Designing and Selling a Structured Product

The Reverse Convertible

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1 Introduction

In this paper we describe the structuring process of a Reverse Convertible (RC). In its simplest form, an RC is a high coupon paying note that is linked to an underlying stock. The coupon payments are paid on a periodic basis during the lifetime of the RC. In addition, at maturity the owner will receive either 100% of the initial investment N or, if the underlying stock value falls below a certain strike price K, a predetermined number of shares of the underlying stock. The total payoff of the RC can be summarized as follows:

$$TP = TC + min(N, \frac{N}{K} S_t)$$

with TP the total payoff, TC the summation of all periodic coupon payments, N the initial investment, K the strike price of the RC and S_t the stock price of the underlying stock at maturity T.

The paper is structured as follows. We first give a general high level overview of the structured product and the underlying data assumptions. Next, we perform a full investment analysis of the product with the intention of selling it to investors. We end with a more technical explanation of the structuring process itself where we highlight some technicalities and defend some of the choices that we made.

2 Characteristics of the product

As the bank, we structure and sell an RC that has the EBAY inc. stock as underlying. The product will be issued on December 14th 2014 and it will be sold at par for 11000$. We keep 1% of this amount as a fee for our services offered. The stock price of EBAY inc. on the issue date is 55.77$. The maturity date of our RC is set to January 15th 2016 and the strike price of the product equals 55.00$. We are able to offer the investors an annual coupon of 7.25% on

the initial investment. The coupon will be paid through 4 quarterly installments of each 199.38$ plus an additional installment of 69.92$ on the maturity date for a total of 867.44$ in coupon payments. At maturity the investor will also receive back the following amount:

$$min(N, \frac{N}{K}S_t) = min(11000\$, \frac{11000\$}{55.00\$}S_t)$$

with S_t the stock price of EBAY inc. on maturity date Jan. 15th 2016.

During the structuring process we sell puts with the same strike price and maturity as our RC. The premium we receive for selling one such put equals 4.75$. We also utilize and interpolate some relevant risk free interest rates. Figure 1. below illustrates where the relevant data is comming from.

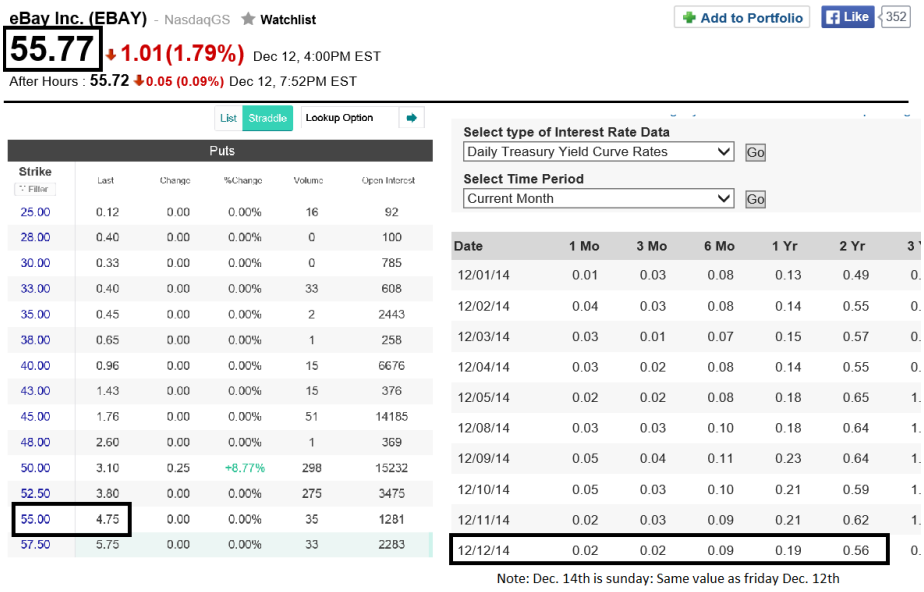

Figure 1: Relevant data assumptions at issue date, Dec. 14th 2014

3 Investment analysis report of the product

During these current times of economic recession it is hard to find investment products that offer a decent return. Risk free interest rates are at an all time low and bonds that are based on such interest rates offer insignificant returns on investment. Our bank fills in the need of investors that are seeking higher returns by offering them structured products. One such product is a Reverse Convertible which offers a very high annualized coupon of 7.25% on the invested

amount. However, the investor should be aware that this high coupon is coupled with the potential risk of a partial or full loss of the initial investment.

3.1 Payoff structure of the Reverse Convertible

The payout structure of the offered product is illustrated in Figure 2. below:

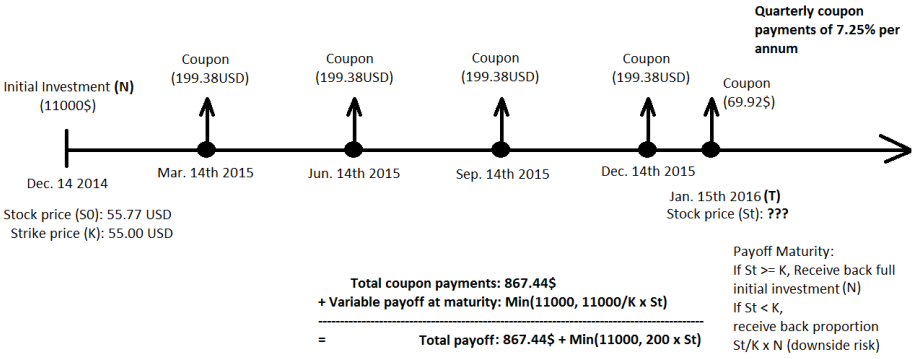

Figure 2: The RC payoff structure during the lifetime of the product

The product is sold for 11000$ on the issue date and offers the investor an annualized coupon of 7.25%. The coupon payments are spread out over 4 quarterly payments plus one final payment at maturity T. At time T there is another final payoff that depends on the value of the underlying stock price S_t of EBAY inc. If this price is higher than the strike price K of the RC (55.00$) then the investor receives back his full initial investment. However, should the EBAY inc. stock price at time T be smaller than the strike price then the investor will only receive back a proportion $\frac{S_t}{K}$ of the initial investment.

3.2 Risk return profile of the Reverse Convertible

The risk return profile of the product can be further investigated by looking at the pnl graph illustrated in Figure 3. below. The first thing to note is that the RC offers a positive return as long as the EBAY inc. stock price at maturity remains higher than 50.66$ (The RC beats the risk free return of 26.65$ when $S_t > 50.80$$). The return is maximized and equal to the total coupon payment when $S_t \geq K = 55.00$$. It can also be seen that the RC outperforms direct investment in the stock, as long as the stock price at maturity remains smaller than 60.17$. An important thing to note is that the RC carries almost the full downside risk of the underlying stock. The investor needs to understand that there exists a small possibility of losing the full initial invested amount while only retaining the coupon payments.

In summary, the RC can potentially provide large excess returns in comparison to both the risk free rate and the underlying stock as long as the stock price

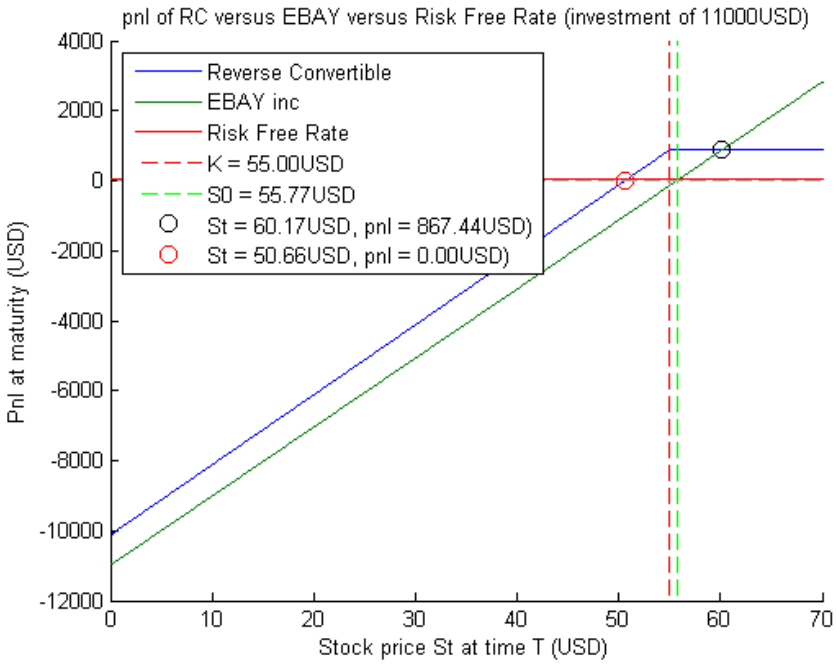

Figure 3: PnL at maturity T (RC versus Stock versus Risk free rate)

S_t at maturity does not deviate too far from its initial price $S_0(> K)$. However, if the investor suspects large swings in the market then he might consider some of the other alternative investment vehicles offered by our sales department.

4 Technical report of the product

4.1 Structuring process

We structure the product so that in all possible scenario's we are always able to pay the investor both the periodic coupons and the final payoff at maturity T. To do this we first add a part of the notional to the risk free bankaccount (B). This amount will generate a payoff of 100% of the notional N at maturity T. In addition, we also sell $\frac{N}{K}$ put options on the underlying with the same maturity T and strike price K as our product. It can be shown that the combined payoff at time T of both these positions is equal to the final RC payoff:

$$N + min(0, \frac{N}{K}(S_t - K)) = N + min(0, \frac{N}{K}S_t - N) = min(N, \frac{N}{K}S_t)$$

On the issue date, we still have some money left to spend, namely the premiums of our put sales and the part of the notional that we did not yet put on

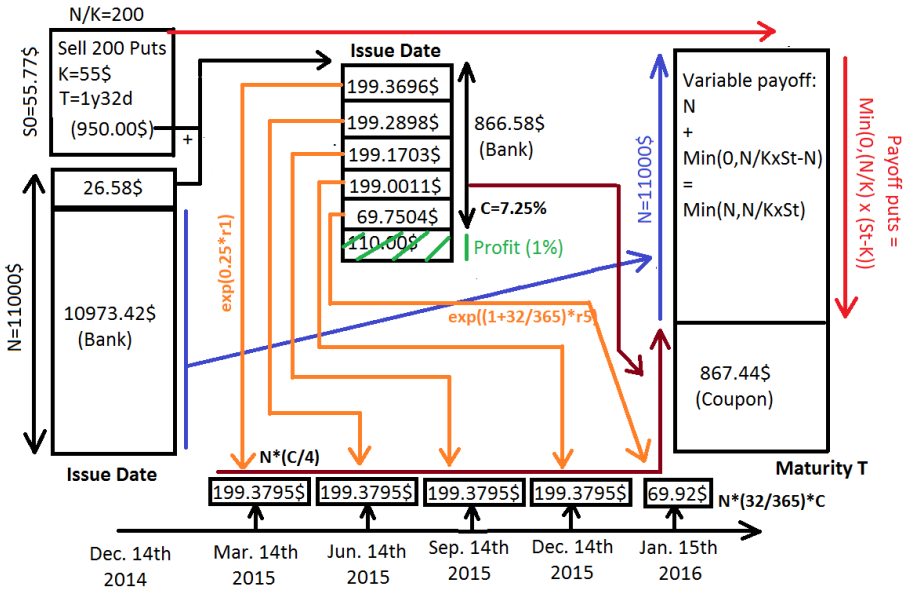

Figure 4: Structuring of the RC

the bankaccount. From this amount we first subtract our profit fee while the remainder is added to the risk free bankaccount B as the $discountedCoupon$, which will generate the future coupon payments. We obtain the annualized coupon rate by taking the relevant risk free interest rates into account:

$$C = \frac{discountedCoupon}{\frac{N}{4}e^{-0.25r_1} + \frac{N}{4}e^{-0.50r_2} + \frac{N}{4}e^{-0.75r_3} + \frac{N}{4}e^{-r_4} + N\frac{32}{365}e^{-((1+\frac{32}{365})r_5)}}$$

with r_1, r_2, r_3, r_4, r_5 the risk free rates on bankaccount B for the 3 month, 6 month, 9 month, 1 year and 1 year + 32 days periods respectively. We can now use C to calculate both the future and discounted coupon payments, as is illustrated for the 1st and 5th coupon payment in Figure 4. above.

4.2 Choices on product characteristics

We chose to sell the available at or out of the money puts with the highest possible strike price $K \leq S_0$ because this gives us the highest possible premium, thus allowing us to offer the highest possible coupon to investors. We price the RC at 11000$ because the 1% profit of 110$ is significant in comparison to the administration costs of handling each individual customer. Furthermore, the structuring process works smoothly with this price because it entails the selling of exactly 200 puts per sold product.