct Professor of Banking, University of Basel; Head of Structured Products, Zürcher Kantonalbank
June 2015

ABSTRACT

This paper analyzes structured products with a focus on the Swiss market. Empirical results for these products' five major categories are presented, along with case studies and a general discussion. The paper addresses three main questions:

- How did structured products perform in the period 2008–2014?
- What are the costs for investors at issuance?
- What aspects and strategies must be considered when investing in structured products?

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Although structured products have attracted considerable attention over recent years, only few empirical studies exist. This paper provides the first comprehensive and representative analysis for Switzerland, based on more than 20,000 individual products and studying the period 2008–2014. The category *warrants* has been excluded from the study. Structured products come in many different flavors: depending on their type, their payoff profiles can vary substantially. Barrier reverse convertibles are by far the largest category in this study's sample, followed by tracker certificates, discount certificates, bonus certificates, and capital protection certificates. Within each class, the products themselves are highly heterogeneous. First, their life-spans range from just a few months to several years. Next, they trade in different currencies: slightly more than half of the products studied here trade in CHF, another quarter in euros, and the remainder in US dollars or other major currencies. Finally, the vast majority have either single stocks or baskets of stocks as underlyings, but some have indices. The main conclusions are as follows:

- In most of the years considered, structured products performed well. In the period 2012–2014 some 80% or more of structured products generated positive returns. Depending on the category and year, these products generated median returns of between 5% and 15%, per annum implying that half of the products achieved this return or exceeded it. A particularly successful year was 2009 in which most medians were in the range of 19% to 31%. In all of these years, equity markets also performed well. The years 2008, which saw the onset of the most recent global financial crisis, and 2011—the year of the European debt crisis—saw (large) drops in equity markets. These drops also affected the structured products in this sample as they are mostly equity-based, and they too had negative medians. A noticeable exception is capital protection products, where the impact of market movements, on either side, is rather weak.
- Estimating the costs of structured products is difficult as some cost components are difficult to measure or are simply not known at issuance: Structured products are payment promises, contrary to the performance promises of funds. The trader has to guarantee the payment promise from issuance to the redemption date of the product. Therefore, the best known value of the costs is at the termination of the product, and uncertainty about the future value of parameters such as volatilities matters in terms of so-called risk management costs.
- Adding the risk management costs to the theoretical (model) price, which assumes that there are no market imperfections (such as bid-ask spreads) and for which crucial price parameters such as volatilities are constant, defines the "fair price" for the product components if they can be manufactured at zero production costs, if distribution is costless, and if the issuer targets zero profit. Risk management cost figures are not available publicly. An anonymous survey of major issuers in the Swiss market was used to estimate these costs.
- The authors refer to the difference between the issuance price and the fair price of the components as the total expense ratio (TER). The TER equals the sum of the net margin and all production and distribution fees. A structured product's TER mimics the TER of the fund industry, which provides a first step toward comparing these two different wrappings of investment ideas. The empirical analysis for the period April 2012 to April 2015 finds the following rounded median TERs (all figures are per annum): 0.3% for tracker certificates; 0.6% for capital

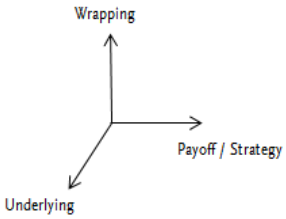
protection certificates; 1% for bonus certificates; 1.4% for discount certificates; and 1.7% for barrier reverse convertibles.

- Swiss investors have an appetite for barrier reverse convertibles on stocks, and behavioral motives appear to play a major role in investment decisions. A case study analyzes under which conditions an investor will survive—with a high probability—a full stock market cycle without breaching the barriers.
- Several additional case studies and illustrative examples distinguish investments in normal market conditions from event-driven investments made when markets are under stress. A main focus is on the SNB and ECB decisions of January 2015: the removal of the EUR/CHF cap and the introduction of negative CHF interest rates, and the decision to apply a program of quantitative easing in the eurozone, respectively. The case studies not only focus on possible return expectations but stress how investors' views are the key to investors making a sound investment or non-investment decision. The studies show that investment in structured products is based on a view of the markets contrary to that which prevails for investments in funds, where a mixture between a model and market view often applies.
- The events of January 2015 show that interventions can create many investment opportunities in different asset classes: equity, fixed income, credit, and FX examples are discussed in the setting of the aftermath of the SNB and ECB decisions. While some opportunities can be persistent, others exist only for a short amount of time. To transform such opportunities into investments two elements are necessary: structured products with a short time-to-market and a precise mapping of the opportunity into liquid investments, and investors who are fit to invest.

Structured Products

Structured products are investments whose repayment value derives from the development of one or more underlying assets. These underlyings are often combinations of traditional securities such as equities, bonds, commodities, and one or more derivative components. Derivative components are used to transform the risk-return characteristics of the traditional products such that the specific needs of an investor are met. Structured product investments are characterized by a short time-to-market, a payoff promise, liquid secondary markets, a short value chain, and a well-defined investment objective. Structured products can, as any other investment, be represented in the three dimensions of underlying, payoff or strategy, and wrapping; see Figure 1.

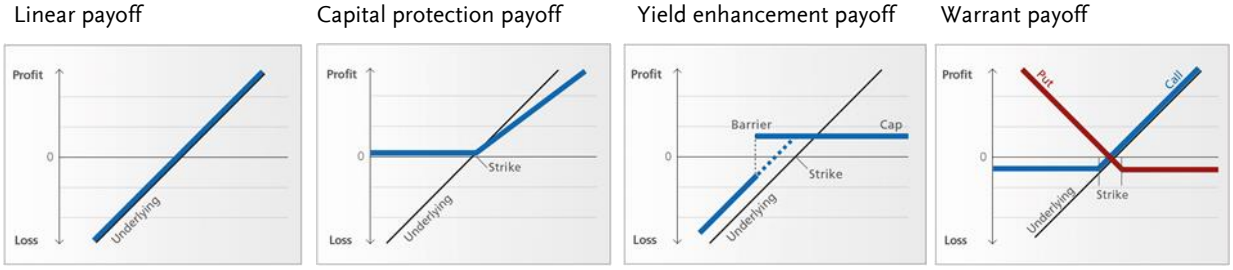
Figure 1: The three dimensions of investment products.



Underlyings are classified according to their asset classes, such as equity or FICC (fixed income, currency, and commodities) and by their number of constituent underlying values—that is to say, single constituents, baskets, or indices. The last decade has shown that payoffs can be classified, at the top level, into four types:

- *Linear payoffs*, where arbitrary gains and losses are possible for investors. The payoff of the products is tied to the price of an index or a basket of stocks. These products are called "tracker certificates" (TCs).
- The issuer of a *capital protection payoff* guarantees, at maturity of the product, a predefined redemption value.
- If markets are expected to move sideways, *yield enhancement* products are used. Barrier reverse convertibles (BRCs) are the products preferred by Swiss investors.
- For "*warrants*" the investor pays an option premium upfront. As previously stated, warrants are not covered in this study.

Figure 2: Top-level payoffs.



The Swiss Derivative Map classifies all structured products using these categories at the top level and also specifies a more detailed second level categorization.[1] The logic of the map is very successful, and was also used as the basic input to the product classification at the European level.

The investment strategy of most structured products is passive and generally does not change during the lifetime of the products, with TCs being the sole exception. TCs can be passively or actively managed. Active strategies can be based on a mathematical rule that describes the investment strategy during the lifetime of the product, or investment managers can discretionally manage the underlying basket. These different approaches to management are the same as those used in the fund industry: TCs are the structured product counterpart of investment funds and ETFs. The type of wrapping chosen depends on the size of the investment, tax issues, the investment restrictions of the investors, market access, and time-to-market requirements. Hence, it might be optimal to wrap an economic investment idea as a structured product, a mutual fund, an ETF, etc.

Table 1: Some characteristics of mutual funds compared to structured products.

Mutual funds	**Structured products**
Long-term and risk-based diversification approach. Mixture of model and market views.	Long- or short-term and opportunistic trading approach. Market views only.
Mass products for public distribution.	Mass or tailor-made products starting from CHF 20,000 in investment size, or less.
No issuer risk due to segregated accounts ("*Sondervermögen*").	Issuer risk. It can be mitigated using COSI or TCM wrapping.[2]
Long time-to-market.	Short time-to-market in most cases.
Performance promise ("*Leistungsversprechen*").	Payment promise ("*Zahlungsversprechen*").
High setup costs.	Low setup costs.
Mature life-cycle management.	Life-cycle management is less developed.
Comprehensive setup in the dimensions of market standards, market access, investor protection, taxation, and law; off balance sheet.	Weaker formal setup; high quality secondary markets; on balance sheet.
Appropriate for large investment sizes.	Appropriate for small and large investment sizes.
Over CHF 823 billion invested in mutual funds (Swiss Fund Data, 2015).	Over CHF 250 billion in Swiss securities accounts (SNB statistic, 2015).

[1] There is a fifth category in the map, which will not be considered here.

[2] COSI are structured products with a minimal counterparty risk. This protection is provided by means of a collateral pledge. Investors thus profit from increased protection on the invested capital. This unique service is offered by SIX Group. With TCM—Triparty Collateral Management—SIX Securities Services assumes responsibility for administering exposures (pledged assets) and collateralizing them using assets of the same value (securities and cash).

Example

Apple announced, on 9 March 2015, that their smartwatch portfolio would be launched in spring 2015. Just three days later Swatch announced *their* new smartwatch models that would compete against their rivals from Silicon Valley. The theme was covered by all media as the final market adoption of new, "intelligent" watches. Investors were looking for opportunities to invest in companies with exposure to this theme.

How should one construct such an investment vehicle? In this scenario, time-to-market was short, the patience of investors was close to zero, and potential issuers feared others would serve investors first, so the only solution was a TC. To set up a fund with FINMA approval would have taken several months. The first TC had its initial fixing on 20 March 2015, less than two weeks after the first press announcement. The investor had a 100% participation on the performance of a basket that contained 20 shares, not only from producers from the smartwatch theme but also from key suppliers in this upcoming industry. While there was no room for an investment fund to profit from the investment opportunity, funds can be a useful wrapper of the investment idea as follows: Suppose that the investment is successful and that the invested amount is increasing. A fund issuer could then benefit from the same economic concept by launching a mutual fund. What is the rationale? First, if the invested amount is large then a fund wrapper can be profitable—it does not make sense to start a fund if the invested amount is not larger than at least CHF 10 million. Second, a fund does not carry issuer risk, which is one of the main reasons why some investors are not allowed—or willing—to invest in structured products.

The example shows that, for linear products, structured products and funds are in principle only different wrappers of the same economic investment idea. The main differences between the two are the maturity of the investment, the investment size, and issuer risk. It should be noted, while this paper uses the term *structured products* throughout, the expressions *structured products* and *certificates* are used synonymously.

Performance

To date there have been no comprehensive studies on the performance of structured products in Switzerland. One major reason for this is the lack of comparability. Structured products differ substantially from each other in terms of their payment structure and risk profiles, catering for different investors' views and expectations on the one hand, and reacting differently to market developments on the other. A cursory examination of BRCs, capital protection certificates (CPCs), and TCs alone is enough to illustrate this diversity: the first have an upper cap, the second a lower cap, and the third neither. Views on future developments and hedging requirements will determine how attractive one type is compared to another. Expectations about volatility, the direction of price movements, and—in particular—the potential of prices falling below certain thresholds are the main criteria for preferring one type of structured product over another. This implies that direct comparison across categories is difficult if not impossible. It also implies that a category's popularity will be driven by general developments and expectations.

A serious performance study has to take all of the aforementioned points into account. The investigation that follows focuses primarily on the yearly performance of classes of structured

products over the period 2008–2014, and few comparisons between classes will be offered during the discussion. Likewise, there will be no benchmarking to the underlying: most products have some features that put a cap on one side of the payoffs, often with some leverage or scaling of participation. A direct comparison of annualized returns only would ignore these effects and would therefore be misleading.

Data Pre-Processing

The following analysis considers the types of structured products that, respectively, enjoy the largest shares of the market—namely, BRCs, bonus certificates (BCs), CPCs with coupon, CPCs with participation, discount certificates (DCs), and TCs. The study considers structured products listed on the SIX Structured Products Exchange with equity and equity index underlyings. For a detailed overview of the types of products considered in the sample, see the cost analysis section. The majority of observations already made are relatively recent; hence the emphasis of the analysis will be on the period 2012–2014, while results for the years prior to 2010 need to be interpreted with extra caution. Returns are computed in terms of price changes in the secondary market and of coupons. Both price and coupon data were provided by Derivative Partners AG. The actual amounts of coupon payments are not available, so the value of the coupons is derived from the product description of coupon size and frequency. The market data are based on live quotations from the SIX Structured Products Exchange, and are of good quality. The coupon data are purely informational, and are more likely to suffer from quality issues. For example, coupon amounts and frequencies can be incorrectly specified, or missing.

Structured products typically have short maturities. For example, around three-quarters of the BRCs considered have maturities of one year or less, and start and end dates virtually never coincide with the beginnings or ends of calendar years. Consequently, structured products often exist for only a few months in one calendar year and a few more in the previous or the next one. For the calendar year in which the structured product is issued, the return is computed from the date with the first available quote until year end; for the year within which the product matures, from start of year until the last available quoted price. These returns are then annualized. In all cases, mid-prices of market quotes were used to capture the investor's perspective.

Annualizing returns based on short periods—for example, a week—can result in extreme and unrealistic annual returns. This could heavily distort the overall results, irrespective of the fact that such a short period can hardly reflect the yearly performance of a given product. Therefore, the following procedure has been adopted to compute annualized returns and aggregate statistics:

- If a product exists for less than two months in a given calendar year, it is not included in the analysis for that year. Two months was found to be a reasonable threshold—the aggregate results do not differ substantially from longer cutoff thresholds (e.g., three months), but are based on a noticeably larger set of observations.
- All aggregate statistics will be based on weighted observations. The longer a product exists within a given calendar year, the more emphasis it receives when evaluating the performance of a class in that calendar year. This reduces the exaggerations of short-term effects while maintaining some relevant information about performance during that period.

Apart from TCs, all structured products considered have caps, limiting one side of their payoffs and, consequently, their returns. Such asymmetries have undesirable effects on commonly used summary statistics: averages become biased toward outliers and no longer reflect what typically happens, and standard deviations and volatilities do not catch the fact that large deviations will mainly occur only on one side and that upside risk and downside risk can differ substantially. Figure 14 illustrates this effect. The following analysis therefore prefers quantile-based indicators:

- To get a better idea of the "typical" outcome, the median observation provides a robust measurement for which half of the observations are above, and the other half below. More technically, the median represents the 50% quantile, with a 50:50 chance that a structured product from that sample performs above or below the median.
- Likewise, quantiles for other probabilities provide information about the range of observations and typical deviations from the center. For example, one-quarter of the products have a performance below the 25% quantile while three-quarters exceed it; while for the 75% quantile, it is exactly the other way round.
- The mean, on the other hand, can be biased—a small number of outliers can distort the sample average, which then no longer reflects the performance of typical (or even the majority of) products. For example, data errors are more likely to affect the mean, since they are a source of outliers. For this reason, means will be reported in the table with summary statistics for the sake of completeness; but for the main analysis, medians and quantiles provide more insights.

These measurements allow a clearer picture of the performance characteristics of an entire class. Also, they are more robust to outliers and measurement errors than the usual average and standard deviation, which also helps with the previously discussed issues of short maturities and annualization, in particular in their weighted versions.

General Findings

For most of the years considered in this study, the majority of structured products yielded a positive performance. In particular, for the years 2012–2014 all of the categories considered had positive median returns (see Figure 3) implying that the majority of products generated positive returns (see also Figure 4). By contrast, 2011 and—above all—2008 were particularly difficult years, in which a large proportion of products generated negative returns. This reflects the general developments for those years. The Swiss market index (SMI) lost approximately 33% in 2008 due to the most recent global financial crisis (GFC), and in 2011—which was affected by the European debt crisis—the SMI was down by approximately 9%. Likewise, the positive performance during 2012–2014 was paralleled by the positive performance of the SMI. Nonetheless, a direct comparison of equity and structured products is difficult given these products' payoff structures and features such as capital protection or coupon: almost all of the structured products considered in this study have limits on the positive side of returns, but not on the negative. This, however, is offset with a much lower probability of negative than positive returns. This manifests itself in the fact that, under "normal" market conditions, these products are very likely to generate a positive return with relatively little volatility. Because of these fundamental differences in payoff structures and likelihoods of outcomes, this paper abstains from benchmarking.

The second main reason why benchmarking would prove difficult is the rather short time-to-maturity of most structured products. The reported median performances are based on annualized values as many of the constituents of a yearly sample only existed for some months but not for the entire year; they therefore reflect the outcome of a buy-and-hold investment for start to end of a calendar year (if the product did exist for the entire year), or a repeated investment in comparable products.

Looking at median performances over the years also shows that some classes of product are more reactive to market developments than others: not surprisingly, TCs closely follow overall movements in equity markets, while products with capital protection typically fluctuate within a rather narrow band; and depending on their design and conditioned payments at maturity, deviations from the typical outcome can be asymmetric. The following discussion highlights some of these category-specific findings; the summary statistics can be found in Table 2. Investors in BRCs, TCs, DCs, and BCs fail in the aggregate to have a forecast view of the evolution of financial markets. They, again on average, did not foresee the most recent GFC or the European debt crisis in 2011. The losses from these products show that investors overestimated return expectations and underestimated risks.

Figure 3: Median performance.

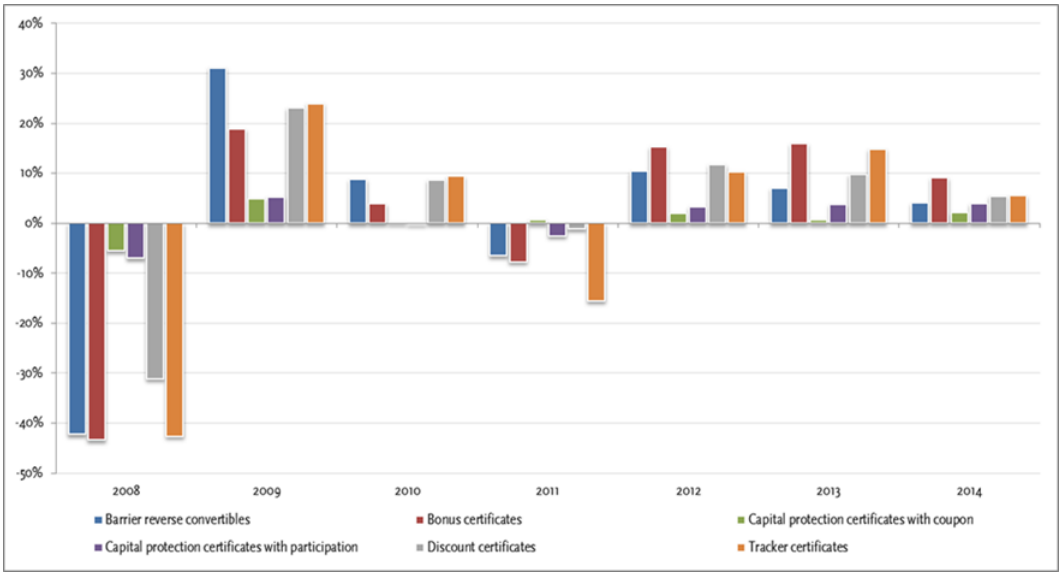
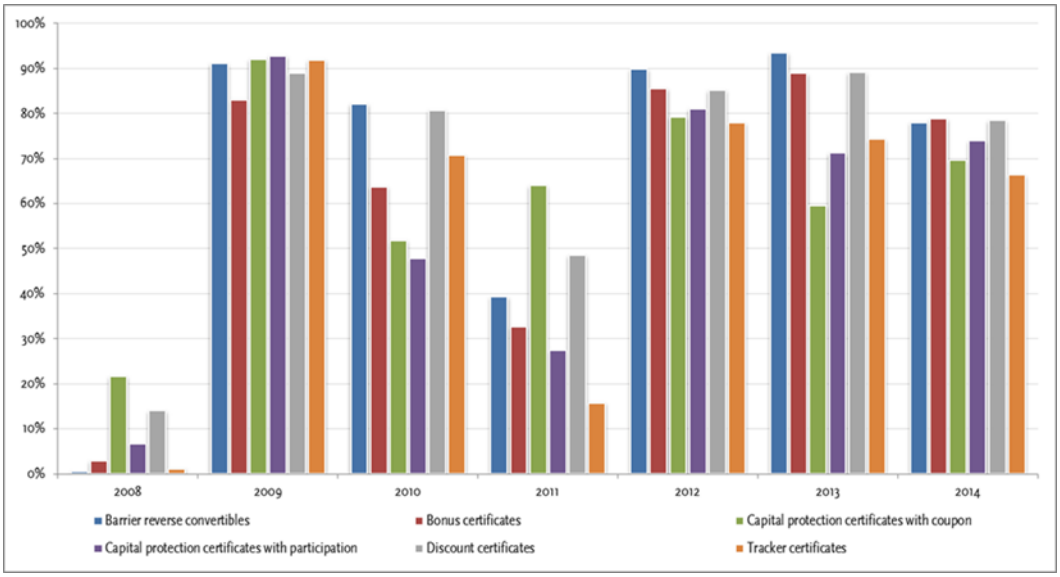


Figure 4: Fractions of products with positive returns.

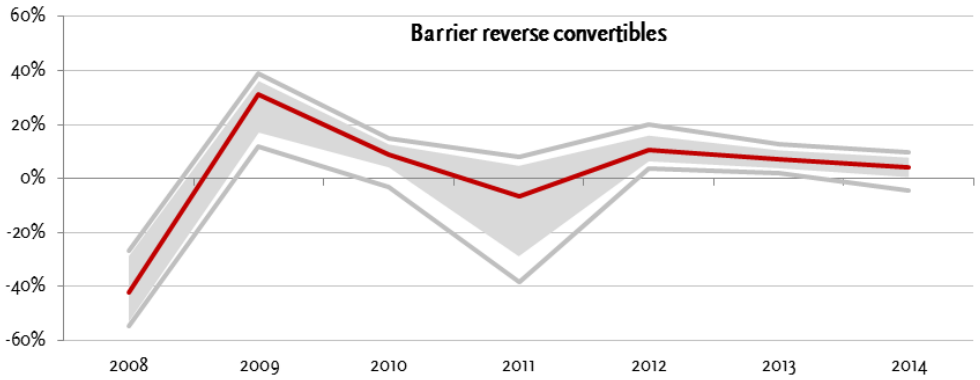


Barrier Reverse Convertibles

With more than 20,000 individual products considered, BRCs constitute by far the largest group in this study. From 2012 to 2014, BRCs typically generated returns of 10%, 7%, and 4% per year, respectively (weighted median returns), with deviations of individual products growing smaller over time. This can be seen in Figure 5: the red line depicts the median—that is, it splits the products in half, with 50% having higher, and the rest having lower returns. The gray area gives the 25%–75% quantiles, and the two gray lines the range for the 15%–85% quantiles—that is, the bandwidths covering 50% and 70%, respectively, of the sample. Note that for BRCs and similar products the median, representing "typical" product performance, is closer to the upper than to the lower bounds. The payoff structure limits the positive performance. Effectively this leads to a high probability of positive performance, while negative performance is less likely, but is not capped. This skewness in the returns will be discussed in more detail in the "investments" section of this study.

In 2014, three out of four BRCs performed positively; in the two preceding years it was even nine out of ten. Comparing results over time also reveals that performance can change noticeably from year to year: in 2009, for example, another nine out of ten products again had positive returns, yet with a median of 30%. Over these five years, this class attracted huge interest from investors, with twenty times the number of included products for 2014 compared to 2008. By design, BRCs are affected by large drops in the prices of underlyings; this explains the poor performance in the years 2008 and 2011.

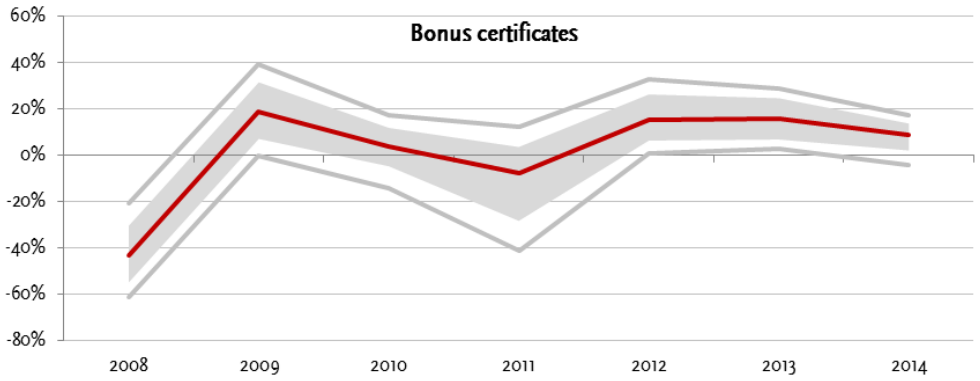
Figure 5: Median (red line), 25%–75% quantile band (gray area), and 15%–85% quantiles (gray lines).



Bonus Certificates

Similar to BRCs, the profit and loss of a BC depends on whether a barrier has been hit; however, they do not have a cap on the profit. Accordingly, their performance is similar to that of BRCs in years with sharp falls in the markets, yet more positive in bearish markets. The median BC generated a return of 15% or more during 2012–2013, and 9% in 2014, with typically four out of five performing positively. More popular than BRCs in the years following the most recent GFC, their number stagnated and eventually dropped over recent years.

Figure 6: Median (red line), 25%–75% quantile band (gray area), and 15%–85% quantiles (gray lines).

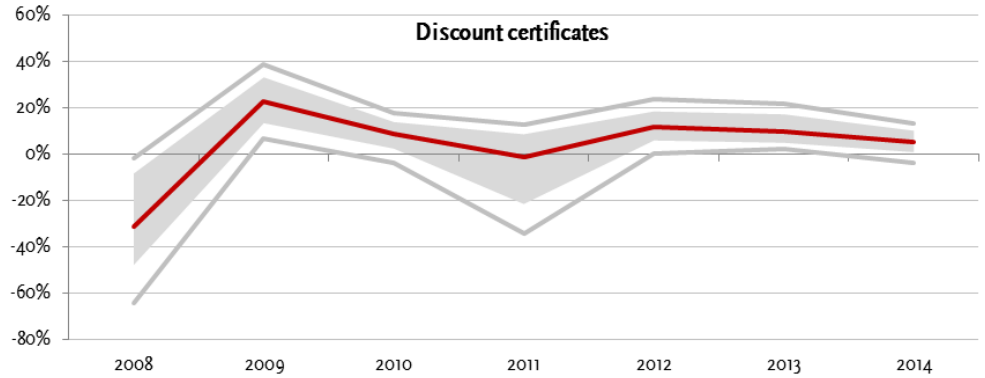


Discount Certificates

DCs have a cap on profits, but lack the barrier that characterizes BRCs. Payments at maturity can be lower even without sharp drops in the underlying's price; this, however, is also reflected in the pricing of this product. The typical DC has had, over the last three years, a return of 12%, 10%, and 5%, respectively, with approximately four out of five having a positive return. Due to the cap on profits, negative deviations from the typical outcome can be bigger than positive ones. This can be seen for 2011, for which the confidence band is asymmetric around the median with larger negative, than

positive, deviations. The median was still close to zero, implying that almost half of the products had a positive return. DCs share this asymmetric behavior with BRCs and BCs; consequently, under (strongly) negative market developments they all have mean returns noticeably below their medians.

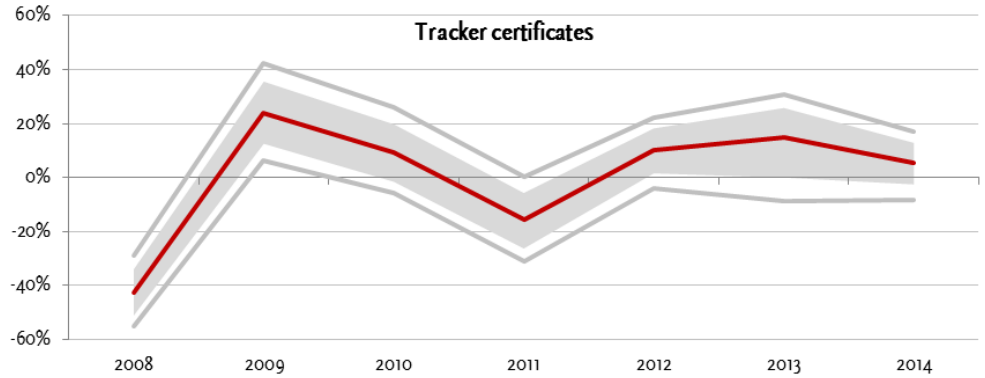
Figure 7: Median (red line), 25%–75% quantile band (gray area), and 15%–85% quantiles (gray lines).



Tracker Certificates

Unlike the other product categories considered here, TCs have no conditional payoffs at maturity. Consequently, they do not exhibit the asymmetries found in all the other categories, and their values directly reflect general market developments. Not surprisingly, TCs were hit hard by market turmoil in 2008 and 2011, and have the lowest proportion of positively performing products of all categories considered.

Figure 8: Median (red line), 25%–75% quantile band (gray area), and 15%–85% quantiles (gray lines).



Capital Protection Certificates

CPCs exhibit the most stable performance of all classes investigated. For CPCs with participation, the median performance is always in single digits. The bandwidths within which the majority of these

products perform are narrower than those of other categories, indicating their low level of risk. Losses are possible due to price fluctuations during CPCs', comparatively long, time to maturity and because capital protection levels are often below 100%. Apart from CPCs with participation, CPCs also exist with coupons. Preliminary results show that the performance of the latter variety is very similar to that of their "participation" counterparts; however, due to missing data for several years, a detailed discussion is not possible here and these results are therefore not reported.

Figure 9: Median (red line), 25%–75% quantile band (gray area), and 15%–85% quantiles (gray lines).

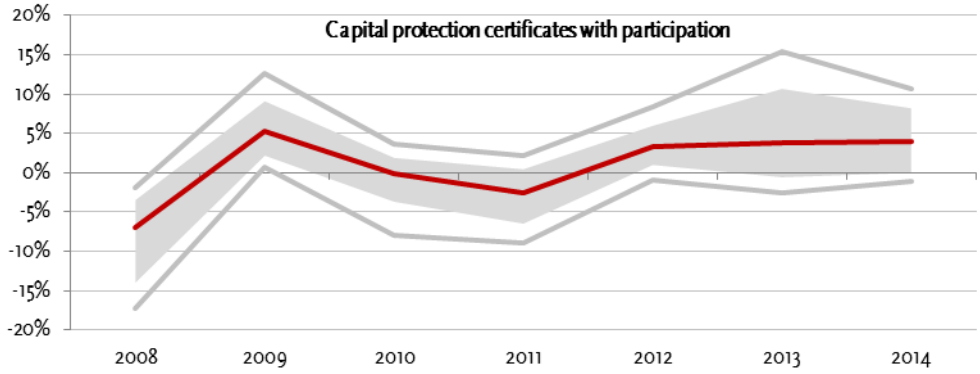


Table 2: Summary statistics for the annualized performance of the five main categories.

	2008	2009	2010	2011	2012	2013	2014
Barrier reverse convertibles							
Median	**-42%**	**31%**	**9%**	**-6%**	**10%**	**7%**	**4%**
25% quantile	*-53%*	*17%*	*4%*	*-29%*	*6%*	*4%*	*1%*
75% quantile	*-29%*	*36%*	*13%*	*5%*	*16%*	*10%*	*8%*
Mean	**-43%**	**25%**	**6%**	**-12%**	**11%**	**6%**	**1%**
Fraction positive	1%	91%	82%	39%	90%	94%	78%
N	*48*	*159*	*2497*	*3892*	*4155*	*4833*	*6114*
Bonus certificates							
Median	**-43%**	**19%**	**4%**	**-8%**	**15%**	**16%**	**9%**
25% quantile	*-55%*	*7%*	*-5%*	*-28%*	*6%*	*7%*	*2%*
75% quantile	*-30%*	*32%*	*12%*	*4%*	*26%*	*25%*	*14%*
Mean	**-43%**	**18%**	**3%**	**-11%**	**16%**	**16%**	**6%**
Fraction positive	3%	83%	64%	33%	86%	89%	79%
N	*689*	*678*	*696*	*530*	*505*	*501*	*461*

Capital protection certificates with participation							
Median	**-7%**	**5%**	**0%**	**-2%**	**3%**	**4%**	**4%**
25% quantile	*-14%*	*2%*	*-4%*	*-6%*	*1%*	*-1%*	*0%*
75% quantile	*-3%*	*9%*	*2%*	*0%*	*6%*	*11%*	*8%*
Mean	**-10%**	**7%**	**-2%**	**-3%**	**3%**	**6%**	**5%**
Fraction positive	7%	93%	48%	27%	81%	71%	74%
N	*191*	*218*	*324*	*227*	*188*	*195*	*244*
Discount certificates							
Median	**-31%**	**23%**	**9%**	**-1%**	**12%**	**10%**	**5%**
25% quantile	*-48%*	*14%*	*3%*	*-21%*	*6%*	*5%*	*1%*
75% quantile	*-8%*	*33%*	*14%*	*9%*	*19%*	*17%*	*10%*
Mean	**-33%**	**20%**	**7%**	**-8%**	**11%**	**10%**	**4%**
Fraction positive	14%	89%	81%	49%	85%	89%	78%
N	*335*	*489*	*439*	*685*	*900*	*1259*	*1217*
Tracker certificates							
Median	**-43%**	**24%**	**9%**	**-16%**	**10%**	**15%**	**6%**
25% quantile	*-51%*	*13%*	*-2%*	*-26%*	*2%*	*0%*	*-3%*
75% quantile	*-34%*	*36%*	*20%*	*-6%*	*18%*	*26%*	*13%*
Mean	**-43%**	**23%**	**9%**	**-16%**	**9%**	**12%**	**5%**
Fraction positive	1%	92%	71%	16%	78%	74%	66%
N	*432*	*514*	*750*	*967*	*1052*	*1084*	*1133*
Swiss market index							
Annual performance	-33%	15%	-2%	-9%	13%	17%	9%

Cost Analysis

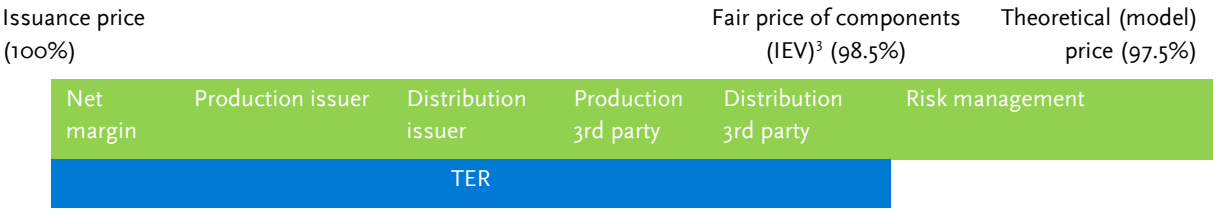
The logic of fees for structured products will now be considered and will be compared to the fees and costs for funds. A structured product has, in general, three fee categories:

- Distribution fees;
- Production fees;
- Risk management costs.

The first two categories are based on fees—that is to say, costs plus a possible net margin. Distribution and production fees do not change during the lifetime of the products and are borne by the investor. The lower the fees, the better the terms and conditions for the investor—so, for example, a higher participation rate, coupon payments, or a capital protection level follow. Risk management costs are not known with certainty at the issuance date—the numerical value is known best at the redemption date but even then the exact value is not known if one takes into consideration the portfolio issues of the trading books. Figure 10 shows the various fee components of a structured

product. Beside the three categories, the net margin is the residual component between the issuance price (assumed to be 100%) and the theoretical price (assumed to be 97.5%).

Figure 10: The different fee and cost components of a structured product (the authors).



The theoretical price, which is also called the model price, is the price of the product if all components of the product such as options, stock, funds, etc. are priced using a theoretical model—that is to say, as if there were

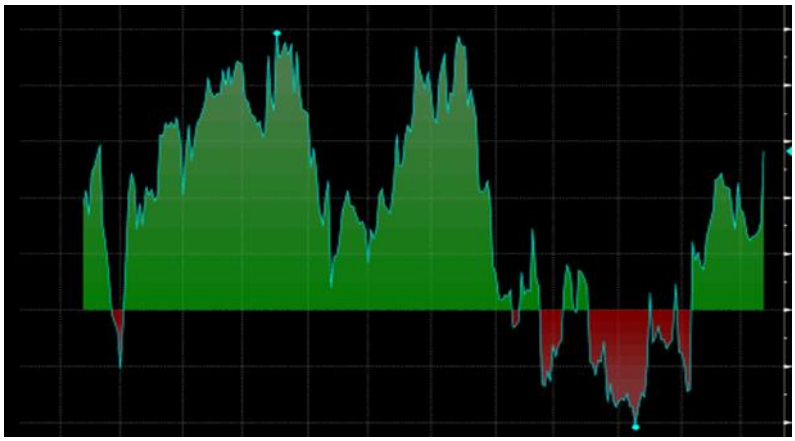
1. No market frictions such as bid-ask spreads;
2. No uncertainty premium for changing price-sensitive parameters such as dividends, volatilities, and correlations;
3. No capital-at-risk charges—for example the shareholder of the issuing firm does not charge a return for the risk capital, but risk capital is charged and this charge depends not only on the individual products in the trading book but also on the risk profile of the whole portfolio;
4. No gains from risk-free investments at early redemptions;
5. No risk costs for the leverage in some products.

Therefore, without taking risk management costs into account, nobody can buy a structured product at the theoretical price. The uncertainty premium alone will be commented upon since the other elements do not require further explanation. Why do traders need to consider an uncertainty premium? The structured product is a payoff promise—at any future date the issuer has to serve the payoff liability. If a trader does not consider these uncertainties, the issuer is likely to lose money through its structured product business.

Consider the Australian dollar / Swiss franc (AUD/CHF) correlation, which matters for the value of derivatives with AUD/CHF as their underlying value. Figure 11 shows the historical development of this correlation value. The historical values are by no means constant. The value of the derivative changes over time. This also leads to varying liability value. The traders have therefore to adjust their position, which guarantees the liability value (dynamic hedging). At the issuance date of the structured product, the future value of correlation is not known. But the trader has to fix a value in order to price the product. A different marking of the correlation leads to a different price of the derivative. Which value should the trader choose? The average value could be chosen, or the historical maximum or minimum, or any other value. Whatever value ex ante is chosen, ex post the chosen value can turn out to be too optimistic (the trader loses money) or too conservative (the trader makes money).

[3] IEV = Issuer estimated value

Figure 11: Historical 1-year correlation AUD/CHF from Jan 2012 to Jan 2013. Green areas denote a positive correlation and red areas a negative correlation (Bloomberg).



Adding all these real imperfections to the theoretical price defines the fair price of the components. The difference is the risk management component. Whether or not the uncertainty premium was sufficient to cover the final payoff is only known to the trader at the redemption date.

In a mutual fund, the risk management component is not fully borne by the issuer of the fund. The tracking error of the fund—that is to say, the deviations of the fund investments from the underlying benchmark—is charged to the investor. This is possible since the fund does not make a payoff promise to the investor and hence the fund manager does not need to hedge the tracking error. It should be noted that the tracking error is not included in the TER of funds.

The difference between the issuance price and the fair price of the components in Figure 10 is defined by several Swiss issuers as the TER, in order to mimic the TER of the fund industry. Production fees include index fees for underlying values, issuance costs such as fees for the stock exchange listing, structuring costs, life-cycle management costs such as for the reporting or management of corporate actions, and all personnel and non-personnel costs for the employees involved in the structured product value chain. Since 1 March 2015, issuers of structured products in Switzerland have had to disclose all distribution fees.

The costs referred to in the next section were computed as follows:

- The issuance price of the structured product based on the first ask price was used.
- The theoretical (model) price was received from an independent price provider.
- Risk management costs were estimated anonymously by several issuers.
- The TER, as defined above, was calculated as shown in Figure 10.

The decomposition of the different fee and cost components in Figure 10 suggests that the issue of cost transparency for structured products is well defined and easy to establish. But it is not. At least three issues matter.

1. The decomposition is time dependent since the risk management costs vary over time.
2. Which information is publicly known and verifiable; which information is private to the issuer?
3. Is there a potential for moral hazard from the issuer's side?

These issues are addressed in the sequel as follows: Due to its importance, the focus lies on the primary market; specifically, what the costs are for an investor who buys the product in the primary market. The costs in the secondary market are different. A study of the German market by Döhrer et al. (2013) shows that the expected issuer margin decreases monotonically over time for all product categories except for capital protection products. This is also expected to hold for the Swiss market and indicates that the costs for the investor are not increasing in the secondary market.

Unlike the Döhrer et al. study of the German market (op cit), which estimates the expected issuer margin, the present analysis concerns the costs that an investor faces. A first reason for this is that, for almost all financial products, the issuer's profit is private information. Second, risk management costs are issuer specific: two traders that price the same product might differ in their risk management costs since, for example, the risks of the product diversify the risks of the trading book of trader 1 (positive impact on capital at risk) while trader 2 does not seek the risks of the product and therefore has a different willingness to pay for them.

Most information from the cost and fee decomposition is also private, with only the issuance price and the distribution fee figures being publicly available. This appears to suggest serious risks of moral hazard. But the analysis thus far has not considered several institutional aspects that counteract such behavior from the issuer's side.

1. Standardization: Structured products are mass products. They are generated and managed over the life cycle with a high degree of automatization. Therefore, there is no opportunity (in case of automatized platforms) or only a small one (in case of products with a subscription period) to manipulate the cost and fee structure of single products.
2. Structured product units are part of the trading units of banks. Thus they are subject to strict control processes, including risk control under which they are accountable to their bank's compliance unit. These controls are not applied on a broad superficial level but rather to individual products on a day-to-day basis.
3. The price of structured products is mark-to-market. There is no room to add arbitrary, non-qualified components from the trader's side.
4. The Swiss structured product market is a competitive market. Professional buyers of products ask several issuers to quote a price (i.e., to state terms and conditions). The quality of the secondary market is tracked by Derivative Partners AG using the Payoff Market Making Index, which is published on a monthly basis. Although competition cannot prevent any undesirable shift between the different cost components, it does make it impossible to transform the whole cost structure without affecting the terms and conditions of the product. This is true since structured products are liabilities for the issuer with a payoff promise.

To summarize, the calculation of costs for a structured product is a complicated task. The main reason for this is that financial products are forward looking in time contrary to most physical products: The calculation of the costs or margins of a bottle of wine does not face any uncertainty about the future value of price-sensitive parameters.

Data Pre-Processing and Sample Construction

The following analysis largely considers the same types of structured products as does the performance analysis—namely, BRCs, BCs, CPCs with coupon, and DCs. The analysis is performed over the three years prior to the point at which the study was conducted: from April 2012 to April 2015. For comparability purposes, only those TCs with limited life-spans were included. (TCs with unlimited life-spans must be sold in the secondary market and must be held to maturity, which makes them unlike the other classes of structured products). In the sample, there were only very few capital protection products with participation, so that category was also dropped. All data for the cost study were obtained from Derivative Partners AG.

The cost calculation for this analysis builds on the fee and cost components of a structured product as illustrated in Figure 10. In order to compute the costs of structured products, the difference between the earliest available ask price and the corresponding theoretical price has been calculated. This is an approximation of the difference between the issuance price and the theoretical price. But the authors of the present paper lacked reliable data for the issuance price and the theoretical price at the issuance date. The assumption is that the error is small since this study considers many products and price fluctuations are likely to cancel each other out to some degree. As explained in the previous section, the theoretical price in this analysis is the price of a product if all components of the product are priced using a theoretical model. This price does not include risk management costs, which are borne by the issuer and which can be significant for the kinds of complex products available in Switzerland, such as BRCs. The computation of theoretical prices is beset with considerable difficulties. The products themselves are heterogeneous, and even products within the same class can have different features, such as callability. The terms of the products are laid out in individual term sheets, and while databases of terms have been assembled, these suffer from data omissions and data entry errors.

To solve these problems, theoretical prices were also obtained from Derivative Partners AG—a vendor that provides model prices for structured products in the Swiss market—and calculated by using this company's internal model. Derivative Partners AG's internal pricing model takes into account both discrete dividends and implied volatilities and uses a local volatility model to price more complex products, which are path dependent. Implied volatilities are derived from Eurex option prices. Derivative Partners AG model prices provide a standard benchmark for the market, and are already used as an independent source of product valuation for collateralized secured instruments (COSI). The sample consists of all products available from April 2012 until April 2015 for which Derivative Partners AG had model prices. Derivative Partners AG provided a time series of theoretical model prices corresponding to ask prices. The goal of this study is to measure the costs borne by the investor at issuance, so for each product the earliest ask price has been used as the relevant price for comparison. As some of the products may have been issued well before the sample period began, products were included in the sample only if they were issued after the Derivative Partners AG data start date. In addition, the data for products with shorter maturities seems particularly full of outliers. So to ensure data accuracy the sample has also been restricted to products with a product life-span of at least 51 weeks (a product's life-span is the period between its issue and its maturity). One additional source of outliers is products with missing price data, so the sample only includes products that have ask prices available for at least 181 days to maturity. Altogether, the sample of this study is very large, containing 7,275 products. Model prices are particularly susceptible to errors in the product descriptions. So to control for outliers this study concentrates on medians.

Within each product class, the observed products themselves are heterogeneous. The products trade in a range of currencies: 54% trade in Swiss Francs, while 26% trade in euros, 17% in US dollars, and the remainder in other major currencies. A total of 95% of the observed products have equities as underlyings, while 5% have indices. Regarding the underlyings, 52% are Swiss, while 15% are American, 12% are German, 7% are French, and the remaining 14% are other currencies.

As explained in the previous section, risk management costs need to be added to the theoretical price in order to obtain the fair component price of a structured product. However, risk management costs are not known with certainty at the issuance date, are not publicly available, and vary among issuers and also in the market situation as volatility changes. In order to consider a representative value for these costs, estimates of risk management costs for the various product types in the current market environment were obtained from four major issuers of structured products in Switzerland. For each estimate, product features such as the underlyings, currency, strike prices, and barriers were predefined and the issuers provided their estimates independently for the products with these features to SFI. In order to avoid moral hazard, the highest estimate figure was not considered when calculating the average estimate figure for each product and the final figures were reported anonymously to the authors of this study. The average annualized value has been used to proxy for these costs. Table 3 shows the interval for the risk management cost estimates. As can be seen, the estimates are similar to each other, but can vary up to 25 basis points from the mean. It must be stated that these estimates only represent such costs in the current market environment and that these costs vary as market parameters, such as volatility, change. Risk management costs can also vary within a product class, which is another potential source of error. TCs do not normally face the same kinds of risk management costs, so the study uses a risk management cost of zero.

Table 3: Average annualized risk management cost estimates, for which the highest reported figures were deleted (four major issuers of structured products in Switzerland).

Product type	**Risk management cost estimates per annum**
Worst of barrier reverse convertibles (barrier at 75%)	1-year maturity: 1.28%–1.50% 3-year maturity: 0.51%–0.87%
Bonus certificates (barrier at 75%)	2-year maturity: 0.84%–1.25%
Capital protection certificates (95% cap. protection)	5-year maturity: 0.06%–0.13%
Discount certificates	1-year maturity: 0.10%–0.25%

As can be seen from the table, the risk management costs for products with barriers and several dependent underlyings—such as the worst of BRCs—can be sizeable. The costs are not a source of income for the issuer; they are simply a cost the issuer bears to hedge the complex product features

that are not known at issuance. For simpler products, these costs are much lower. For TCs, for example, the costs are close to zero[4] since there are no complex structures to hedge.

The following example, which was sent to the authors by an anonymous issuer, discloses the fine structure of the risk management costs for a BRC with a Nestlé, Novartis, and Roche underlying, 1-year maturity, and a barrier at 80%. The pricing holds for the market conditions in March 2013:

- Spread of volatilities 0.55%.
- Uncertainty premium 0.38%
- Dividend risk 0.23%
- Funding spread 0.30%

This results in risk management costs of 1.46%.

General Findings

Table 4 reports the cost results for each product class. The costs are the difference between the ask price and fair price of the components, expressed as a percentage of the theoretical price. The count column reports the number of products in the sample for each class, while the other three columns represent the 25%, 50%, and 75% quantiles for each class. All figures are annualized.

Table 4: 25%, 50%, and 75% quantiles for the product sample for the period April 2012 to April 2015.

Product type	Number of products	25% quantile	50% quantile	75% quantile
Barrier reverse convertibles	5,477	0.81%	1.71%	2.64%
Bonus certificates	333	0.19%	0.98%	2.22%
Capital protection certificates	48	0.24%	0.58%	1.38%
Discount certificates	1,370	0.92%	1.39%	2.28%
Tracker certificates	47	0.11%	0.32%	0.62%

As mentioned above, TCs without expiration dates are excluded, since annualization is meaningless for a product with an unlimited life-span. Since investors can only realize the gains from such a TC by selling it, an alternative measurement would be the percentage difference between the ask price and the mid-price. There are 88 TCs in the Derivative Partners AG sample. For those 88 products, the 25%, 50%, and 75% quantiles are 0.26%, 0.36%, and 0.54%, respectively. It is tempting to compare these figures with their counterparts from the fund industry. To avoid a comparison of apples to oranges, some remarks should be considered. First, of the 88 TCs 10 were dynamic and 78 static. Since dynamic strategies, either by a rule or discretionary, are more complex than static ones the former are

[4] Such costs can arise if the investor does not bear the bid-ask spreads in rebalancings and are difficult to imagine in secondary markets. Illiquid underlying values such as some funds or the minimum trading unit in bond trading could generate this type of cost.

more expensive. Second, the type of underlying in TCs is an important cost driver. If a TC consists of a basket of 20 liquid stocks, much lower costs should follow than for a basket of 20 credit default swaps. Third, the volume of TCs matters: the larger the volume, the lower the production costs per unit. Also, for funds a number of disclaimers apply. Like the prices of most goods and services, the expenses of funds differ considerably across the array of available products. First, does one consider actively managed funds, index funds, or ETFs? Second, are the underlying values equities, bonds, or from another asset class? Third, are large and small size funds considered? Fourth, how is the investment objective defined? For equity funds, are growth, value, alternative strategies, or any other investment objective considered? Taking these remarks into account, data from the Investment Company Institute (2013), for mutual funds and index funds, and from DB Tracker (2015,) for ETFs, provide the following mean figures—

- Mutual funds: 0.74% for equity funds, 0.61% for bond funds where the figures are volume weighted. Since larger funds have lower fees, the corresponding figures are 1.37% and 1.16% for bond funds without volume weighting.
- ETFs: 0.49% for equity and 0.25% for bonds.
- ETF core: 0.09%.

Despite all these differences, it can be stated that:

- Structured products are not cost competitive to ETF core.
- Structured products face similar costs to ETFs.
- If only actively managed TCs are considered, they seem to have a price advantage over mutual funds.

There are several previous studies that have considered the question of costs for derivatives and structured products. Of these, Döhrer et al. (op cit) find the lowest costs of any study, considering a cross-section of German structured products on a single day, and using a complex estimation procedure to back out implied issuer margins. The authors' estimation procedure leads to exponentially decreasing estimates of the issuer margin over the lifetime of the product, except for the case of CPCs. Most of the products in the study were evaluated in the middle of their lifetimes, which biases the issuer margin estimates downward compared to the margin at issuance. Since most products are bought at issuance, this is the relevant cost for the vast majority of investors. The sample of products studied by Döhrer et al. (op cit) is also very different from that of the present study, in that the vast majority of products in their sample are CPCs, which are the least complex and therefore lowest cost product. One might wonder why the costs differ within different types of product by a factor of 2 to 4 if one compares the quantiles. Besides the different risk appetite of the traders other factors also have an impact. First, distribution fees can be very different. If an investor uses the products in a mandate where no distribution fees are allowed, a different price follows than follows for an investor that charges its end customers a fee of 0.5%. Second, the production fees are different both for different issuers and different underlyings. Since not all issuers have achieved the same standard of automatization, production costs per unit are different. If an investor wants a product with underlying Nikkei 225 and another investor asks for the same structure but on the SMI, the former product will be more expensive since the index fees for the Nikkei 225 are higher than for the SMI. Third, as for any product, volume matters: a pricing request for an issuance of CHF 1 million has a

different pricing ticket than a CHF 40 million request. These differences need to be considered if one decides to validate a third independent valuation party's pricing of products.

If the results of this study are compared to the many prior academic or regulatory studies,[5] the majority of the latter find much higher costs. The reason for this is simple, as Döhrer et al. (op cit) already state in detail in their study: Academics need to focus on the theoretical value due to lack of data—that is to say, they treat the risk management costs borne by the issuer as if they were costs borne by the investor. Therefore, one has to be very careful when interpreting academic studies in this field.

Investments When Markets are "Normal"

The statistics in the cost and performance section of this paper show that many Swiss investors prefer to invest in BRCs, autocallables,[6] TCs, and—if the time value of money is positive—also in capital protection structured products. This White Paper will not discuss when and how such investments are chosen since this is covered in detail in Meier and Sandmeier (2012), Rieger (2009), and Tolle et al. (2006). The focus here will be on the issues of technology and investor behavior.

Technology

Structured products are today offered to investors on a tailor-made basis using platforms starting from a minimum investment of CHF 20,000 or even lower. An investor can construct and buy a tailor-made product without any delay. Comprehensive documentation of the investment is also generated automatically before the trade is confirmed. The pricing of the product is based on real-time data and products can be sold in the secondary market at any time with tight bid-ask spreads. To the authors' knowledge, there is no other banking unit that is able to generate a customized security for such a low investment amount using a fully automatized value chain.

The technological trends in the structured products industry are manifold. Some single-issuer platforms are transformed into multi-issuer platforms that give investors the opportunity to compare the offerings of different issuers; see, for example, the Vontobel deritrade platform. Other issuers offer the functionality needed for running a structured products business to smaller banks, which are not able to issue products on a stand-alone basis ("white labelling"; e.g., Leonteq). Other issuers are actually enlarging their offering such that investors can value an investment decision in the portfolio context. Finally, issuers are finding out to what extent "big data" can be used to refine investor's preferences and even to provide anticipatory offerings (i.e., investors' preferences are known ex ante from their activities in the virtual world, which makes questionnaires for determining investors' preferences redundant). These activities show that the Swiss structured products industry is not a mere follower of what today is called FinTech, but is itself active as a first mover. This makes

[5] ESMA Report (2014), Henderson and Pearson (2011), Jorgenson et al. (2011), and Szymanowska et al. (2009).

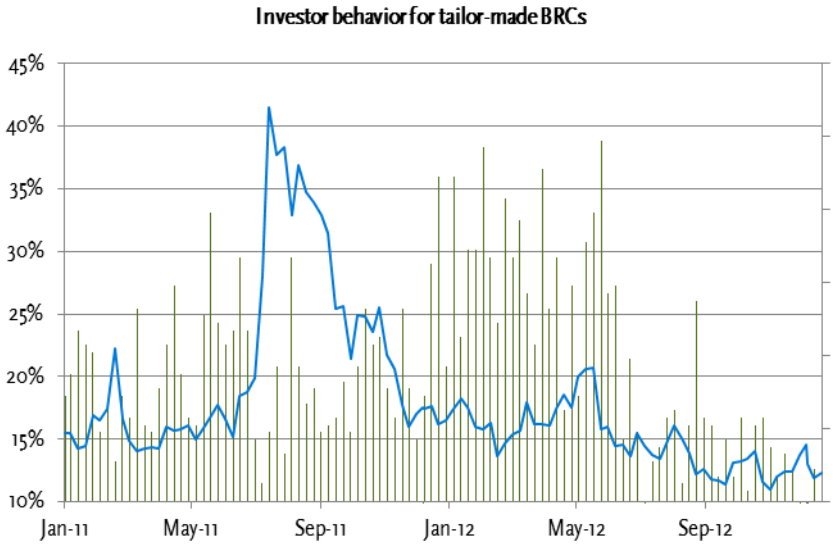
[6] Autocallables are structured products that offer an opportunity both for early redemption at a predefined cash amount and for coupon. Both opportunities are linked to the performance of the underlying.

structured products—from a technological perspective—fitter to face future challenges than many other banking functions.

Investor Behavior

Investors in Switzerland like to invest in BRCs on stocks. Investors in other countries have different preferences about the underlying value and the payoff. A study by Hens et al. (2014) proves that cultural background matters for the degree of risk aversion although these differences are diminishing due to globalization. Investments in such products occur more often when markets are calm than in periods in which markets are under stress. This is remarkable since analysis reveals that in Swiss structured products equity markets a period of falling share prices is paralleled by increasing volatility. But an investment in a BRC means that the investor, among others, sells a put option. If volatility is high this put option is worth more than it is in calm markets. Therefore, in turbulent markets the BRC investor receives a higher coupon and/or can choose a lower barrier for the same coupon than in normal markets. But Figure 12 shows that investors refrain from BRC investments when volatility is high. The volatility of SMI spiked in summer 2011 when the European debt crisis led to an increase in uncertainty about the future of the eurozone. The data for the figure were taken from a platform via which investors can create their own BRCs.

Figure 12: Number of transactions (bars) and SMI volatility (line) for the 1,900 investors who used a selected tailor-made structured-product platform. Since more than 90% of the underlyings were Swiss stocks, SMI volatility is a good proxy (ZKB).

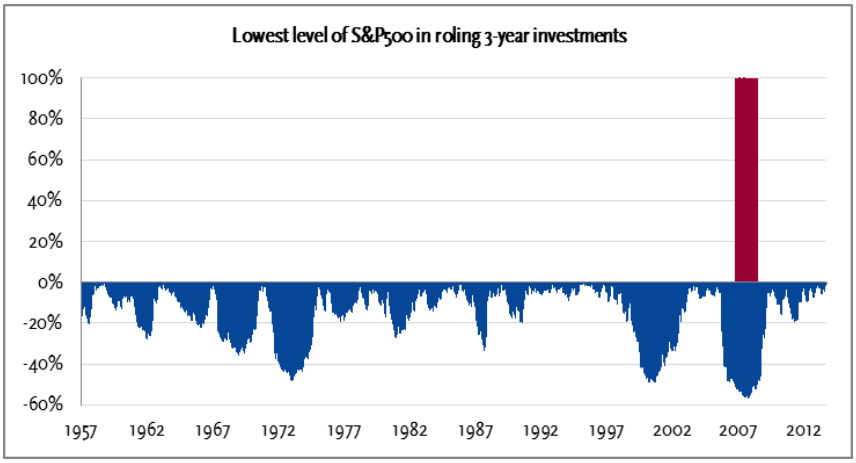


In periods of increasing volatility, many BRCs breached their barriers. As a result, many investors were disappointed but others simply accepted that the risk of breaching the barrier materialized. This leads us to consider two types of investors in BRCs: through-the-cycle investors and point-in-time investors. The first require an investment that should be *independent* of the stock market cycle. The second type of investor wants to exploit the current market opportunity; thus the investment *depends* on the stock

market cycle. For the latter, the interplay between the barrier (the risk level of the product) and the actual volatility in the market matters. Through-the-cycle investors by definition accept a lower return and lower risk compared to their point-in-time counterparts.

Is it possible to quantify the risk and return boundaries for BRCs on stocks for through-the-cycle investors—that is, to derive barrier levels that are independent of the stock market cycle? To answer this question, a three-year investment in the S&P 500, with a 50% barrier, starting in 1957, repeated 1958, and so on up to 2011—for the last time—will be considered. Figure 13 shows the lowest value of the index for each three-year investment (blue area). The red bar shows the period in which an investment in the BRC would have led to a breach of the barrier: this only happened during the most recent GFC. In all other investments in the 55-year period, a 50% barrier level would have led to capital protection.

Figure 13: Lowest value of the S&P 500 for annual 3y investments (S&P).

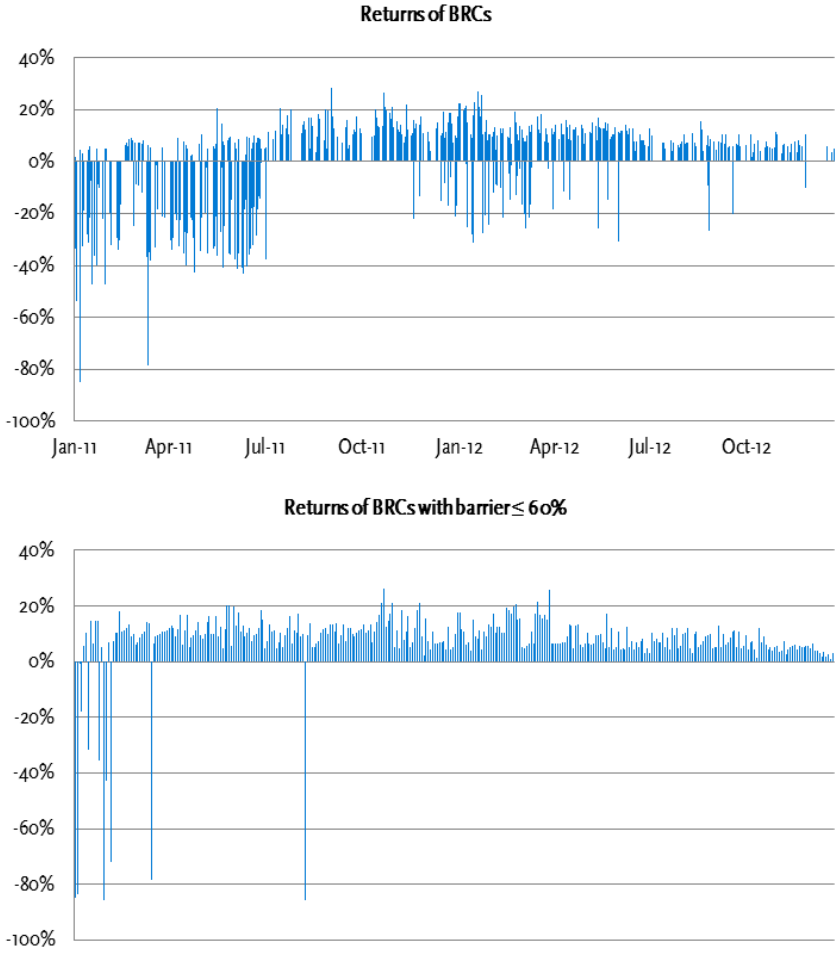


It is also evident from Figure 13 that a barrier level of, say, 80% or 70% cannot be considered to be appropriate for a through-the-cycle investor. The above findings will next be applied to a portfolio of 1,900 tailor-made products, using the fully automatized platform of a large Swiss issuer in the period January 2011 to March 2013. This period has been chosen as it covers a full stock market cycle: market turbulences in August 2011 due to the European debt crisis, followed by a stock market recovery. Figure 14 shows—in the left panel—the returns of all BRCs. One observes that there were many barrier hits in August 2011 and for products maturing shortly after this market turmoil there was not enough time to recover. Is this data set representative? The large number of barrier hits due to the market turmoil of August 2011 can also be observed in the following table (Derivative Partners AG) regarding all listed BRCs in the Swiss market (see Table 5). This shows that the choice of the data from the issuer can be seen as representative.

Table 5: Barrier events of active BRCs, 2008–2014 (Derivative Partners AG).

Year	Number of active BRCs	Number of active BRCs (less BRCs with barrier event in the previous year)	Number of barrier events	Percentage
2008	5,196	5,196	3,115	60%
2009	5,461	3,538	272	8%
2010	7,182	6,968	561	8%
2011	9,839	9,480	3,418	36%
2012	11,498	9,178	371	4%
2013	11,932	11,706	632	5%
2014	10,905	10,700	233	2%

Figure 14: Returns of tailor-made BRCs. On the horizontal axis the products are ordered in increasing order of their maturity date, starting in January 2011 and ending in March 2013 (fully automatized platform of a Swiss structured products issuer).



Note to the two previous figures. First figure: one observes a cluster of negative returns for products that were issued before August 2011. This is only possible if they breached their barrier in August 2011. Second figure with barriers below or at 60%: the cluster of negative returns due to the barrier hits in August 2011 vanishes if the barrier is not larger than 60%. The few large negative returns left were due to investments in the underlying values of firms that defaulted.

The average return of the products in the stock cycle was 2.2% and the proportion of products with a positive return was 77%. The second panel shows the same analysis but only for products with a barrier not higher than 60%. One observes that much fewer barrier hits follow. The average return of the portfolio jumps to 7.7% and the proportion of products with a positive return to maturity is 97.9%. There are only a few products with heavy losses left. These products cannot be related to the above discussion of through-the-cycle vs point-in-time investors, but can be to investors who have chosen an underlying value that defaults or that is close to default.

Investment Opportunities Driven by Events

While some events are isolated and affect only a single corporate, events at the political or market level often lead to more interesting investment opportunities for structured products. Policy interventions can trigger market reactions that in turn can lead to new policy interventions. The SNB decision, in January 2015, to remove the euro cap and to introduce negative interest rates had an effect on Swiss stock markets, EUR/CHF rates, and fixed income markets. Next, investment opportunities caused by political or market events—but not firm-specific events—will be discussed.

The BRC analysis in the last section showed that investors prefer to invest in times when markets are not under stress. This is remarkable since events create investment opportunities due to higher volatility. In addition, gaining an investment view and evaluating it personally is easier if an event has happened and markets are under stress than it is in normal times. Once an event has occurred, an investor no longer needs to guess whether any event could happen in the future that would affect the investment. However, an investor does have to consider the possibility that markets will return to the pre-event state or to a new state that will become the new normal, or if the changes in market values are just a beginning. Analyzing these possibilities is not a simple task, but it is simpler than the situation in normal markets, where the likelihood of the occurrence of events has to be considered. It should be stressed that a general requirement for investments based on events is fitness of all parties involved—investors, advisory, and the issuer. In order to benefit from such investments, the active involvement of all parties is necessary.

Political Events

SNB and ECB

The SNB announced, on 15 January 2015, the removal of the euro cap and the introduction of negative CHF short-term interest rates. This decision caused the SMI to lose about 15% of its value within 1–2 days, and the FX rate EUR/CHF dropped from 1.2 to near parity. Similar changes occurred for USD/CHF. Swiss stocks from export oriented companies or companies with a high cost base in Swiss francs were most affected. The drop in stock prices led to a sudden and large increase in Swiss stock market volatility. Swiss interest rates became negative for maturities of up to thirteen years.

It was also known at the time that the ECB would make public its stance on quantitative easing (QE) one week later. The market participants' consensus was that Mario Draghi—president of the ECB—would announce a QE program. The events in Switzerland—which came as a surprise—and the ECB QE measures subsequently announced paved the way for the following investment opportunities:

1. A CHF investor could invest in high quality or high dividend paying EUR shares at a discount of 15%. EUR shares were expected to rise due to the forthcoming ECB announcement.
2. All Swiss stocks, independent of their market capitalization, faced heavy losses independently of their exposure to the Swiss franc.
3. The increase in volatility made BRCs with very low barriers feasible.
4. The strengthening of the Swiss franc versus the US dollar, and the negative CHF interest rates, led to a USD/CHF FX swap opportunity that only qualified investors could benefit from.
5. The negative interest rates in CHF and rates of almost zero in the eurozone made investments in newly issued bonds very unattractive. Conversely, the low credit risk of corporates brought about by the ECB's decision offered opportunities to invest in the credit risk premia of large European corporates via structured products.

Before certain investment opportunities are discussed in more detail, it should be noted that by the time this paper was written (about five months after the events described above took place), all investments were profitable and some even had two-digit returns. This certainly does not mean that the investments were risk free, as such investments are not risk free. But it shows that many investment opportunities are created by policy interventions. This contrasts with the often voiced complaints about negative interest rates and the absence of investment opportunities for firms, pension funds, and even private investors. Some investment ideas will now be considered in more detail.

Opportunities to invest in high dividend paying EU stocks

The idea was to buy such stocks at a discount due to the gain in value of the Swiss franc against the euro. The first issuer of a TC offered such products on Monday, 19 January 2015—that is to say, two business days after the SNB's decision was announced. With all products, investors participated in the performance of a basket of European shares with a high dividend forecast. The baskets' constituents were selected following suggestions from the issuing banks' research units. Investors could choose between a structured product denominated in Swiss francs or in euros depending on their willingness to face—besides the market risk of the stock basket—also the EUR/CHF FX risk.

This investment had two main risk sources. If it was denominated in euros, the EUR/CHF risk held and one faced the market risk of the large European companies whose shares comprised the basket. Most investors classified the FX risk as acceptable since a significant further strengthening of the Swiss franc against the euro would meet with counter measures from the SNB. More specifically, a TC on a basket of fourteen European stocks was issued. The issuance price was fixed at EUR 98.75. As of 1 April 2015 the product was trading at EUR 111.10 (mid-price)—equivalent to a performance of 12.51% pro rata. Similar products were launched by all the large issuers.

Other issuers launched a TC on Swiss stocks, putting all large Swiss stocks in a basket that had only a little exposure to the Swiss franc, but which also faced a heavy price correction after the SNB decision

in January. Again, the input of each issuing bank's research unit in identifying these firms was key. The underlying investment idea for this product can be seen as a typical application of behavioral finance: an overreaction of market participants to events is expected to vanish over time.

The risk in this investment was twofold. First, one could not know with certainty whether the SNB would consider further measures, such as lowering interest rates further, which would have led to a second drop in the value of Swiss equity shares. Second, international investors with euros or US dollars as their reference currency could realize profits since the drop in Swiss share values—around 15%—was more than offset by the gain from the currency, which lost around 20% in "value"; roughly, an institutional investor could earn 5% by selling Swiss stocks. Since large investors exploit such opportunities rapidly, it became clear three days after the SNB's decision was announced that the avalanche of selling orders from international investors was over.

Low-barrier BRCs

Investors and private bankers searched for cash alternatives with a 100% capital guarantee. The negative CHF interest rates made this impossible: if 1 Swiss franc today is worth less than 1 Swiss franc will be worth tomorrow, one has to invest more than 100% today to get a 100% capital guarantee in the future.

Low-barrier BRCs—say with a barrier at 39%—could be issued with a coupon of 1%–2% depending on the issuer's credit worthiness and risk appetite for a maturity of 1 to 2 years. S&P500, Eurostoxx 50, SMI, NIKKEI 225, and other broadly diversified stock indices were used in combination as underlying values for the BRCs. The low fixed coupon of 1%–2% takes into account that the product is considered as a cash alternative with 0%, or even a negative, return.

Therefore, investors received, at maturity, the coupon payment—in any case—and also 100% of the investment back if no equity index lost more than 61% during the life-span of the product. If at least one index lost more than 61%, the investor received the worst performing index at maturity, together with the coupon. The risks of such an investment differ clearly from those of a deposit. For a deposit in Switzerland, there is a deposit guarantee of up to CHF 100,000. Furthermore, almost all banks in Switzerland did not charge their clients the negative interest rate costs. Hence, at present, a deposit is seen by many customers as "less risky", albeit also with zero performance before costs.

A low-barrier BRC, apart from issuer risk, has market risk. Can one estimate the probability that one of the indices in a basket will lose more than 61% in one year? One could simulate the basket and simply count the frequency of events leading to a breach. Such a simulation has the drawback that one needs to assume parameters for the indices. Another method would be to consider the historical lowest level of such a basket—that is to say, what was the maximum loss in the past if one invested in a low-barrier BRC? Using data going back to the initiation of the indices, no index lost—in one year—more than 60% (see also Figure 13). This was the rational to set the barrier at 39%. This is obviously not a guarantee that this statement will apply also in the future, but it helps investors to decide whether they accept the risk or not.

Although this discussion has concerned a BRC on equity, a similar discussion applies to such convertibles that have currencies and commodities as underlyings. Relevant political and market events in the recent past—and to which the above discussion also applies—occurred in October 2014

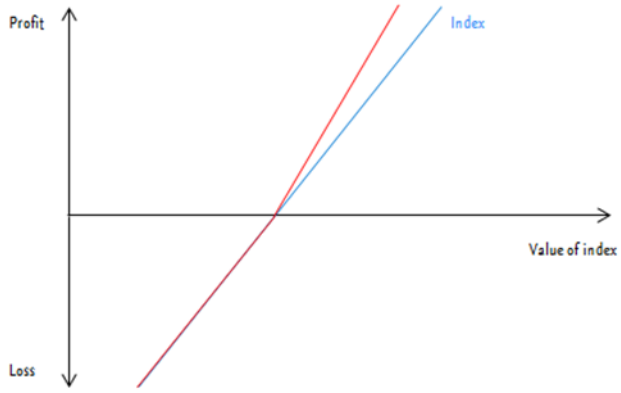
and, due to the European debt crisis, in August 2011. With regards to the former set of events, the pressure on equity markets was due to uncertainty regarding Russia and what would happen next in Ukraine; and on 15 October 2015 liquidity evaporated in treasury futures and prices skyrocketed—an event known as the "flash crash in the treasury market".

Japan: Abenomics

As expected, the Liberal Democratic Party of Japan gained a substantial parliamentary majority in the 2012 elections. The economic program introduced by the newly elected PM Shinzo Abe was built on three pillars: 1) fiscal stimulus, 2) monetary easing, and 3) structural reforms ("Abenomics"). Subsequently, the Yen (JPY) plunged versus its main trading currencies, providing a hefty stimulus to the Japanese export industry. The issuer of one product offered an outperformance structured product on the Nikkei 225 in quanto Australian dollars, meaning that the structured product in question is denominated in AUD and not in JPY, which would be the natural currency given the underlying Nikkei 225. This means that investors did not face JPY/AUD currency risk but if they were Swiss investors who think in Swiss francs, they still faced AUD/CHF risk. The acronym "quanto" means "quantity adjusting option".

Outperformance certificates enable investors to participate disproportionately in price advances in the underlying instrument if it trades higher than a specified threshold value. Below the threshold value the performance of the structured product is the same as the underlying value. How can investors invest in an index in such a way as to gain more when markets outperform a single market index investment, but still not lose more if the index drops? The issuer uses the anticipated dividends of the stocks in the index to buy call options. These options lead to the leveraged position on the upside (see Figure 15).

Figure 15: Payoff of an outperformance structured product.



The reason for using quanto AUD is the higher AUD interest rates compared to JPY interest rates. Higher interest rates lead to higher participation and the participation in the quanto product was 130%. The risk of the investment lay in whether Abenomics would work as expected; and possibly FX AUD/CHF. The economic program in Japan worked out well with redemption of 198% after two years.

This redemption contains a loss of 16.35% due to the weakness of the Australian dollar against the Swiss franc.

Market Events

The focus here will be on the credit risk of structured products. Although the examples are presented under the heading of market events, the status of the market in the most recent GFC and in 2014/2015 was the result of a complicated catenation of business activities, policy interventions, and market participants' reactions.

The discussion below shows that structured products with underlying "credit risk" offer, under specific circumstances, valuable investment opportunities to some investors. But the number of such products issued is much smaller than the number of equity products. One reason for this is that not all issuers are equally experienced or satisfy the requirements for issuing credit-risky structured products (necessary FI trading desk, balance sheet, and risk capital constraints). Another reason is the lack of acceptance of such products among investors, regulators, portfolio managers, and relationship managers, all of whom often do not have the same experience and know-how as they do regarding equity products.

Negative Credit Basis after the Most Recent GFC

Negative credit basis is a measurement of the difference in the same risk in different markets. The basis measures the difference in credit risk—measuring once in the derivatives markets and once fixed in the bond markets. Theoretically, one would expect that the credit risk of ABB has the same value independent of whether an ABB bond or a credit derivative defined on ABB's credit risk is being considered.

This is indeed true if markets are not under stress—at which point the credit basis is close to zero. But if liquidity is an issue, the basis becomes either negative or positive. In the most recent GFC, liquidity was a scarce resource. The basis became negative since investing in bonds required funding the notional while for credit derivatives only the option premium needs to be financed. For large corporates, the basis became strongly negative by up to -7%. The following table shows how the positive basis in May 2003 changed to a negative one in November 2008 (bps are basis points: 1 bps is 1% of 1%).

Table 6: Credit basis for a sample of corporates in 2003 and their negative basis in the most recent GFC.

Corporate	Credit basis in May 2003 (bps)	Credit basis in November 2008 (bps)
Merrill Lynch	47	-217
General Motors	-32	-504
IBM	22	-64
JPMorgan Chase	22	-150

To invest in a negative basis product, the issuer of a structured product locks in the negative basis for an investor by forming a portfolio of bonds and credit derivatives of those firms with a negative basis. For each day on which the negative basis exists a cash flow follows, which defines the participation of the investor. When the negative basis vanishes, the product is terminated. Example: Investing in the negative credit basis of General Motors (see Table 6) leads to a return, on an annual basis, of 5.04% if the basis remains constant for one year. If the product has a leverage of 3, the gross return is 15.12%. To obtain the net return, one has to deduct the financing costs of the leverage.

Structured products with this idea in mind were offered in spring 2009 to qualified investors. The products offered an annual fixed coupon of around 12% and participation in the negative basis. The high coupons were possible as some issuers leveraged investors' capital. This could only be offered by those few issuers in the most recent GFC that were cash rich; typically AAA-rated banks. The products paid one coupon and were then terminated after 14 months since the negative basis approached its normal value. The product value led to a performance of around 70% for a 14-month investment period. Was this formidable performance realized ex ante a free lunch—that is to say, a riskless investment? No. If the financial system had fallen apart, investors would have lost all the invested capital. But the investors basically only needed to answer the following question: Will the financial system and real economy return to normality? If yes, the investment was reduced to the AAA issuer risk of the structured product.

Many lessons can be drawn from these products. A very turbulent time for markets can offer extraordinary investment opportunities. The valuation of these opportunities by investors must follow different patterns than in times of normal markets: There is for example no history and no extensive back-testing, and hence an impossibility of calculating any risk and return figures. But there is a lot of uncertainty. Making an investment decision when uncertainty is the main market characteristic is an entirely different proposition to doing so when markets are normal and the usual risk machinery can be used to support decision-making with a range of forward-looking risk and return figures. If uncertainty matters, investors who are cold-blooded, courageous, or gamblers, and analytically strong, will invest, while others will prefer to keep their money in a safe haven.

Positive Credit Basis 2014

The monetary interventions of the ECB and other central banks led to excess liquidity, which was mirrored in a positive basis for several large firms. Monetary policy also implied low or even negative interest rates. This made investment in newly issued bonds unattractive. To summarize, investors

were searching for an alternative to their bond investments, but an alternative that was similar to a bond.

A credit linked note (CLN) is a structured product. Its payoff profile corresponds to a bond's payoff in many respects. A CLN pays—similarly to a bond—a regular coupon. The size of the coupon and the amount of the nominal value repaid at maturity both depend on the credit worthiness of a third party, the so-called reference entity (the issuer of the comparable bond). This is also similar to the situation for bonds. But the size of the CLN coupon derives from credit derivative markets. Hence, if the credit basis is positive, a larger CLN coupon follows, as compared to the bond coupon of the same reference entity. CLNs are typically more liquid than their corresponding bonds since credit derivative markets are liquid while many bonds, even from large corporates often suffer from illiquidity. CLNs are flexible in their design of interest payments, maturities, and currencies. CLNs also possess, compared to bonds, tax advantages; in fact, the return after tax for bonds that were bought at a price above 100% is—at present—often negative. The investor in a CLN faces two sources of credit risk: the reference entity risk as for bonds, and the issuer risk of the structured product. As an example, Glencore issued a new 1.25% bond with coupon in Swiss francs. Due to the positive basis, the coupon of the CLN was 1.70%. Another product with, as the reference entity, Arcelor Mittal in EUR implied a higher CLN effective yield compared to the bond of 1.02% in EUR.

Let us consider a more detailed example. Consider the reference entity Citigroup Inc. The bond in CHF matures in April 2021 and its price is 102.5 with a coupon of 2.75%. The bond spread is 57 bps, which leads to a yield to maturity of -0.18%—an investor should sell the bond. The CLN has a spread of 75 bps, which proves the positive basis and an issuance price of 100. The coupon of the CLN is—then—0.71%, which leads to a yield to maturity of 0.57% if funding is subtracted. Therefore, selling the bond and buying the CLN generates an additional return of 75 bps.

Conclusion

Measuring the performance of structured products, the investment opportunities and caveats, and, in particular, the costs investors have to bear, is not a straightforward task. Structured products differ substantially from each other in their payoff structures and risk profiles; and even within their various categories they are extremely heterogeneous. Any discussion of their pros and cons needs to consider this diversity.

This study empirically investigates structured products in the Swiss market with a special emphasis on barrier reverse convertibles, bonus certificates, capital protection certificates, and similar products, mostly with Swiss stocks as underlying assets. The results show that these products have a very low probability of generating a loss when markets are behaving in a normal fashion, that their performance can become negative when the underlyings are under pressure, and that their TERs, including distribution costs and net margins, are in the range of half to about one and a half percent.

What these figures do not show, however, is that these products appeal to investors for different reasons. They have very particular risk profiles, and they can cater for applications where solutions are needed: for investors who have strong opinions about maximum shortfalls and expectations about direction movements in the markets, for investment vehicles in the forefront or the wake of special economic events, and so on. This makes it difficult to benchmark these products and even to compare them to each other. Also, many of the traditional risk-adjusted performance measures are not useful when the magnitude and likelihood of downside risks differ so substantially from those of upside risks.

What these figures do show, however, is the increased attention these products have received, and there is no reason to assume that this will change in the near future. This emphasizes all the more that a careful analysis and understanding of the workings and potentials of structured products is necessary, and perhaps even points to a need for special indicators and evaluation methods.

References

DB X-Trackers, Deutsche Asset and Wealth Management, 2015.

Döhrer, B., Johanning, L., Steiner, N. and A. Völkle, Issuer Margins for Structured Products in Germany. Working Paper, 2013.

Hutter, B., Tolle, S. and P. Rüthemann, Strukturierte Produkte in der Vermögensverwaltung, NZZ Libro, 2006.

ESMA, Structured Products. Risk and Return for Retail Investors, Economic Report No. 1, Retailisation in the EU, European Securities and Markets Authority, Paris, 2014.

Henderson, B. and N. Pearson, The Dark Side of Financial Innovation. A Case Study of the Pricing of Retail Financial Products, Journal of Financial Economics, Vol. 100 (2), 227-247, 2011.

Investment Company Institute, Mutual Fund Expenses and Fees, 2014 Investment Company Fact Book, Chapter Five, 2014.

Jorgenson, P., Norholm, H. and D. Skovmand, Overpricing and Hidden Costs of Structured Bonds for Retail Investors, Evidence from the Danish Market for Principal Protected Notes, mimeo, 2011.

Meier, M. and D. Sandmeier, Die Welt der Strukturierten Produkte. Das Buch zur SVSP Swiss Derivative Map, 2012.

Rieger, M. O., Optionen, Derivate und strukturierte Produkte: Ein Praxisbuch, Schäffer-Poeschel, 2009.

Rieger, M. O., Wang, M. and T. Hens, Risk Preferences around the World, Management Science, 2014.

Syzmanowska, M., Horst, J.T. and C. Veld, Reverse Convertible Bonds Analyzed, Journal of Futures Markets, Vol. 29 (10), 895-919, 2009.

Swiss Finance Institute
Swiss Finance Institute (SFI) strives for excellence in research and doctoral training, knowledge transfer, and continuing education in the fields of banking and finance, as befits Switzerland's international reputation as a leading financial center. Created in 2006 as a public–private partnership, SFI is a common initiative of the Swiss finance industry, leading Swiss universities, and the Swiss Confederation.

SFI Knowledge Center
The SFI Knowledge Center promotes and supports dialogue, information flow, and collaboration between academia and the financial services industry. The center performs an active intermediary role in gathering and disseminating financial knowledge, helping find solutions to current problems, and identifying new trends in banking and finance.

SFI White Papers
The SFI Knowledge Center publishes White Papers that give new stimulus to relevant topics, raise knowledge standards, and contribute to ongoing discussions or initiate debate on matters of particular relevance to the Swiss financial services industry.

Swiss Finance Institute
Walchestrasse 9
8006 Zurich

KnowledgeCenter@sfi.ch

www.SwissFinanceInstitute.ch/whitepaper