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An Economic Analysis of Protect Certificates - An Option-Pricing Approach

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We introduce and describe a new financial product referred to as Protect Certificates and show that the payoff of a Protect Certificate can be duplicated by the combination of a zero coupon bond, call options on the underlying asset and put options on the underlying asset. We develop pricing models for several variations of Protect Certificates and show that issuers receive considerable profit at primary market issuance. We compare the issuers' profit from Protect Certificates to two other types of structured products, Outperformance Certificates and Bonus Certificates, and find that issuers earn statistically and economically higher profits from the issuance of Protect Certificates. We conclude that buyers highly value the capital protection offered by Protect Certificates, but tend to overpay for this protection.

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1. Introduction

As a result of financial innovation, the past decade has witnessed a substantial increase in both the size and scope of structured product markets. Most structured products are created by intermediaries (insurance companies, brokers, commercial banks, or investment banks) through various combinations of fixed income securities, equity securities, and/or derivative securities. The intermediary (issuer) will typically market the structured product to investors using a proprietary brand name. The sophistication of structured products is a concern for regulators (Ricks, 1988; Lyon, 2005; NASD, 2005; Simmons, 2006; Isakov, 2007), especially when issuers begin targeting less-sophisticated individual investors as primary customers (Laise, 2006; Maxey, 2006).

Constantly evolving, structured products come in many different forms. A precise categorization of all structured products is nearly impossible, but they can be broadly classified according to their targeted objective.[1] Typical objectives include higher income, capital protection, outperformance of a security or index, or some combination thereof. As there is rarely a "free lunch" in financial markets, investors are often required to sacrifice one objective for another. For example, a product known as Reverse Exchangeable Bonds is designed to provide investors higher income over the life of the security at the expense of capital protection of investor principal and dividends (Hernadez, Lee, & Liu, 2010). Investors relinquish dividends (income) in exchange for capital protection with equity-linked structured products such as Certificates Plus Reloaded (Hernandez, Tobler, & Liu, 2010) and Express Certificates (Hernandez, Tobler, & Brusa, 2010). Conversely, investors relinquish dividends (income) in exchange for leveraged upside performance when purchasing equity-linked structured products such as Bonus Certificates (Hernandez, Brusa, & Liu, 2008) or Outperformance Certificates (Hernandez, Lee, Liu, & Dai, 2011).

In this paper, we examine a unique and previously unstudied type of structured product which we refer to as "Protect Certificates" ("PC" hereafter), an equity-linked structured product issued by

[1] In fact, many bank websites categorize their structured products in groups such as "Bonus", "Outperformance", "Reverse Convertible", "Capital Protection", etc.

major banks in Europe.[2] For the buyer, the rate of return on the investment in PCs is contingent upon the performance of a pre-specified underlying equity security or index over a pre-specified period of time (known as term to maturity). If the price of the underlying asset goes up during the term to maturity, investors in PCs will receive a return equal to a pre-specified multiple (known as the participation rate[3]) times the return on the underlying asset at maturity. Upside returns on PCs may be limited (capped certificates) or unlimited (uncapped certificates). In calculating the return on the underlying asset, the certificate issuer considers only the change in the asset price; the cash dividends paid during the period are not included. In other words, investors in PCs do not receive cash dividends even though the underlying asset may pay dividends during the life of the contract.

As its name implies, investors are afforded downside protection with PCs, but with some limitations. Investors are guaranteed a minimum redemption amount at maturity, but only if the price of the underlying asset closes above below a predetermined level, referred to as the knock-in level, at maturity. [4, 5] If the price of the underlying asset is below the knock-in level at maturity, investors may be partially exposed ("Airbag" Certificates) or fully exposed ("Protect Outperformance" Certificates) to downside losses.

In comparison to other types of structured products, PCs are similar to both Bonus Certificates and Outperformance Certificates in many respects. For example, all three are equity-linked structured products where the value at maturity is determined by the value of the underlying asset, excluding dividends. With respect to upside potential, PCs are nearly identical to Bonus Certificates and Outperformance certificates, having a predetermined rate of participation and can either be capped or uncapped. The three differ, however, with respect to downside protection. Outperformance Certificates offer no downside protection. Both Bonus Certificates and PCs offer some downside protection in relation to a pre-determined knock-in level. Bonus Certificates provide a guaranteed minimum payout at maturity as long as the value of the underlying asset does not decline below the knock-in level *at any time* during the term to maturity. Thus, if the knock-in level is breached at any time during the term to maturity, investors in Bonus Certificates fully participate in any downside losses that exist at maturity. With PCs, however, investors are only required to participate in losses (partially or fully) if the value of the underlying asset is below the knock-in level *at maturity*. Based on these similarities and differences, if these three types of structured products had similar characteristics (underlying asset, participation rates, length of contract, etc.) we would expect Outperformance Certificates to sell for the lowest price and PCs to sell for the highest price, with Bonus Certificates somewhere in between.

The purpose of the paper is to provide an in-depth economic analysis of PCs and explore how the principles of financial engineering are used to create this specific type of structured product. We also develop pricing models for the certificates based on option pricing theory. Finally, we empirically examine PCs issued by European banks that are outstanding in August 2005 and investigate if issuers make a profit in the primary market. We also compare issuer profits for Protect Certificates to previously documented issuer profits for Outperformance Certificates and Bonus Certificates during the same time period.

The remainder of the paper is organized as follows. The design of Protect Certificates is introduced in Section 2. Pricing models for PCs are developed in Section 3. We discuss special

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[2] PCs are also known by the commercial names of "PartProtect TRACKER", "AIRBAG Notes", "Advanced Index Certificates", "Protect Participation Certificates", "Protect Outperformance Certificates", "Protector", "Power Pro Certificates", or "S²MART" and are issued by well-recognized European banks such as Bayerische Hypo- und Vereinsbank AG, Dresdner Bank AG, DZ Bank AG, Goldman Sachs, ING Bank NV, UBS Investment AG, Westdeutsche Landesbank, J.P. Morgan International Derivatives Ltd., Merrill Lynch (now a division of Bank of America), Societe Generale and ABN Amro NV (now part of Royal Bank of Scotland)

[3] The *participation rate* is sometimes greater than *100%* -- that is why Protect Certificates are sometimes termed as "*Outperformance*" Certificates.

[4] The guaranteed minimum redemption amount may be the same as or higher than the par amount of the certificates.

[5] Usually the knock-in level is set up as a percentage of the *initial price* (e.g. 75% of the initial price). A certificate with a knock-in level of, for example, 75% of the initial price, is also referred to as having a 25% *downside protection*.

variations of Protect Certificates in Section 4. In Section 5, we describe the PC market and calculate the profits to issuers in the primary market based on our pricing models developed in Section 3. Section 6 concludes.

2. Design of Protect Certificates

The rate of return of a PC is contingent upon the price performance of its underlying asset over its term to maturity. The beginning date for calculating the gain (or loss) of the underlying asset is known as the *fixing date* (or pricing date) and the ending date of the period is known as the *expiration date*. The price of the underlying asset on the fixing date is referred to as the *reference price* (or exercise price, or strike price), and the price of the underlying asset on the expiration date is referred to as the *valuation price*. In the sample to be analyzed in Section 4, the exercise price and the valuation price are the closing prices on the fixing date and the expiration date respectively. With respect to the upside potential of PCs, they can be either capped or uncapped. We describe the characteristics of each type in the following sections.

2.A. Uncapped Certificates

If we denote I_0 as the underlying asset price on the fixing date, $I_{KI} = I_0 k$ as the *knock-in level*, and I_T as the valuation price, then for an initial investment of \$1 in an uncapped certificate, the total value that an investor will receive on the expiration date (known as the *redemption value* or settlement amount), V_T, is equal to:

$$V_T = \begin{cases} \$1 + p\dfrac{I_T - I_0}{I_0} & \text{if } I_T > I_0 \\ \$1 & \text{if } I_0 k < I_T \le I_0 \\ \$1 - \dfrac{1}{k}\dfrac{I_0 k - I_T}{I_0}\mathrm{I}_A(x) + \dfrac{I_T - I_0}{I_0}\mathrm{I}_{PO}(x) & \text{if } I_T \le I_0 k \end{cases} \tag{1}$$

The $\mathrm{I}_A(x)$ and $\mathrm{I}_B(x)$ in Equation (1) are indicator functions defined as

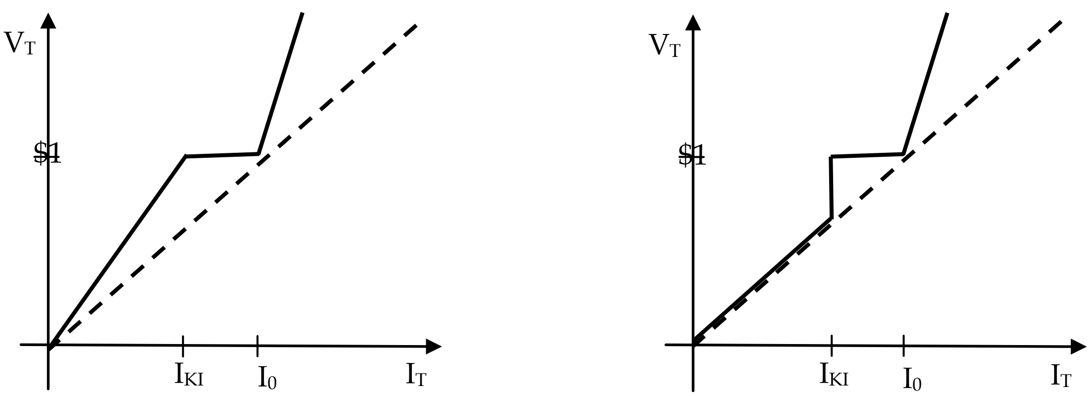
$$\mathrm{I}_A(x) = \begin{cases} 1 & \text{if the certificate is Airbag Certificate} \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

$$\mathrm{I}_{PO}(x) = \begin{cases} 1 & \text{if the certificate is Protect Outperformance Certificate} \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

Alternatively, the relationship between the terminal value of an uncapped PC and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) can be represented in Figure I. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying asset. The dotted line represents the terminal value of the underlying asset.

The slope for the value of the underlying asset in Figure I is, of course, one. The slope for the value of the certificate, when the price of the underlying asset goes up, is equal to the participation rate, p. The slope for the value of the certificate, when the price of the underlying asset goes down below the knock-in level, is equal to the ratio *1/k* for Airbag Certificates and is equal to one for Protect Outperformance Certificates.

Figure I
The terminal value of an uncapped Protect Certificate



Airbag *Protect Outperformance*

2.B. Capped Certificates

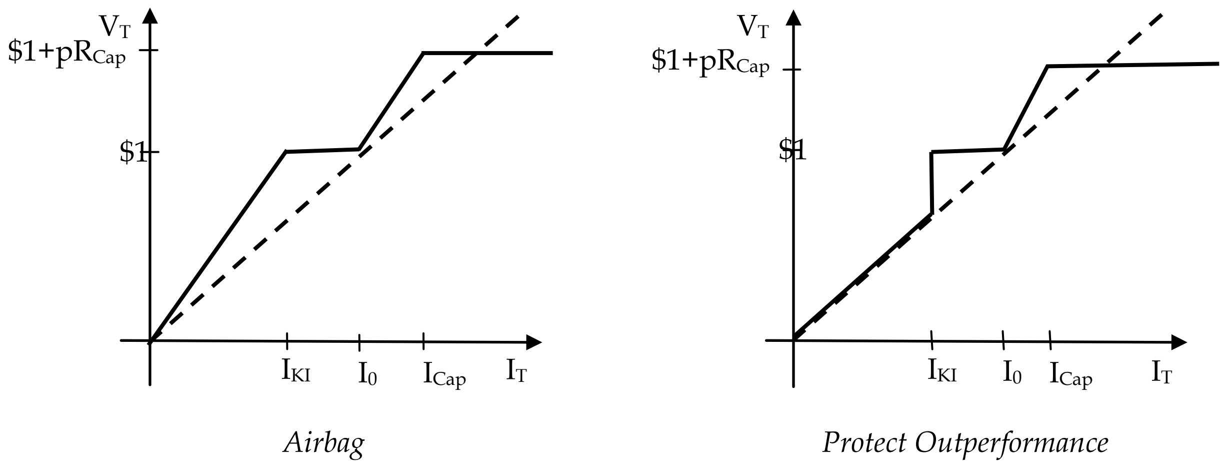
If we denote $I_{Cap} = I_0 h$ as the cap level and $\$1 + p\left(I_{Cap} - I_0\right)/I_0 = \$1 + pR_{Cap}$ as the maximum redemption amount, then the redemption value, V_T, for a capped PC on the expiration date is equal to:

$$V_T = \begin{cases} \$1 + p\left(\dfrac{I_0 h - I_0}{I_0}\right) & \text{if } I_T > I_0 h \\ \$1 + p\left(\dfrac{I_T - I_0}{I_0}\right) & \text{if } I_0 < I_T \leq I_0 h \\ \$1 & \text{if } I_0 k < I_T \leq I_0 \\ \$1 - \dfrac{I_0}{I_0 k}\dfrac{I_0 k - I_T}{I_0}\,\mathrm{I}_A(x) + \dfrac{I_T - I_0}{I_0}\,\mathrm{I}_{PO}(x) & \text{if } I_T \leq I_0 k \end{cases} \tag{4}$$

Similarly, the relationship between the terminal value of a capped PC and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) can be represented in Figure II. The solid line represents the terminal value of the PC on maturity day T, as a function of the terminal value of the underlying asset. The dotted line represents the terminal value of the underlying asset.

In Appendices 1 through 6, we present summary information for six examples of Protect Certificates: one uncapped Airbag Certificate, one capped Airbag Certificate, one uncapped Protect Outperformance Certificate, and three special cases of Protect Certificates, respectively.

Figure II
The terminal value of a capped Protect Certificate



3. The Pricing of Protect Certificates

3.A. Airbag Certificates

3.A.1. Uncapped Airbag Certificates

The *redemption value*, V_T, for an initial investment in one uncapped Airbag Certificate with a *strike price* of I_0, a *performance factor* of *p*, a *knock-in level* of $I_{KI} = I_0 k$, and a *term to maturity* T, is exactly the same as the payoff for holding the following three positions:

1. A long position in one zero coupon bond with face value equal to $1 and maturity date same as the maturity date of the Protect Certificate;
2. A long position in call options with exercise price of I_0, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $\frac{p}{I_0}$;
3. A short position in put options with exercise price of $I_0 k$, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $\frac{1}{I_0 k}$.

Since the payoff of uncapped Airbag certificates is the same as the combined payoffs of the above three positions, we can calculate the fair value of the certificates based on the value of the three positions. Any selling price of the certificates above the value of the above three positions is the gain to the certificate issuer.

The value of Position 1 is the price of a zero coupon bond with a face value $1 and maturity date T. So it has a value of $\$1e^{-rT}$. The value of Position 2 is the value of p/I_0 shares of call options with each option having the value C_1 (Black and Scholes, 1973):

$$C_1 = I_0 e^{-qT} N(d_1) - X e^{-rT} N(d_2) \quad (5)$$

Where r is the risk-free rate of interest, q is the dividend yield of the underlying assets, T is the term to maturity of the certificate, $X(\equiv I_0)$ is the exercise price and

$$d_1 = \frac{\ln\left(\frac{I_0}{X}\right) + \left(r - q + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}} \tag{6}$$

$$d_2 = d_1 - \sigma\sqrt{T} \tag{7}$$

Where σ is the standard deviation of the underlying asset return. The value of Position 3 is the value of $1/I_0k$ shares of put options with each option having the value P_1 (Black and Scholes, 1973):

$$P_1 = Xe^{-rT}N(\text{-}d_2) - I_0 e^{-qT}N(\text{-}d_1) \tag{8}$$

Where r is the risk-free rate of interest, q is the dividend yield of the underlying asset, T is the term to maturity of the certificate, X ($\equiv I_{KI} \equiv I_0k$) is the exercise price, and d_1 and d_2 can be calculated using Equation (6) and (7) respectively. Therefore, the total cost, TC, for each uncapped Airbag Certificate based on the fair value of the three positions is

$$TC_{uA} = \$1e^{-rT} + \frac{p}{I_0}C_1 - \frac{1}{I_0k}P_1 \tag{9}$$

3.A.2. Capped Airbag Certificates

In order to replicate the payoff of a capped Airbag Certificate we need to add an additional position to the replicating portfolio of an uncapped Airbag Certificate:

4. A short position in $\frac{p}{I_0}$ call options on the underlying asset with an exercise price of I_0 and the term to expiration of T.

The value of Position 4 is the price of p/I_0 shares of call options with exercise price of I_0h, term to expiration of T with each option having the value C_2 based on Equation (5), (6), (7). Therefore, the total cost, TC, for each capped Airbag Certificate is

$$TC_{cA} = \$1e^{-rT} + \frac{p}{I_0}C_1 - \frac{1}{I_0k}P_1 - \frac{p}{I_0}C_2 \tag{10}$$

We can also present the cost of one capped Airbag Certificate per unit of underlying asset as

$$TC_{cA} = I_0e^{-rT} + pC_1 - \frac{1}{k}P_1 - pC_2 \tag{11}$$

We can also generalize the equation to include those cases when the minimum redemption amount is more or less that 100% of the principal. If we denote $I_0^* = I_0 \ 1 + \alpha$, then the total cost, TC, for each capped Airbag Certificate is

$$TC_{cA} = I_0^*e^{-rT} + pC_1^* - \frac{1}{k}P_1^* - pC_2^* \tag{12}$$

Where the *strike price* of the certificate and the call option C_1^* is now I_0^* instead of I_0. The strike price of the put options P_1^* and call options C_2^* are $I_{KI}^* = I_0^* k$ and $I_{Cap}^* = I_0^* h$ respectively.

3.B. Protect Outperformance Certificates

3.B.1. Uncapped Protect Outperformance Certificates

The *redemption value*, V_T, for an initial investment in one uncapped Airbag Certificate with a *strike price* of I_0, a *performance factor* of *p*, a *knock-in level* of $I_{KI} = I_0 k$, and a *term to maturity* T, is exactly the same as the payoff for holding the following four positions:

1. A long position in one zero coupon bond with face value equal to $1 and maturity date same as the maturity date of the Protect Certificate;
2. A long position in call options with exercise price of I_0, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $\frac{p}{I_0}$;
3. A short position in cash-or-nothing put options with exercise price of $I_0 k$, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $1-k$.
4. A short position in put options with exercise price of $I_0 k$, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $\frac{1}{I_0}$.

Since the payoff of uncapped Airbag certificate is the same as the combined payoffs of the above four positions, we can calculate the fair value of the certificates based on the value of the four positions. Any selling price of the certificates above the value of the above three positions is the gain to the certificate issuer.

The value of Position 1 is the price of a zero coupon bond with a face value $1 and maturity date T. So it has a value of $\$1e^{-rT}$. The value of Position 2 is the value of p/I_0 shares of call options with each option having the value C_1 based on Equation (5), (6), (7). The value of Position 3 is the value of *(1-k)* shares of cash-or-nothing put options with exercise price of $I_0 k$ with each option having the value P_2 (Reiner and Rubinstein, 1991):

$$P_2 = I_0 \ k \ e^{-rT} N(-d) \tag{13}$$

Where

$$d = \frac{\ln\left(\frac{1}{k}\right) + \left(r - q + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}} \tag{14}$$

The value of Position 4 is the value of $1/I_0$ shares of put options with each option having the value P_1 based on Equation (8). Therefore, the total cost, TC, for each uncapped Protect Outperformance Certificate is

$$TC_{uB} = \$1e^{-rT} + \frac{p}{I_0} C_1 - \ 1-k \ P_2 - \frac{1}{I_0} P_1 \tag{15}$$

We can also present the cost of one uncapped Protect Outperformance Certificate per unit of underlying asset as

$$TC_{cB} = I_0 e^{-rT} + pC_1 - \ I_0 - I_{KI} \ P_2 - P_1 - pC_2 \tag{16}$$

We can also generalize the equation to include those cases when the minimum redemption is more or less that 100% of the principal. If we denote $I_0^* = I_0 (1+\alpha)$, then the total cost, TC, for each uncapped Protect Outperformance Certificate is

$$TC_{cB} = I_0^* e^{-rT} + pC_1^* - (I_0^* - I_{KI})(P_2^* - P_1^*) - pC_2^* \tag{17}$$

Where now the *strike price* of the certificate and the call option, C_1^*, is I_0^* instead of I_0, the *strike price* of the put options P_1^* and P_2^* is $I_{KI}^* = I_0^* k$, and *strike price* for the call options C_2^* is $I_{Cap}^* = I_0^* h$.

3.B.2. Capped Protect Outperformance Certificates

In order to replicate the payoff of a capped Protect Outperformance Certificate we need to add an additional position to the replicating portfolio of an uncapped Protect Outperformance Certificate:

5. A short position in $\frac{p}{I_0}$ call options on the underlying asset with an exercise price of I_0 and the term to expiration of T.

The value of Position 5 is the price of p/I_0 shares of call options with exercise price of $I_0 h$, term to expiration of T with each option having the value C_2 based on Equation (5), (6), (7). Since the payoff of a capped certificate is the same as the combined payoffs of the five positions, we can calculate the fair value of the certificate based on the value of the five positions. Therefore, the total cost, TC, for each capped Protect Outperformance Certificate is

$$TC_{cB} = \$1e^{-rT} + \frac{p}{I_0} C_1 - (1-k)\left(P_2 - \frac{1}{I_0} P_1\right) - \frac{p}{I_0} C_2 \tag{18}$$

3.C. Impact of Parameter Change on Payoff Value

Figure III illustrates the impact of changes in different parameters on the final payoff value of the PCs. Panels A through D consider the impact of changes in the participation rate (p %), minimum redemption amounts (α %), knock-in levels (k %), and cap levels (h %), respectively.

Figure III
The Effect of Different Parameters in The Protect Certificate's Payoff
Panel A: Different participation rates (p %)

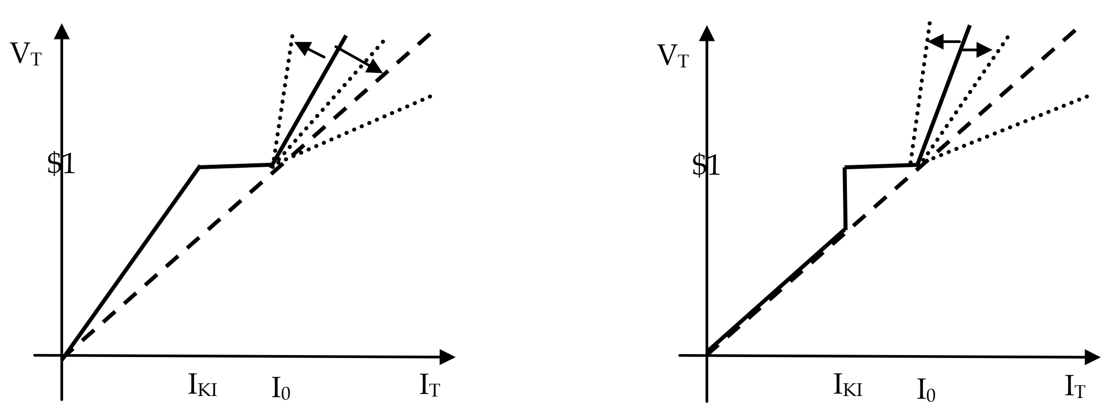


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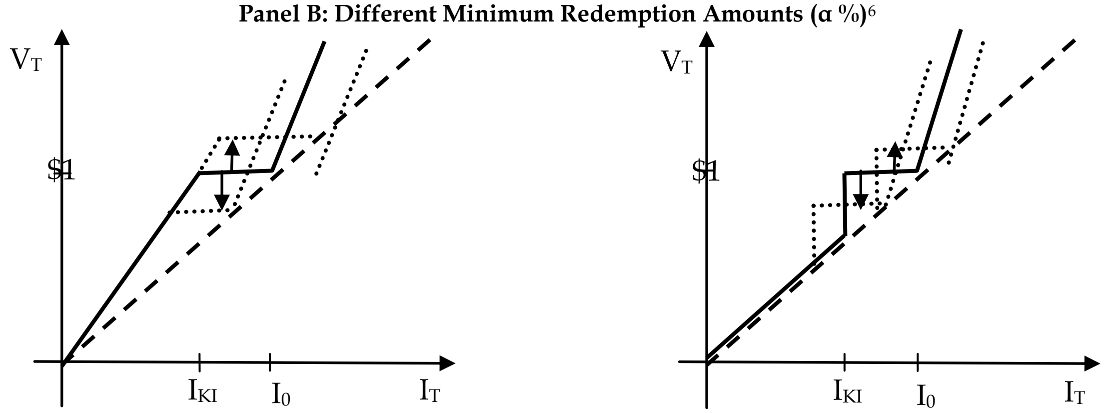
Figure III – (continued)

Panel B: Different Minimum Redemption Amounts (α %)[6]



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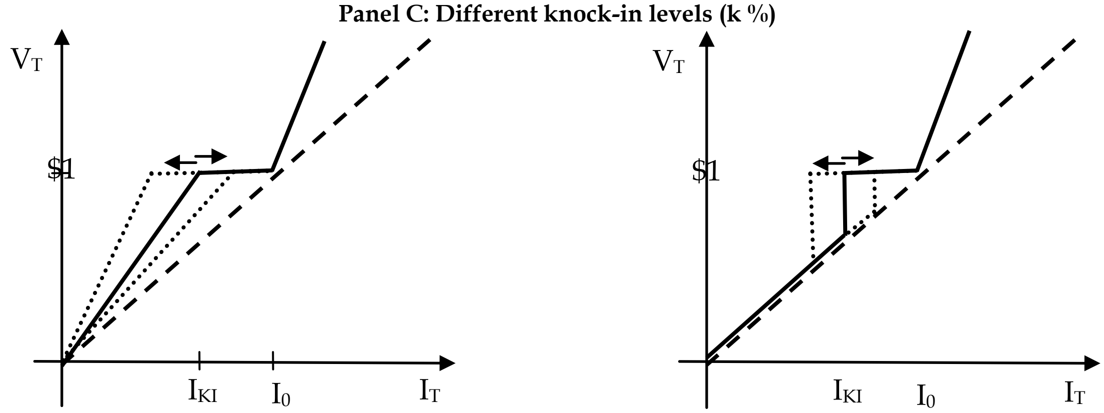
Panel C: Different knock-in levels (k %)



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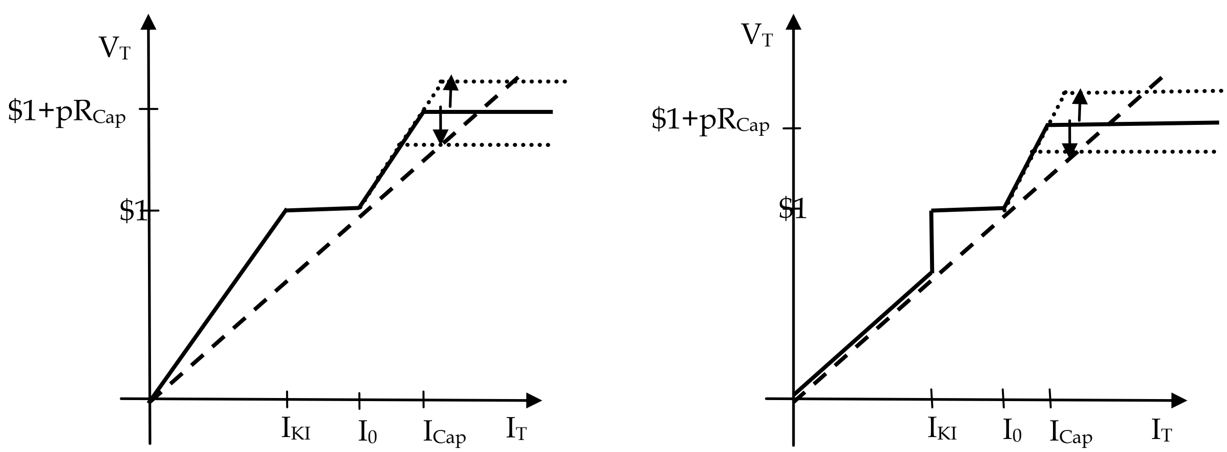
Panel D: Different cap levels (h %)



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[6] The knock-in level is kept constant as a percentage of the minimum redemption amount, I_0^*.

4. Other Special Cases of Protect Certificates

4.A. Merrill Lynch STRYPES

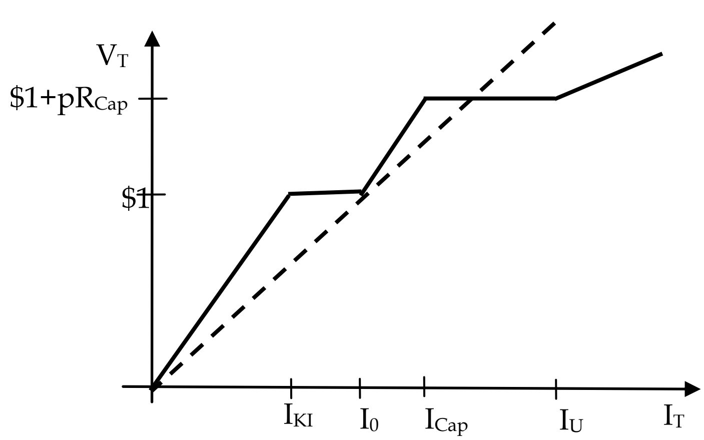
During 1998 and 1999 Merrill Lynch & Co., Inc. issued a structured product known as Structured Yield Product Exchangeable for Stock (*STRYPES*). Appendix 4 is an example of one *STRYPES*, the "7 7/8% Structured Yield Product Exchangeable for Stock due in February 1, 2001 payable with share of common stock of CIBER, Inc. or cash with an equivalent value." The payoff of this security on the maturity date is similar to the payoff of a capped Airbag Certificate but above a certain value of the underlying asset price the cap is removed.

If we denote $I_{Cap} = I_0 h$ as the cap level in a similar way as in the capped Airbag Certificates and Protect Outperformance Certificates, $I_U = I_0 u$ as the level of the underlying asset at which the investor on the certificate starts to participate again on the gains of the underlying asset gains, then the redemption value, V_T, for a *STRYPES* certificate on the expiration date is equal to:

$$V_T = \begin{cases} \$1 + \left(\dfrac{I_0 h - I_0}{I_0}\right) + \dfrac{u}{h}\left(\dfrac{I_T - I_0 u}{I_0 u}\right) & if\ I_T > I_0 u \\ \$1 + \left(\dfrac{I_0 h - I_0}{I_0}\right) & if\ I_0 h < I_T \le I_0 u \\ \$1 + \left(\dfrac{I_T - I_0}{I_0}\right) & if\ I_0 < I_T \le I_0 h \\ \$1 & if\ I_0 k < I_T \le I_0 \\ \$1 - \left(\dfrac{I_0 k - I_T}{I_0}\right)\dfrac{I_0}{I_0 k} & if\ I_T \le I_0 k \end{cases} \tag{19}$$

Similarly, the relationship between the terminal value of a *STRYPES* and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) can be represented in Figure IV. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying index. The dotted line represents the terminal value of the underlying index.

Figure IV
The terminal value of a STRYPES



The terminal value from Equation (19), V_T, for an initial investment of $1in one STRYPES can be expressed mathematically as:

$$V_T = \$1 + \frac{1}{I_0} Max\ I_T - I_0;0\ - \frac{1}{I_0 k} Max\ I_0 k - I_T;0\ - \frac{1}{I_0} Max\ I_T - I_0 h;0 + \frac{1}{I_0 h} Max\ I_T - I_0 u;0 \quad (20)$$

The first four positions are exactly the same as the ones needed to replicate the payoff of a capped Airbag Certificate. The $Max\ I_T - I_0 u;0$ in Equation (20) is the payoff for a long position in a call option with exercise price $I_0 u$. Consequently, the total cost of one *STRYPES* is the same as the total cost of one capped Airbag Certificate plus the fifth position, a long position in call options with exercise price of $I_0 u$, term to expiration of T (which is the term to maturity of the Protect Certificate), and number of options of $\frac{1}{I_0 h}$ and each option having the value C_3 based on Equation (5), (6), (7) and the present value of the coupons paid by the STRYPES.

$$TC_{STRYPES} = TC_{cA} + \frac{1}{I_0 h} C_3 + \sum_i^n Ce^{-r\ t_i} \quad (21)$$

4.B. UBS Partial Principal Protected Notes

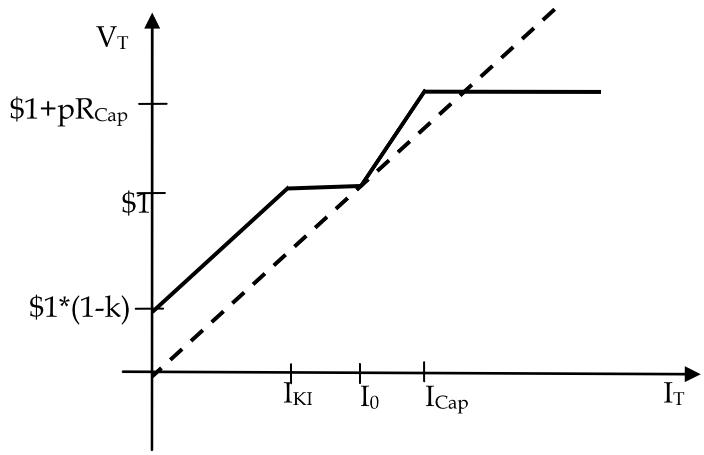
In early 2003 UBS started issuing a structured product known as Partial Principal Protected Notes (to be referred to as PPPN henceforth). Appendix 5 is an example of one PPPN, the "UBS $16,000,000 Notes Linked to the S&P 500® Index Due February 28, 2008". The payoff of this security on maturity date is similar to the payoff of the capped Airbag Certificates but the maximum loss is capped. The maximum loss is equal in percentage to the knock-in level.

If we denote $1*(1-k) as the minimum redemption amount, then the redemption value, V_T, for a certificate on the expiration date is equal to:

$$V_T = \begin{cases} \$1 + p\left(\frac{I_0 h - I_0}{I_0}\right) & if\ I_T > I_0 h \\ \$1 + p\left(\frac{I_T - I_0}{I_0}\right) & if\ I_0 < I_T \le I_0 h \\ \$1 & if\ I_0 k < I_T \le I_0 \\ \$1 - \left(\frac{I_0 k - I_T}{I_0}\right) & if\ I_T \le I_0 k \end{cases} \quad (22)$$

Similarly, the relationship between the terminal value of a PPPN and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) can be represented in Figure V. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying index. The dotted line represents the terminal value of the underlying index.

Figure V
The terminal value of a Partial Principal Protected Note



The terminal value from Equation (22), V_T, for an initial investment of $1in one PPPN can be expressed mathematically as:

$$TC_{\text{PPPN}} = \$1e^{-rT} + \frac{p}{I_0}C_1 - \frac{1}{I_0}P_1 - \frac{p}{I_0}C_2 \tag{23}$$

The portfolio of four positions as indicated in Equation (23) has a payoff similar to the payoff of a PPPN certificate. Equation (23) is similar to Equation (10) with the only difference that the short position in put options with exercise price of $I_0 k$, term to expiration of T (which is the term to maturity of the Protect Certificate), has a number of options of $\frac{1}{I_0}$ instead of $\frac{1}{I_0 k}$.

4.C. ABN AMRO Airbag Accelerator Certificates

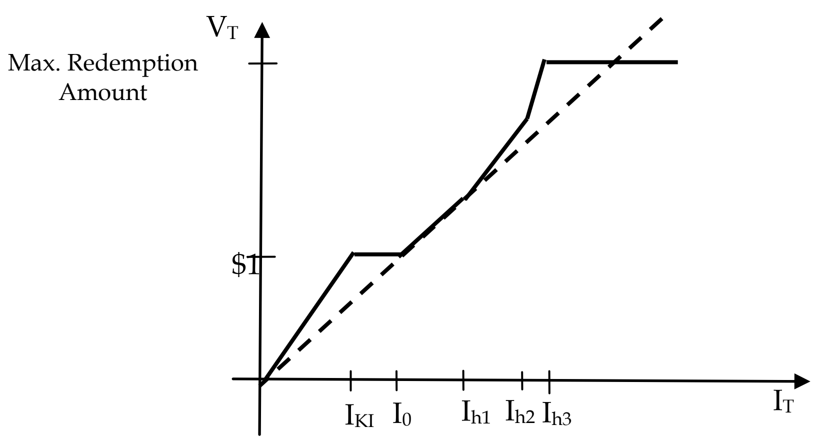
In October 2, 2003 ABN-AMRO Bank NV started issuing a structured product known as Airbag Accelerator (to be referred to as AAC henceforth). Appendix 6 is an example of one Airbag Accelerator, the "AEX-index® Airbag Accelerator Certificate IV". If we denote I_{h1} as $I_0 h_1$, I_{h2} as $I_0 h_2$, and I_{h3} as $I_0 h_3$, then the redemption value, V_T, for a certificate on the expiration date is equal to:

$$V_T = \begin{cases} \$1 + \left(\frac{I_0 h_3 - I_0}{I_0}\right) + p\left[\left(\frac{I_0 h_3 - I_0 h_1}{I_0}\right) + \left(\frac{I_0 h_3 - I_0 h_2}{I_0}\right)\right] & if\ I_T > I_0 h_3 \\ \$1 + \left(\frac{I_T - I_0}{I_0}\right) + p\left[\left(\frac{I_T - I_0 h_1}{I_0}\right) + \left(\frac{I_T - I_0 h_2}{I_0}\right)\right] & if\ I_0 h_2 < I_T \le I_0 h_3 \\ \$1 + \left(\frac{I_T - I_0}{I_0}\right) + p\left(\frac{I_T - I_0 h_1}{I_0}\right) & if\ I_0 h_1 < I_T \le I_0 h_2 \end{cases}$$

$$V_T = \begin{cases} \textbf{continued} & \\ \$1 + \left(\dfrac{I_T - I_0}{I_0}\right) & if\ I_0 < I_T \le I_0 h_1 \\ \$1 & if\ I_0 k < I_T \le I_0 \\ \$1 - \dfrac{I_0}{I_0 k}\dfrac{I_0 k - I_T}{I_0} & if\ I_T \le I_0 k \end{cases} \tag{24}$$

Similarly, the relationship between the terminal value of an AAC and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) can be represented in Figure VI. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying index. The dotted line represents the terminal value of the underlying index.

Figure VI
The terminal value of an Airbag Accelerator Certificate



The terminal value from Equation (24), V_T, for an initial investment of \$1 in one AAC can be expressed mathematically as:

$$TC_{AAC} = \$1e^{-rT} + \left[\frac{1}{I_0}C_1 + \frac{p}{I_0}C_2 + \frac{p}{I_0}C_3\right] - \frac{1}{I_0 k}P_1 - \frac{2}{I_0}C_4 \tag{25}$$

Where C_1 is a call option with exercise price of I_0, C_2 is a call option with exercise price of I_{h1}, C_3 is a call option with exercise price of I_{h2}, P_1 is a put option with exercise price of $I_0 k$, and C_4 is a call option with exercise price of I_{h3}. All the options have term to expiration T which is the term to maturity of the AAC. The portfolio of six positions as indicated in Equation (25) has a payoff similar to the payoff of an AAC. Equation (25) is similar to Equation (10) with the difference that the single long position in call options, C_1, in Equation (10) is replaced by three different long positions in call options, C_1, C_2, and C_3, in Equation (25) (in brackets).

5. Data Description and Empirical Results

5.A. Data

Our sample consists of all PCs outstanding in August 2005 issued between January 1998 and August 2005. We developed our sample from final term sheets published on web pages of each bank (the banks' websites are available from the authors upon request). In Table 1 we present the descriptive statistics for both the Airbag Certificates and Protect Outperformance Certificates samples. We also present data for the three special cases of protect certificates described in the previous section.

Table 1
Descriptive statistics for the Protect Certificates samples

Type	N	Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity (Years)	Knock-In Level (%) [a]	Cap Level (%) [a]	Max. Return (%)	Issue Price (%) [a]
Airbag								
Uncapped	49	1,744	36	4.12	77.86	-	-	101.01
Capped	13	513	39	3.08	78.85	168.21	72.46	100.44
Total	62	2,257	36	3.90	78.06	168.21	72.46	100.89
Protect Outperformance								
Uncapped	1	20	20	3.52	80.00	-	-	101.50
Capped	-	-	-	-	-	-	-	-
Total	1	20	20	3.52	80.00	-	-	101.50
Special Cases								
STRYPES	1	58	58	3.00	95.00	-	-	99.31
PPPN	14	156	11	5.16	77.90	185.00	85.00	100.00
AAC	3	125	42	3.01	78.33	128.00	42.00	102.00
Total	18	339	19	4.68	78.89	150.80	59.20	100.30

[a] as a percentage of the reference price

5.B. The Protect Certificates Market

In Table 1 we present descriptive statistics for the sample. For Airbag Certificates, the average size is € 36 million, term to maturity is 3.90 years, and knock-in level is 78.06% of the reference price. The total value issued is €2.26 billion on 62 issues.

For Protect Outperformance Certificates, there is only one issue of € 20 million, term to maturity of 3.52 years, knock-in level of 80%, and it was sold at 101.5% of the reference price.

The sample of special cases has an average size of € 19 million, term to maturity 4.68 year, with a knock-in level of 78.89% of the reference price. The total value of the sample of special cases is about € 339 million on 18 issues.

5.C. Issuer Profitability

In this section, we examine the profitability of issuing Protect Certificates. In order to calculate the profit, we need the following data for each certificate: 1) the certificate issue price (P), 2) the price of the underlying asset (I_0), 3) the cash dividends[7] of the underlying assets and the ex-dividend

[7] Note that the underlying asset may pay discrete dividends during the life of certificates. The present value of these discrete dividends PV_D is equal to $\sum_{i=1}^{n} D_i e^{-rt_i}$, where D_i is paid at *i*-th ex-dividend date t_i. These discrete dividends play an important role in measuring the profit for issuing the certificates and should be properly dealt with. We follow the methodology of Roll (1977) that suggests that the stock price is divided into two parts: the net-of-dividend stock price (i.e., $I_0 - PV_D$) and PV_D. The former part is assumed to follow a lognormal diffusion process, whereas the latter part is assumed

dates so we can calculate the dividend yield, q, 4) the risk-free rate of interest, r, 5) the exercise prices (X) and the barrier levels (H) of the option components in the certificates, 6) the volatility (σ) of the underlying asset, and 7) the term of maturity of the certificates (which is also the term to expiration of the options included in the certificate), T.

The certificate prices, P, are obtained from the final term sheets published on the web pages of issuing banks. We double check the prices and other variables in the Bloomberg Information System and several websites to ensure the accuracy of the data. [8] The prices of underlying assets are obtained from the Bloomberg System; dividend data are taken from IBES on the Bloomberg; the risk-free rates of interest are the yields of government bonds of similar maturities as those of the certificates.[9] The exercise prices (X), the cap levels (I_C), and the barrier levels (H) of the options and the terms to maturity of the certificates (T) are all taken from the final term sheets. The volatilities (σ) of the underlying assets are the implied volatilities obtained from the Bloomberg Information System based on the *call* and *put* options of the underlying assets. [10] For a few cases where the *implied* volatility is not available, we use the *historical* volatility calculated from the underlying securities prices in the previous 260 days.

We calculate the profit for each certificate issue that has complete data based on Equation (9) (for *uncapped Airbag* Certificates), Equation (10) (for *capped Airbag* Certificates), Equation (15) (for *uncapped* Protect Outperformance Certificates), and Equation (18) for *capped* Protect Outperformance Certificates. Profitability for the special cases is computed using equations (21), (23), and (25) as appropriate.

Table 2
Profitability in the primary market

Type	N	Maturity (Years)	Dividend Yield (%)	Volatility (%)	Profitability (%)	P-value
Airbag						
Uncapped	37	3.83	2.76	29.59	4.55	<0.001
Capped	12	2.92	2.57	41.74	18.99	<0.001
Total	49	3.60	2.71	32.56	8.09	<0.001
Protect Outperformance						
Uncapped	1	3.52	4.23	0.00	27.20	
Capped	-	-	-	-	-	
Total	1	3.52	4.23		27.20	
Special Cases						
STRYPES	1	3.00	0.00	54.13	-3.46	
PPPN	-	-	-	-	-	
AAC	3	3.01	3.06	40.32	20.36	<0.007
Total	4	3.01	2.29	43.77	14.40	0.098

to grow at the risk-free rate. Option prices can be computed by applying the Black–Scholes formula with the stock price replaced by the net-of-dividend stock price.

[8] These websites include OnVista (Germany http://www.onvista.de/), the Yahoo (Germany http://de.yahoo.com/), ZertifikateWeb (Germany http://www.zertifikateweb.de/), TradeJet (http://www.tradejet.ch), Berlim-Bremen Boerse Stock Exchange (http://www.berlinerboerse.de), Stuttgart Boerse Stock Exchange (http://www.boerse-stuttgart.de/), American Stock and Options Exchange (http://www.amex.com), U.S. Securities and Exchange Commission (http://www.sec.gov), and Swiss Stock Exchange (http://www.swx.com).

[9] We match the maturity dates of government bonds with those of the certificates. When we cannot find a government bond that matches the term of maturity for a particular certificate, we use the linear interpolation of the yields from two government bonds that have the closest maturity dates surrounding that of the certificate.

[10] The implied volatility calculated by the Bloomberg System is the weighted average of the implied volatilities for the three call options that have the closest at-the-money strike prices. The weights assigned to each implied volatility are linearly proportional to the "degree of near-the-moneyness" (i.e. the difference between the underlying asset price and the strike price) with the options which are closer-to-the-money receive more weight.

We present the profitability of issuing PCs in Table 2. If we denote B_0 as the issue price of the certificate, and TC as the total cost (fair value) of issuance, any issue price above the fair value is the gain to the certificate issuer. The profit function for the issuer of certificates is

$$\Pi = B_0 - TC \tag{26}$$

The profitability is measured by the profit (∏) as a percentage of the total issuing cost (TC), i.e.

$$\text{Profitability} = \frac{\Pi}{\text{TC}} * 100\% = \frac{\text{B}_0 - \text{TC}}{\text{TC}} * 100\% \tag{27}$$

The results in Table 2 show that average profit is 8.09% for 49 Airbag issues, 27.20% for the Protect Outperformance issue, and 14.40% for the Special Cases, all of which are statistically different from zero. For the sample of Airbag Certificates, capped certificates are considerably more profitable that uncapped certificates. This suggests that buyers of capped Airbag Certificates do not sufficiently discount the reduced profitability created by the cap.

5.D. Profitability of Protect Certificates Compared to Other Structured Products

Our finding that Protect Certificates are overpriced is consistent with prior research on structured products. Several studies have reported that structured products have been overpriced, 2%-7% on average, in the primary market based on theoretical pricing models: King and Remolona (1987), Chance and Broughton (1988), Abken (1989), Chen and Kensinger (1990), and Chen and Sears (1990), Baubonis et al. (1993), and Hernandez, Brusa & Liu (2010) for Equity Linked Certificates of Deposit; Burth et al. (2001), Benet et al. (2006) and Hernandez, Lee & Liu (2010) for Reverse Convertible Bonds; Hernandez, Lee, Liu & Dai (2011) for Outperformance Certificates, Hernandez, Brusa & Liu (2008) for Bonus Certificates, Wilkens et al. (2003), Grünbichler and Wohlwend (2005), and Stoimenov and Wilkens (2005) for various products.

We compare the profitability of our sample of PCs to samples of two other types of structured products examined previously in the literature: Outperformance Certificates (Hernadez, Lee, Liu, & Dai, 2011) and Bonus Certificates (Hernandez, Brusa, & Liu, 2008). Recall that the distinguishing characteristic of Protect Certificates from Outperformance Certificates and Bonus Certificates is the degree of downside protection afforded to the buyer. Protect Certificates, as the name implies, offer a greater amount of downside protection. The comparison is presented in Table 3 Panel A and Panel B and is divided by whether the structured product is capped or uncapped.

Table 3
Profitability in the primary market by structured product

Panel A

Type	N	Amount Issued (€ Mill.)	Maturity (Years)	Knock -In Level (%) [a]	Cap Level (%) [a]	Particip- tion Rate (%)	Divid- end Yield (%)	Volatility (%)	Issue Price (%) [a]	Profita- bility (%)	P-value
Outperformance Certificates											
Uncapped	596	14,944	2.34	-	-	1.59	3.60	19.40	100.29	3.31 [b]	<0.001
Capped	911	28,263	1.39	-	151.30	2.03	1.51	21.20	99.78	4.29 [c]	<0.001
Bonus Certificates											
Uncapped	5,078	108,567	3.11	74.37	-	1.02	3.30	20.49	100.18	2.60 [d]	<0.001
Capped	482	14,064	2.48	72.49	136.37	1.04	2.90	20.62	100.29	3.08 [e]	<0.001
Protect Certificates - Airbags											
Uncapped	49	1,744	4.12	77.86	-	1.07	2.76	29.59	101.01	4.55 [f]	<0.001
Capped	13	513	3.08	78.85	168.21	1.13	2.57	41.74	100.44	18.99 [g]	<0.001

[a] as a percentage of the reference price [b] based on 580 cases [c] based on 657 cases [d] based on 4,752 cases [e] based on 462 cases [f] based on 37 cases [g] based on 12 cases.

Table 3 - (continued)

Panel B

Tests of Difference of Means	P-value
Uncapped	
Outperformance Certificates vs. Protect Certificates	<0.001
Outperformance Certificates vs. Bonus Certificates	<0.001
Protect Certificates vs. Bonus Certificates	0.056
Capped	
Outperformance Certificates vs. Protect Certificates	<0.001
Outperformance Certificates vs. Bonus Certificates	<0.001
Protect Certificates vs. Bonus Certificates	0.003

Uncapped Airbag Certificates (4.55%) appear more profitable than both uncapped Outperformance Certificates (3.31%) and Bonus Certificates (2.60%), but the difference in means is only statistically significant with respect to uncapped Outperformance Certificates. Additionally, we compare the profitability of uncapped Outperformance and Bonus certificates and find that Outperformance Certificates are significantly more profitable than Bonus Certificates.

With respect to capped products, Airbag Certificates (18.99%) are significantly more profitable than both Outperformance Certificates (4.29%) and Bonus Certificates (3.08%). Similar to the uncapped sample, the capped sample of Outperformance certificates is also significantly more profitable than the capped sample of Bonus Certificates.

We draw an important conclusion from the profitability comparison. Buyers of structured products appear to value the capital protection afforded to them by Protect Certificates, as they are more profitable for issuers than products that offer less (or no) capital protection. However, the higher level of profitability for primary market issuers suggests that buyers may overpay for this protection.

6. Conclusion

In this paper we introduce a new structured product known as Protect Certificates and we provide detailed descriptions of the product specifications. We further develop pricing models for four types of certificates – Airbag Certificates and Protect Outperformance Certificates, uncapped and capped in each type. We also discuss and price three special cases of Protect Certificates.

We present a detailed survey of the Protect Certificates market for issues outstanding in August 2005 and we empirically examine the issuer profitability in the primary market. Consistent with previous research on structured products, issuers generate considerable profit from Protect Certificates. We compare the mispricing in our sample of PCs with samples of Outperformance Certificates from the Hernandez et al. (2007) study and Bonus Certificates from the Hernandez et al. (2008) study. Comparatively, Protect Certificates generate the largest profit for issuers, suggesting that buyers overpay for the additional capital protection.

Our study provides insight into the design, payoff, pricing and profitability of Protect Certificates. The methodology and approach used in this paper can be easily extended to the analysis of other types of structured products.

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Appendix 1: Example of an Uncapped- Airbag Certificate

Equity Linked Notes **ING**
FINANCIAL MARKETS
Airbag Eurozone 2007
EUR 3 Year Airbag Notes

April 1, 2004

This Airbag offers investors the potential to fully profit from upward movements of Dow Jones Eurostoxx50 Index. In addition, it provides a buffer, shielding the investor from smaller drops in the underlying.

Issuer	ING Bank N.V.
Underlying	Dow Jones Eurostoxx50 Index (Bloomberg: SX5E <Index>)
Issue Size	€60,000,000
Principal Amount	€ 100.00
Issue Price	101.50%
Issue Date	April 1, 2004
Expiration Date	April 2, 2007
Redemption Date	April 4, 2007
Airbag Level	80%
Repayment	According to the Redemption Formula If on the Expiration Date the Eurostoxx50 Index has gone - up, the Airbag Note will redeem the Principal Amount plus the full performance of the Eurostoxx50 Index. - down by less than 20%, the Airbag Note will provide full protection against the drop and will redeem the Principal Amount. - down by more than 20%, the Airbag Note will redeem the Principal Amount minus 125% of the excess drop under the Airbag level I[a] (which in effect is less than the Principal Amount). - I[0] = 2787.49 (March 30,2004) - I[a] = 80% I[0] - I[i] = The official closing of the Dow Jones Eurostoxx50 Index on the Expiration Date
Redemption Formula	

$$\text{Principal Amount}\left[1+\min\left[\left(\frac{I_T - I_{KI}}{I_{KI}}\right);\max\left[0;\left(\frac{I_T - I_0}{I_0}\right)\right]\right]\right]$$

Listing	Euronext Amsterdam
ISIN Code	XS0187691828

Appendix 2: Example of an Capped- Airbag Certificate

Equity Linked Notes **ING**
FINANCIAL MARKETS
Capped Airbag Japan
EUR (Quanto) 6 Month Airbag Notes on index of 225 Japanese Stocks

June 10, 2004

This Airbag offers investors the potential to profit from upward movements of the Nikkei 225 up to 12.85%. In addition, it provides a buffer, shielding the investor from drops up to 5% in the underlying.

Issuer	ING Bank N.V.
Underlying	Nikkei225 Index (Bloomberg: NKY <Index>)
Issue Size	€15,000,000
Principal Amount	€ 1,000
Issue Price	100%
Issue Date	June 10, 2004
Expiration Date	December 14, 2004
Redemption Date	December 17, 2004
Airbag Level	95%
Cap	12.85%
Repayment	According to the Redemption Formula If on the Expiration Date the Nikkei225 Index has gone - up more than 12.85%, the Airbag Note will redeem €1,128.50 - up less than 12.85%, the Airbag Note will redeem Principal Amount plus the full performance of the Nikkei225 Index. - down by less than 5%, the Airbag will redeem €1,000.00 - down more than 5%, the Airbag Note will redeem the Principal Amount minus 100% of the excess drop under the Airbag level I[a] (which in effect is less than the Principal Amount). - I[0] = 11,296.76 (Jun 1, 2004) - I[a] = 95% I[0] = 10,371.922 - I[i] = The official closing of the Nikkei225 Index on December 14, 2004

Redemption Formula

$$\text{Principal Amount}\left[1+\min\left[\left(\frac{I_T - I_{KI}}{I_0}\right);\max\left[\left(\frac{I_T - I_0}{I_0}\right);cap\right]\right]\right]$$

Secondary Market	ING Financial Markets
ISIN Code	XS0194114434

Appendix 3: Example of an Uncapped- Protect Outperformance Certificate

J.P. MORGAN INTERNATIONAL DERIVATIVES LTD.

PROTECT-OUTPERFORMANCE CERTIFICATE 2005/2008

Issuer	J.P. Morgan International Derivatives Ltd.
Index	Dow Jones Euro STOXX 50
Instrument	Certificate
WKN	JPM0DK
ISIN	GB00B06RYG84
Currency	EUR
Denomination	€ 100.00
Subscription Period	11 April 2005 – 4 May 2005
Trade Date	11 May 2005
Valuation Date	11 November 2008
Maturity Date	14 November 2008
Issue Size	200,000 certificates
Issue Price	€ 101.50 per certificate
Participation Rate	150%
Repayment	With regard to each certificate

(A) if $I_T > I_0$	EUR 100 * [1 + 150% * [I_F/I_I – 1]]
(B) if $I_0*80\% < I_T < I_0$	EUR 100
(C) if $I_T < I_0*80\%$	EUR 100*[I_F/I_I]

Listing	Stuttgart
Smallest Unit	1 certificate

Appendix 4: Example of a Special Case Protect Certificate - STRYPES

Merrill Lynch & Co., Inc.

7 7/8% Structured Yield Product Exchangeable For Stock SM
Due February 1, 2001
"STRYPES SM"
Payable With Share of Common Stock of CIBER Inc.
or Cash With an Equal Value

WHAT YOU WILL RECEIVE BEFORE THE MATURITY DATE:
On each February 1, May 1, August 1 and November 1, beginning May 1, 1998, we will pay you interest on the STRYPES in cash at the rate of 7 7/8% per year.

WHAT YOU WILL RECEIVE ON THE MATURITY DATE:
For each STRYPES you own, you will receive a number of shares of common stock of CIBER or an equivalent amount of cash according to the maturity price. The maturity price is the average closing price per share of common stock of CIBER on a number of days before the maturity date. The amount you will receive is also subject to adjustments, which are more fully described in this prospectus.

The maturity date of the STRYPES is February 1, 2001. On the maturity date, ML&Co. will pay and discharge each STRYPES by delivering to the holder of the STRYPES a number of shares of common stock of CIBER, subject to ML&Co.'s right to deliver, with respect to all, but not less than all, shares of common stock of CIBER deliverable on the maturity date, cash with an equal value. The number of shares that ML&Co. will deliver is referred to in this prospectus as the "PAYMENT RATE". ML&Co. will determine the Payment Rate according to the following PAYMENT RATE FORMULA, which is subject to adjustment as a result of dilution events described in this prospectus.

(a) If the Maturity Price (as defined below) is greater than or equal to $91.4713 (the "THRESHOLD APPRECIATION PRICE"), the holder of STRYPES will receive 0.7692 shares of common stock of CIBER per STRYPES;

(b) If the Maturity Price is less than the Threshold Appreciation Price but is greater than $70.3625 (the "INITIAL APPRECIATION CAP"), the holder of STRYPES will receive a fractional share of common stock of CIBER per STRYPES so that the value of the fractional share, which will be determined based on the Maturity Price, equals the Initial Appreciation Cap;

(c) If the Maturity Price is less than or equal to the Initial Appreciation Cap but is greater than or equal to the Initial Price, the holder of STRYPES will receive one share of common stock of CIBER per STRYPES;

(d) If the Maturity Price is less than the Initial Price but is greater than or equal to $51.4188 (the "DOWNSIDE PROTECTION THRESHOLD PRICE"), the holder of STRYPES will receive a number of shares of common stock of CIBER per STRYPES so that the value of the shares, which will be determined based on the Maturity Price, equals the Initial Price; and

(e) If the Maturity Price is less than the Downside Protection Threshold Price, the holder of STRYPES will receive 1.0526 shares of common stock of CIBER per STRYPES.

Appendix 5: Example of a Special Case Protect Certificate – Partial Principal Protected Notes

UBS AG
Partial Principal Protected Notes
UBS AG $16,000,000 Notes Linked to the
S&P 500(R) Index Due February 28, 2008

Issuer	UBS AG
Maturity Date:	February 28, 2008
No Interest Payments:	We will not pay you interest during the term of the Notes.
Underlying Index:	The return on the Notes is linked to the performance of the S&P 500(R) Index.
Payment at Maturity:	At maturity, you will receive a cash payment per $1,000 principal amount of the Notes based on the Index Return. - If the Index Return is positive, you will receive your principal plus 100% of the Index Return, subject to the Maximum Return on the Notes. - If the Index Return is between 0% and -20%, you will receive your full principal. - If the Index Return is less than -20%, you will lose 1% of your principal for each percentage point that the Index Return is below -20%. For example, an Index Return of -25.5% will result in a 5.5% loss of principal. ACCORDINGLY, YOU CAN LOSE UP TO 80% OF THE PRINCIPAL AMOUNT OF YOUR NOTES IF THE INDEX DECLINES BY MORE THAN 20%.
Index Return:	(Final Index Level - Initial Index Level)/ Initial Index Level
Maximum Return:	The Index Return is subject to a Maximum Return of 60%.
Initial Index Level:	The Initial Index Level is 837.10, the closing level of the S&P 500 Index on February 20, 2003.
Final Index Level:	The Final Index Level will be the closing level of the S&P 500 Index on the final valuation date.
Listing:	The Notes have been approved for listing on the American Stock Exchange under the symbol "PPZ.B".
Booking Branch:	UBS AG, Jersey Branch

Appendix 6: Example of a Special Case Protect Certificate – Airbag Accelerator Certificate

AEX-Index® Airbag Accelerator Certificate IV

02 October 2003

Indicative Terms and Conditions
AEX-INDEX® AIRBAG ACCELERATOR CERTIFICATE
3 Years – Airbag – Accelerating participation

Issuer and Lead Manager: ABN AMRO Bank N.V.

Subscription Period:	29 September 2003 up to and including 3 October 2003
Listing Date:	6 October 2003
Underlying Index:	AEX-index® (Reuters code: .AEX)
Initial Index:	The official closing level of the Underlying Index on 3 October 2003
Final Index:	The official closing level of the Underlying Index on 5 October 2006
Airbag Level:	75% of the Initial Index
Indicative Issue Price:	EUR 102
Expiration Date:	5 October 2006
Final Settlement Date:	10 October 2006
Redemption Amount:	If the Final Index

- Has gone up the Airbag Accelerator Certificate will pay out EUR 100 plus the performance of the Underlying Index, whereby the investor participates an extra 50% for every 10% increase in the Underlying Index with a maximum total entitlement of EUR 145.

- Has gone down by less than 25% the Airbag Accelerator Certificate provides protection and will be redeemed by EUR 100.

- Has gone down by more than 25% the Airbag Accelerator Certificate will pay out EUR 100 minus 133.33% (=100%/Airbag Level) of the excess drop below the Airbag Level.

Number of Certificates:	500,000
Minimum trading size:	1 Certificate (or integral multiples)
Listing:	Official Segment of the Stock Market of Euronext Amsterdam N.V.
Security number:	COMMON CODE: 17666401 ISIN: NL0000455921 FONDS CODE: 45592
Quoted on:	Reuters quote: NL45592.AS Reuters page: AAHAIR
Bloomberg quote:	ABNAEX5 NA <equity> Bloomberg page: AAEC11
	Internet: http://www.derivatives.abnamro.com