Contingent claim valuation – The case of Phönix Certificates

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ABSTRACT

This paper introduces a new financial product named Phönix Certificates and provides detailed descriptions of the product specifications. It shows that the payoff of a Phönix Certificate can be duplicated by the combination of a long position in the underlying asset and down & in call options on the underlying asset. A pricing formula is developed to price the certificates. A certificate issued by HSBC Trinkaus & Burkhardt AG is presented as an example to examine how well the model fits empirical data. Finally, a detailed survey of the €69 million Phönix Certificates market for 34 issues outstanding on December 2010 issued by HSBC Trinkaus & Burkhardt AG is presented and the profitability in the primary market is examined. The results show that issuing Phönix Certificates is a profitable business and the results are in line with previous studies pricing other structured products. Moreover, the question of whether structured products with exotic options (e.g. Phönix Certificates) are mispriced more than structured products with plain vanilla options (e.g. Outperformance Certificates) is tested. The result shows no statistically significant difference.

Keywords: Phönix Certificates; Outperformance Certificates; option pricing; structured products; financial innovation

I. INTRODUCTION

The modern structured financial products market – i.e. newly created securities through the combination of fixed income securities, equities, and derivative securities – has experienced an explosive growth in volume, variety and complexity during the last decade (Hernandez et al., 2007). Some of the new products offered are too complex for the average retail investor to understand as expressed publicly by regulators (Ricks, 1988; Lyon, 2005; NASD, 2005; Laise, 2006; Maxey, 2006; Simmons, 2006; Isakov, 2007).

In Hernandez et al. (2007), the authors analyze the Outperformance Certificates €43 billion market by examining a sample of 1,507 issues outstanding in August 2005 issued by banks in Europe. They present pricing formulas to price two types of certificates – i.e. uncapped and capped – and empirically examine the profits in the primary market for issuing the certificates. They find that issuance of the certificates is profitable for the issuers in their sample. Issuers sell the certificates at prices 3%-5% above the fair value based on the components of the underlying assets.

This paper studies a new financial product known as "Phönix Certificates" (to be referred to as PC henceforth), one of the equity-linked "structured products" issued by major banks in Europe. The PC can be considered an "exotic" Outperformance Certificate. The rate of return on the investment in the certificates is contingent upon the performance of a pre-determined underlying asset over a pre-specified period (known as term to maturity). As long as the underlying asset price has never dropped to a predetermined level (which is usually set below the initial price of the underlying asset and referred to as the knock-in level) anytime between the issue date and the maturity date as described in Figure 1 (Appendix), investors of the certificates receive a return equal to the return on the underlying asset. Thus, under the first scenario (Scenario 1) the certificates behave as a long position in the underlying asset. On the other hand, if the underlying asset price ever drops to the knock-in level anytime between the issue date and the maturity date as described in Figure 2, the certificates behave as Outperformance Certificates (Scenario 2). See Hernandez et al. (2007) for more in-depth analysis of Outperformance Certificates. The investors of the certificates receive a return equal to a pre-specified multiple (known as participation rate) times the positive return on the underlying asset calculated from the knock-in level. The participation rate is always greater than 100% – that is why the PC could be considered as especial case of Outperformance Certificates. In other words, the return of the underlying asset is calculated with respect to the knock-in level as the difference between the closing price of the underlying asset on maturity date and the knock-in level as a percentage of the knock-in level. Finally, if the price of the underlying asset on maturity date is lower than the knock-in level as described in Figure 3 (Scenario 3), the investors of the certificates receive the same return as the underlying asset. In calculating the return on the underlying asset, the certificate issuers use only the change in the asset price; the cash dividends paid during the period are not included. In other words, investors in the PC do not receive cash dividends even though the underlying assets pay dividends during the term to maturity. Appendix 1 is an example of a Phönix Certificate.

The purpose of the paper is to extend Hernandez et al. (2007) to Phönix Certificates and provide an in-depth economic analysis for the certificates to explore how the principles of financial engineering are applied to the creation of such newly structured products. A pricing model for the certificates is developed by using option pricing formulas. In addition, an example of a PC issued on June 23, 2010 by HSBC Trinkaus & Burkhardt AG (to be referred to as HSBC henceforth), a well-recognized large bank in Europe, is presented. In this example, the certificate is priced by calculating the cost of a portfolio with a payoff similar to the payoff of the certificate. Finally, all outstanding Phönix Certificates in the market are empirically examined. Whether issuers of certificates earn a profit in the primary market and whether certificates with "exotic" options (Phönix Certificates) are more profitable than certificates with "plain vanilla" options (Outperformance Certificates) are two questions answered in the paper.

The rest of the paper is organized as follows: The design of the certificates is introduced in Section 2. The pricing model is developed in Section 3. In Section 4, an example of PC is presented and the profit for issuing the certificate is calculated using the model developed in Section 3. In Section 5, detailed analyses of the PCs market are provided and the profits in the primary market for issuing the PCs are empirically examined. Section 6 presents the conclusions.

II. DESCRIPTION OF THE PRODUCT

The rate of return of a certificate 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 trade date) and the ending date of the period is known as the expiration date (or closing date). The price of the underlying asset on the fixing date is referred to as the reference price, and the price of the underlying asset on the expiration date is referred to as the valuation price.

If I_0 is the underlying asset price on the fixing date, I_{KI} as the knock-in level, I_T as the valuation price, and p as the performance factor, then for an initial investment in one 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:

$$V_T = \frac{1}{I_0}\begin{cases} I_T & \text{if } I_t > I_{KI} \text{ for all } t \in [0;T] \\ & \text{if } I_t \le I_{KI} \text{ for some } t \in [0;T] \\ I_T + (p-1)(I_T - I_{KI}) & \quad \text{and } I_T > I_{KI} \\ I_T & \quad \text{and } I_T < I_{KI} \end{cases} \qquad \ldots(1)$$

Alternatively, the relationship between the terminal value of a certificate and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) with a knock-in level at 90% of the reference price and a participation rate of 200% can be represented in Figure 4. 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 when the knock-in level was never broken over the term of maturity. The dashed line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying asset when the knock-in level was broken over the term of maturity. The dotted line represents the terminal value of the underlying asset. The slope for the value of the underlying asset (dotted line) in Figure 4 is, of course, one. The slope for the value of the certificate, when the price of the underlying asset goes up and the knock-in level was never broken over the term to maturity (solid line), is equal to one. The slope for the value of the certificate, when the price of the underlying asset goes up and the knock-in level was broken over the term of maturity (dashed line), is equal to participation rate (i.e. 200% in the example).

III. THE PRICING OF PHÖNIX CERTIFICATES

The terminal value from Equation (1), V_T, for an initial investment in one PC with knock-in level I_{KI}, participation rate p, and term to maturity T, can be expressed mathematically as:

$$V_T = \frac{1}{I_0} I_T \qquad \ldots(2)$$

when the underlying asset price has never dropped to the knock-in level between the issue date and the maturity date of the certificate. And,

$$V_T = \frac{1}{I_0}\left[I_T + (p-1)\max\left(I_T - I_{KI};0\right)\right] \qquad \ldots(3)$$

when the underlying asset price has dropped to the knock-in level anytime between the issue date and the maturity date of the certificate. The I_T in Equation (2) and first term in Equation (3) is the payoff for a long position in the underlying asset. The max [I_T-I_{KI}; 0] in Equation (3) is the payoff for a long position in call options with exercise price I_{KI}. The previous call option exists if the price of the underlying asset has ever dropped to the knock-in level between the issue date and the maturity date of the certificate (i.e. down-and-in call options).

The payoff of one PC is exactly the same as the payoff for holding the following three positions:

1. A long position in the underlying asset;
2. A short position in zero coupon bonds. The face values of the bonds are the cash dividends to be paid by the underlying asset and the maturity dates are the ex-dividend dates of cash dividends;
3. A long position in down-and-in call options on the underlying asset. The number of calls is the performance factor minus one (p-1). The exercise price of the option, X, and knock-in level of the option, I_{KI}, are the same (i.e. I_{KI}=X), and the term to expiration is T (which is the term to maturity of the certificate).

Since the payoff of PC is the same as the combined payoffs of the above three positions, the fair value of the certificate can be calculated based on the value of the three positions. Any selling price of the certificate above the value of the above three positions is the gain to the certificate issuer. The value of *Position 1* is the price of underlying asset on fixing date I_0. The value of *Position 2* is the present value of cash dividends to be paid by the underlying asset, to be denoted as PV_D. The value of *Position 3* is the value of (p-1) shares of down-and-in call options with each option having the value C_{di} (Haug, 2007; McDonald, 2006):

$$C_{di} = I_0 e^{-qT}\left(\frac{X}{I_0}\right)^{2(\mu+1)} N\left(d_1\right) - Xe^{-rT}\left(\frac{X}{I_0}\right)^{2\mu} N\left(d_1 - \sigma\sqrt{T}\right) \qquad \ldots(4)$$

r is the risk-free rate of interest, T is the term to maturity of the certificate, X is the exercise price or knock-in level, σ is the standard deviation of the underlying asset return, q is the dividend yield of the underlying asset, and

$$d_1 = \frac{\ln\left(\frac{X}{I_0}\right) + \left(r - q + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} \qquad \text{…(5)}$$

$$\mu = \frac{r - q - \frac{\sigma^2}{2}}{\sigma^2} \qquad \text{…(6)}$$

Therefore, the total cost, TC, for each PC is

$$TC = I_0 + \ (p-1)C_{di} - PV_D \qquad \text{…(7)}$$

If B_0 is the issue price of the certificate, any selling price above the fair value is the gain to the certificate issuer. And the profit function for the issuer of certificates is

$$\Pi = B_0 - TC \qquad \text{…(8)}$$

IV. EMPIRICAL TEST

In this section, a PC issued by HSBC Trinkaus & Burkhardt on June 23, 2010 using the Allianz SE stock as the underlying asset is empirically examined. The PC is the "Allianz SE Phönix Zertifikate - 6/24/2011" (ISIN DE000TB8K8X7), and the major characteristics of the certificate are listed in Appendix I of the paper.

Based on the information in Appendix I, once the knock-in level is touch, the certificate will have a participation rate of 200% on the positive returns of the underlying asset from that point. The certificate started selling on June 23, 2010 and the certificate was sold at €86.77. The expiration date (i.e. the date on which the closing price of the underlying asset will be used as the valuation price) was set on June 17, 2011, approximately 1 year later. In order to calculate the issuer's profit, the following data is needed for the certificate: 1) the price of the underlying asset, I_0, 2) the cash dividends to be paid by the underlying assets and the ex-dividend dates so the dividend yield, q, can be calculated, 3) the risk-free rate of interest, r, and 4) the volatility of the underlying asset, σ. Equations (4), (5), and (6) are based on continuous dividend yield. Since the dividends from the underlying security are discrete, the following approach to calculate the equivalent continuous dividend yield for underlying security that pays discrete dividends is used. For an underlying asset with a price I_0 at t=0 (the issue date) and which pays n dividends during a time period T with cash dividend D_i being paid at time t_i, the equivalent dividend yield q will be such that

$$I_0 - \sum_{i=1}^{n} D_i e^{-r t_i'} = I_0 e^{-qT}$$

$$q = -\frac{\ln\left[1 - \frac{\sum_{i=1}^{n} D_i e^{-r t_i'}}{I_0}\right]}{T} \qquad \text{…(9)}$$

The prices and dividends of the underlying asset are obtained from Bloomberg; the risk-free rate of interest is the yield of government bonds (alternatively, swap rates) of which the term to maturity match those of the certificate. If a government bond that matches the term of maturity for a particular certificate cannot be found, a the linear interpolation of the yields from two government bonds that have the closest maturity dates surrounding that of the certificate are used. The volatility (σ) of the underlying asset is the implied volatility obtained from Bloomberg based on the options of the underlying asset. When the implied volatilities are not available, the historical volatility calculated from the underlying securities prices in the previous 260 days is used. The one-year rate of interest, r, on June 22, 2010, the trade date of the certificate, based on the Euro swap rates is 1.14%. The dividend yield, q, of Allianz SE is 5.33%. The Allianz SE stock value on the issue date of the certificate, I_0, is €84.71. The implied volatility of Allianz SE based on the stock options is 22.90% on the issue date. Allianz SE is expected to pay a dividend of €4.50 on May 5, 2011. Therefore, the total cost of issuing one PC, TC, based on Equation (7) is

$$TC= €84.71 + €3.88 - €4.46 = €84.14 \qquad \ldots(10)$$

The profit for issuing each PC, π, is

$$\Pi = €86.77 - €84.14 = €2.64 \qquad \ldots(11)$$

So the profit for issuing each PC with a knock-in level at €75 is approximately €2.64. There are several ways to examine the reasonableness of the profit (or the quality of the model). One way to test the quality of the model is to examine the profit on the PC. Since the cost of issuing a PC is about €84.14 per certificate, then, a profit of €2.64 seems reasonable. Alternatively, the rate of return on such a transaction can be examined. A profit of €2.64 on a transaction that requires an investment of €84.14 over one year period translates into an annual rate of return of 3.13%. Based on HSBC's 2009 Annual Report, the return of 3.13% is in line with HSBC's return on assets of 1.00% if the marketing costs are taken into account (e.g. sales commissions and promotion expenses) associated with the issue of the PC. The 3.13% return on assets calculated from the pricing model in the paper can also be translated into a return on equity of 30.01% using HSBC's 10.4% of Tier One Capital ratio (by HSBC, 2009 Annual Report). The calculated 30.01% return on equity is also in line with by HSBC's reported pre-tax return on common stockholder's equity in the private banking business line, which is 20.8% (or 21.1% based on comprehensive income) if the marketing costs for issuing the PC are taken into account. The remarkable consistency between the empirical results calculated from the pricing model developed in the paper and the reported financial data in HSBC's Annual Report suggests the model developed in the paper is sound and robust.

V. The Phönix-Certificates Market

The sample of PCs in this study includes all PCs outstanding in the market at the end of December 2010. HSBC Trinkaus & Burkhardt AG is to the best of our knowledge, the only bank issuing structured products with a payoff of these characteristics. In Table 1 (Appendix) the descriptive statistics for the PC market are presented. The total value issued is €69.09 million on 34 issues of PCs. The median issue size is €2.1 million with 43,000 certificates in each issue. The sample consists of 17 pairs of PCs, where one issue has a term to maturity of one year and the other issue has a term to maturity of two years, everything else the same. The performance factor is 2.00 in all the cases and the median knock-in level is at 85.72% of the reference price. The median dividend yield and volatility (taking in account the volatility surface) of the underlying assets are 5.09% and 26% respectively. In Table 1, the profitability for issuing PCs is presented. The profitability is measured by the profit (∏) as a percentage of the total issuing cost (TC), i.e.

$$\text{Profitability} = \frac{\Pi}{TC} * 100\%$$

$$= \frac{B_0 - TC}{TC} * 100\% \quad \ldots (12)$$

The results in Table 1 show that average (median) profit for all the 34 issues is 5.11% (3.47%) above the issuing cost. The result in the paper provided additional evidence that inventors of newly structured products are rewarded for their creativity and innovative ability. 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; Chen and Sears, 1990; Baubonis et al., 1993; Burth et al., 2001; Wilkens et al., 2003; Grünbichler and Wohlwend, 2005; Stoimenov and Wilkens, 2005; Benet et al., 2006; Hernandez et al., 2007, Hernandez et al., 2008; Hernandez et al., 2010) for various types of structured products.

Given that issuing Phönix Certificates is a profitable business, four interestingly related questions arise in terms of the mispricing:

First, it is interesting to know whether PCs with term to maturity of one year (to be referred to as Short Term PCs henceforth) are more or less profitable than PCs with term to maturity of two years (to be referred to as Long Term PCs henceforth). Usually, the longer the term to maturity the more difficult results pricing and hedging an option. In order to answer this question, the profitability of the sample of Short Term PCs is compared with a sample of Long Term PCs. The average profit for all the 17 issues of Short Term PCs is 3.48% and the average profit for all the 17 issues of Long Term PCs is 6.73%. The results of the test of equal means suggest that there is no statistical difference. Results are reported in Table 1.

Second, it is interesting to know whether the issuance of PC is more or less profitable than five years ago. In other words, in a market with no barriers to entry, perfect disclosure of the introduction of new products, and easy replication by competitors, does profitability decline over time? In order to answer this question, the profitability of the sample of PCs outstanding in December 2010 (to be referred to as new sample henceforth) is compared with a sample of PCs outstanding in August 2005 (to be referred to as old sample henceforth). The average profit for all the 34 issues in the new sample is 5.11% and the average profit for all the 24 issues in the old sample is 5.83%. The results of the test of equal means suggest that there is no statistical difference. Results are reported in Table 2.

Third, it is also interesting to know whether the issuance of structured products with exotic options (e.g. Phönix Certificates) is more or less profitable than the issuance of structured products with plain vanilla options (e.g. Outperformance Certificates). In other words, are certificates with options that more difficult to understand, price and hedge mispriced more? In order to answer this question, the profitability of the sample of PCs outstanding in August 2005 (i.e. old sample) is compared with a sample of uncapped Outperformance Certificates from the Hernandez et al. (2007) study. The average profit for the old sample of PC is 5.83% and the average profit for all the 596 uncapped Outperformance Certificates is 3.15%. The results of the test of equal means suggest that the issuance of PCs is more profitable than the issuance of OCs. Results are reported in Table 3.

Four, it is also interesting to know whether the issuance of structured products with exotic options (e.g. Phönix Certificates) is more or less profitable than the issuance of structured products with plain vanilla options (e.g. Outperformance Certificates) but now only considering those securities issued by HSBC. In other words, are PCs issued by HSBC more or less profitable than OCs issued by HSBC? In order to answer this question, the profitability of the sample of PCs outstanding in August 2005 (i.e. old sample) is compared with a sample of uncapped Outperformance Certificates from the Hernandez et al. (2007) study issued by HSBC. The average profit for the old sample of PC is 5.83% and the average profit for all the 46 uncapped Outperformance Certificates issued by HSBC is 3.61%. The results of the test of equal means suggest that the issuance of PCs is more profitable than the issuance of OCs at the 5% confidence level. Results are reported in Table 4.

6. Conclusion

In this paper a newly structured product known as Phönix Certificates is introduced and detailed descriptions of the product specifications are provided. A pricing formula is developed to price the certificates. This paper shows that the payoff of a Phönix Certificate can be duplicated by the combination of a long position in the underlying asset and down & in call options on the underlying asset. A certificate issued by HSBC Trinkaus & Burkhardt AG is presented as an example to examine how well the model fits empirical data. Finally, a detailed survey of the €69 million Phönix Certificates market for 34 issues outstanding on December 2010 is presented and the profitability in the primary market is examined. The results show that Phönix Certificates are sold on average at 3.11% above the issuing cost and the results are in line with previous studies pricing other structured products. Moreover, the test of whether structured products with exotic options (e.g. Phönix Certificates) are mispriced more than structured products with plain vanilla options (e.g. Outperformance Certificates) is positive. The methodology used in this paper can be extended to the analysis of other structured products.

References

Benet, B., A. Giannetti & S. Pissaris (2006). Gains from structured product markets: The case of reverse-exchangeable securities (RES). *Journal of Banking and Finance*, 30, 111-132.

Burth, S., T. Kraus & H. Wohlwend (2001). The pricing of structured products in the Swiss market. *Journal of Derivatives,* 9, 30-40.

Chance, D., & J. Broughton (1988). Market index depository liabilities. *Journal of Financial Services Research*, 1, 335-352.

Chen, A., & J. Kensinger (1990). An analysis of market-index certificates of deposit. *Journal of Financial Services Research,* 4, 93-110.

Chen, K., & R. Sears (1990). Pricing the SPIN. *Financial Management*, 19, 36-47.

Grünbichler, A., & H. Wohlwend (2005). The valuation of structured products: Empirical findings for the Swiss market. *Financial Markets and Portfolio Management*, 19, 361-380.

Haug, E. (2007). *The complete guide to option pricing formulas (2nd Edition)*. New York, NY: McGraw Hill.

Hernandez, R., J. Brusa & P. Liu (2008). An economic analysis of bonus certificates - Second-generation of structured products. *Review of Futures Markets* 16, 419-451.

Hernandez, R., W. Lee & P. Liu (2007), 'The Market and the Pricing of Outperformance Certificates', Working Paper - 16th Annual Meeting of the European Financial Management Association, Vienna, Austria.

Hernandez, R., Lee, W. & Liu, P. (2010). An economic analysis of reverse exchangeable securities – An option-pricing approach. *Review of Futures Markets* 19, 67-95.

Isakov, D. (2007, August 28). Le prix élevé de certains instruments tient aux frictions qui apparaissent sur le marché. *Le Temps***.**

Laise, E. (2006, June 21). An arcane investment hits main street. *Wall Street Journal - Eastern Edition* 247(144), D1-D3.

Lyon, P. (2005, October). Editor's Letter: The NASD guidance does seem to suggest that structured products should be the preserve of the privileged few who are eligible for options trading. *Structured Products*.

______ (2005, October). US retail in the firing line. *Structured Products*.

Maxey, D. (2006, December 20). Market builds for structured products. *Wall Street Journal - Eastern Edition*.

McDonald, R. (2006). *Derivatives markets (2nd Edition)*. Boston, MA: Pearson Education Inc.

National Association of Securities Dealer, 2005, *Notice to Members 05-59 Guidance Concerning the Sale of Structured Products*.

Ricks, T. (1988, January 7). SEC chief calls some financial products too dangerous' for Individual Investors. *Wall Street Journal*, p. 46.

Stoimenov, P., & S. Wilkens (2005). Are structured products 'fairly' priced? An analysis of the German market for equity-linked instruments. *Journal of Banking and Finance*, 29, 2971-2993.

Simmons, J. (2006, January). Derivatives dynamo. *Bloomberg Markets*, 55-60.

Wilkens, S., C. Erner & K. Roder (2003). The pricing of structured products in Germany. *Journal of Derivatives*, 11, 55-69.

Appendix I - Example of a Phönix Certificate

The certificate in Appendix 1 was issued by investment bank HSBC Trinkaus using the Allianz SE stock as the *underlying asset*. The *fixing date* HSBC set for the certificate was June 22, 2010 and the *issue price* of the certificate was €86.77 per certificate (issued at par). The *expiration date* was set on June 24, 2011.

HSBC Trinkaus & Burkardt AG

Phönix-Certificate

Final Terms and Conditions

Issuer	HSBC Trinkaus
Nominal Amount	EUR 15,000,000
Number of Certificates	24,000
Denomination	1 certificate = 1 share
Currency	EUR
Issue Price	EUR 86.77
Sales Start Date	23 June 2010
Observation Period Start	25 June 2010
Observation Period End	17 June 2011
Valuation Date	17 June 2011
Maturity Date	24 June 2011
Underlying Asset	Allianz SE (WKN 840400)
Knock-In Level	EUR 75.00
Redemption	

If the underlying asset has never traded below the Knock-In Level during the observation period the holder will receive at Maturity Date the following amount in respect of one certificate:

$$V_T = \frac{1}{I_0} I_T$$

If the underlying asset ever drops below the Knock-In level during the observation period the holder will receive at Maturity Date the following amount in respect of one certificate:

$$V_T = \frac{1}{I_0}\left[I_T + (p-1)\max\left(I_T - I_{KI}; 0\right)\right]$$

Otherwise,

$$V_T = \frac{1}{I_0} I_T$$

Secondary Market	Deutsche Börse
ISIN / Valor	TB8K8X / DE000TB8K8Y5
Settlement	Clearstream / Euroclear

APPENDIX II - Figures

FIGURE 1
Repayment Scenario1

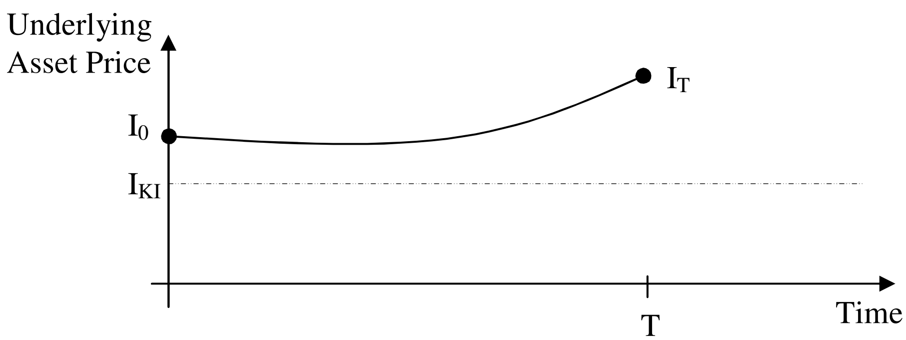


FIGURE 2
Repayment Scenario2

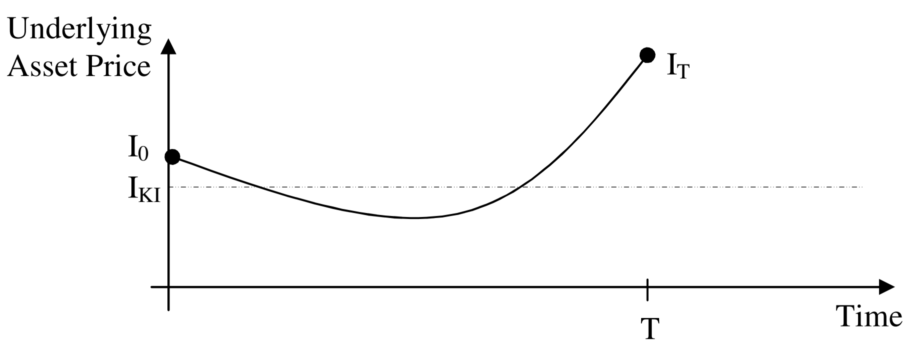


FIGURE 3
Repayment Scenario3

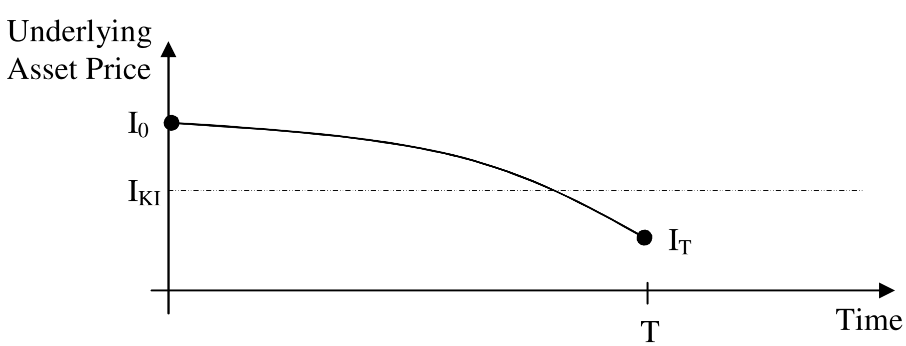
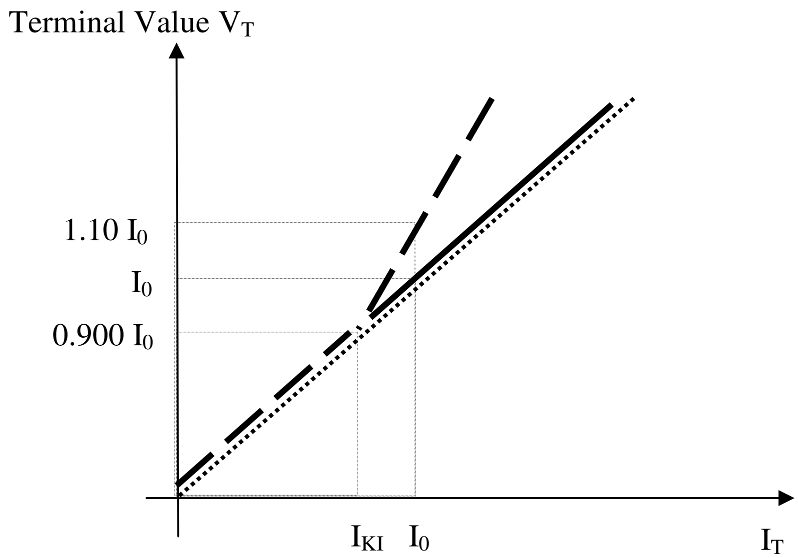


FIGURE 4
The terminal value of an investment in one Phönix Certificate as a function of underlying asset price I_T, with a knock-in level at 90% of the reference price and participation rate of 200%.



Appendix III - Tables

Table 1 – Descriptive Statistics and Profitability: New Sample

Statistic	N	Total Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity (Years)	Knock-In Level (%) [a]	Dividend Yield (%)	Volatility (%)	Risk Free Rate (%)	Profit (%)	p-value
Short Term	17	34.55	2.03	1.00	85.92	5.07	26.43	1.14	3.48	<0.001
Long Term	17	34.55	2.03	2.00	85.92	5.10	27.43	1.34	6.73	<0.001
p-value									0.073	
Pooled	34	69.20								
Mean			2.03	1.50	85.92	5.09	26.93	1.24	5.11	<0.001
Median			2.05	1.50	85.72	5.33	25.93	1.24	3.47	

[a] knock-in level as a percentage of the underlying asset's price on the issue date

Table 2 – Descriptive Statistics and Profitability: New Sample vs. Old Sample

Statistic	N	Total Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity (Years)	Knock-In Level (%) [a]	Dividend Yield (%)	Volatility (%)	Risk Free Rate (%)	Profit (%)	p-value
New Sample	34	69.20	2.03	1.50	85.92	5.09	26.93	1.24	5.11	<0.001
Old Sample	24	151.28	6.30	2.35	96.26	5.19	21.76	2.74	5.83	<0.001
p-value			**<0.001**	**<0.001**	**<0.001**	0.8116	**<0.001**	**<0.001**	0.6313	

[a] knock-in level as a percentage of the underlying asset's price on the issue date

Table 3 – Descriptive Statistics and Profitability: Phönix Cert. vs. Outperformance Cert.

Statistic	N	Total Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity (Years)	Knock-In Level (%) [a]	Dividend Yield (%)	Volatility (%)	Risk Free Rate (%)	Profit (%)	p-value
PC	24	151	6.30	2.35	96.26	5.19	21.76	2.74	5.83	<0.001
OC	596	14,944	25.20	2.34	100.39	3.21	19.40	2.28	3.15	<0.001
p-value			**<0.001**	**<0.001**	**0.005**	**<0.001**	0.072	**<0.001**	**0.002**	

[a] knock-in level as a percentage of the underlying asset's price on the issue date

Table 4 – Descriptive Statistics and Profitability: Phönix Cert. vs. Outperformance Cert. both issued by HSBC Bank

Statistic	N	Total Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity (Years)	Knock-In Level (%) [a]	Dividend Yield (%)	Volatility (%)	Risk Free Rate (%)	Profitability (%)	p-value
PC	24	151	6.30	2.35	96.26	5.19	21.76	2.74	5.83	<0.001
OC	46	1,171	25.46	3.72	99.84	3.36	17.59	2.51	3.61	<0.001
p-value			**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.040**	

[a] knock-in level as a percentage of the underlying asset's price on the issue date