The Value of Earn-out Clauses:
An Option-Based Approach

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Abstract

Earn-outs are provisions in which the seller of a business receives additional future payments based on the achievement of certain future financial goals by the target. These provisions can effectively contribute to bridging the gap between buyer and seller and hence facilitate a transaction – especially in times of increased uncertainty regarding the future economic development of the business. This paper presents a model for valuing the contingent claim associated with earn-out clauses. The proposed model is based on option pricing theory; its implementation is straightforward.

Key Words: Earn-out, Valuation, Mergers and Acquisitions, Option Pricing, Contingent Claim

1. Introduction

Earn-out clauses are contractual provisions that state that the seller of a business will obtain additional, future compensation, based on the target company's business achieving certain financial goals.[1] In other words, the transaction price is split into two components: a fixed initial payment (at closing) and a subsequent payment, which is conditional on the target business' economic development. Such provisions help resolve the differences between buyer and seller. That is, they bridge gaps in expectations and thereby facilitate a transaction – especially in times of increased uncertainty regarding future economic development.

Earn-out clauses are usually designed as optional contracts: while there is a right to participate in positive future developments, there is no downside for the beneficiary of the earn-out, even in the case of negative outcomes. We call such contracts *earn-out options*. The transaction's merit and the decision whether to proceed with the transaction depends on the fixed initial payment plus the value of this earn-out option. As a consequence, the valuation of the earn-out clause is crucial.

In this paper we present a model for valuing the option of earn-out clauses. The model is based on a modified version of the *Schwartz/Moon* (1973) option pricing model. We apply the model to different types of earn-out clauses and demonstrate the implementation with a case study.

2. Why Using Earn-out Clauses?

2.1 Differing Expectations and Asymmetric Information

The main reason to employ earn-out provisions within mergers and acquisitions is to resolve differing expectations between buyer and seller regarding the target's future economic prospects. Additionally, another obstacle can be due to the asymmetric relation between the two parties that stems from the fact that, the seller, as an insider, knows much more about the target business and its future prospects. Even after a thoroughly conducted due diligence, the buyer cannot reach the seller's level of information. As a consequence, for the buyer, there is always the risk that the seller is exploiting the buyer's position by presenting an overly optimistic scenario of the company's economic

[1] For an overview of contingent payments in M&A see R. F. Bruner, *Applied mergers and acquisitions* (Hoboken: 2004), pp. 608–535.

prospects as a basis. Since the value of the target and hence the transaction price depends on its expected future economic development, the two parties may be unable to agree on a price, jeopardizing the transaction. In such a case, an earn-out clause may effectively facilitate the completion of the transaction.

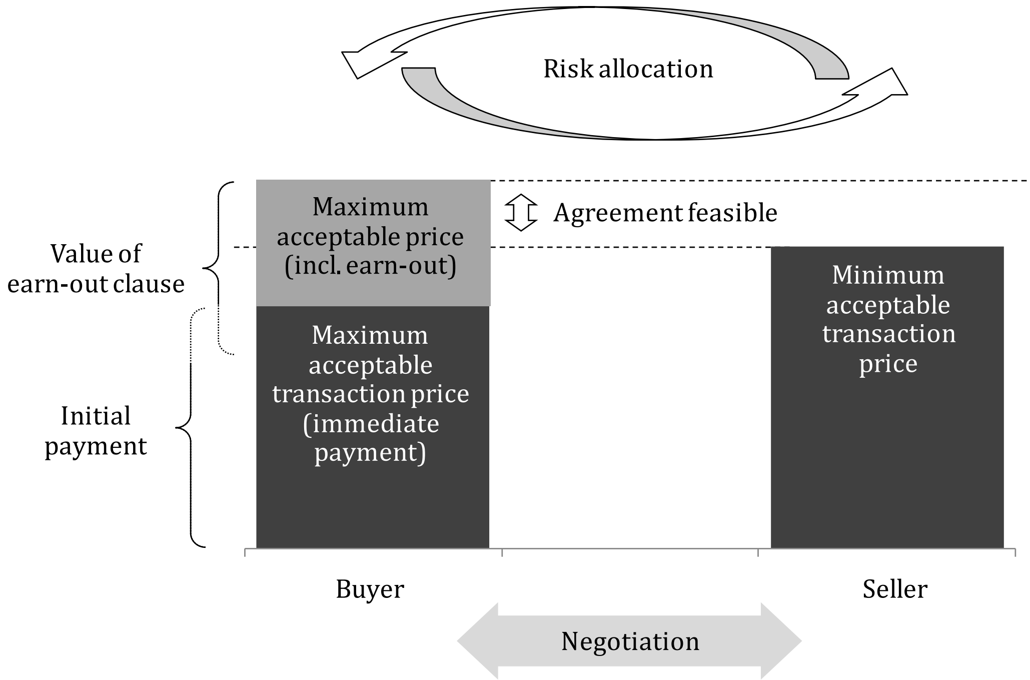

Figure 1: Earn-out provision to overcome differing expectations

Because the subsequent earn-out payment is contingent on the target's positive economic development, the buyer may be willing to accept a total transaction price (fixed price at closing plus the value of the earn-out clause) that exceeds the maximum acceptable price the buyer would have paid immediately. The seller, on the other side, accepts a lower fixed initial payment to obtain the option of participating in a positive economic development. An agreement is feasible if the total of the fixed initial payment and the value of this earn-out option exceed the seller's minimum acceptable price (see Figure 1).

The structure of the earn-out clause determines the risk allocation between the buyer and the seller. Generally, from the buyer's perspective, earn-out provisions allow the reduction of two different risks. First, by accepting the earn-out, the seller signals the reliability of the stated forecast figures the valuation is based on. This lowers the risk that the seller is exploiting the buyer based on superior knowledge. Second, since the earn-out payment is contingent on the future economic development, the seller continues to carry part of the business risk.

Additionally, if the seller still exerts influence on the business operations, e.g., as a member of the executive board, the earn-out provides the seller an incentive to help the business reach the target the earn-out payment is contingent on.

2.2 Adverse Market Conditions and High Uncertainty

The overall attractiveness of earn-out clauses increases with the uncertainty regarding the future economic prospects. As this uncertainty rises, it increases the difficulty of both sides agreeing on a valuation scenario, and therefore a transaction price. This is a prevalent scenario in the current financial and economic crisis. To cope with this high uncertainty, earn-outs currently enjoy great popularity. In many cases, they have become a prerequisite for a transaction. Earn-out clauses facilitate a lower initial payment at closing, which is acceptable from the seller's viewpoint since the payment will be supplemented by a subsequent earn-out payment if the economic situation recovers. From the buyer's viewpoint, earn-out provisions lead to a partial delay of the total payment, which preserves liquidity and so is favorable for the buyer – especially in times of liquidity constraints.

3. Earn-out Design

There is a variety of possible designs for earn-outs. Usually, the total transaction price is split into two components: a fixed payment, which is immediately payable, and a variable payment, which is contingent on future realizations of some index or measure of financial or operating performance, such as revenues, EBIT or cash flow. Generally, the underlying performance measure on which the earn-out is pegged should fulfill certain requirements regarding objectivity, measurability and accuracy.

To determine the variable earn-out component, buyer and seller define a threshold level for the performance measure beforehand. If this threshold is exceeded, the seller either participates (proportionately) in the positive development or the seller receives a fixed supplementary earn-out payment. Figure 2 exhibits pay-off profiles of possible earn-out clauses. In case (a), if the performance measure exceeds threshold K it triggers a proportionate participation. For case (b), the variable, subsequent payment is capped at a level U. Finally, case (c) displays a situation where, if the performance measure exceeds the threshold K, it triggers a fixed, subsequent payment. Generally, the design of earn-outs is fairly flexible and more complex pay-off profiles can be structured.

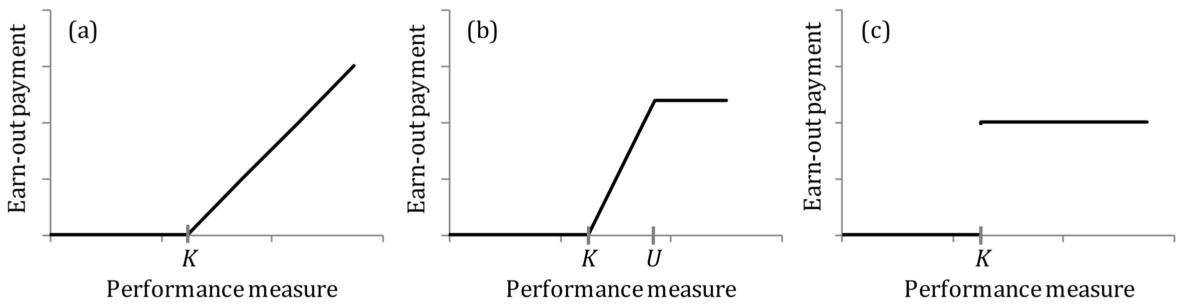

Figure 2: Examples of different earn-out models

These three samples share an optional feature, that is, the seller participates only in positive developments which is why we characterize this type of earn-out as asymmetric. The parties may agree on a more symmetric scheme where the buyer receives a future refund from the seller if the underlying performance measure falls below a certain threshold. In practice however, optional (asymmetric) provisions, which trigger a subsequent payment solely in the seller's favor prevail. The reason for this is that after the transaction, the seller's influence on the business operations is usually limited.

To determine an adequate threshold for the measure of performance the earn-out is pegged to, historical average values, or forecast figures, stated by the seller, are usually applied. Furthermore, the earn-out period must be determined, i.e., the period the earn-out provision is effective. The usual length of this period amounts up to five years.[2]

4. Valuation Model

4.1 Analogy to Options on Common Stock

To value earn-out clauses we use an analogy of financial options on common stock. For example, the pay-off profile (a), displayed in Figure 2 corresponds to the pay-off of a European call option (with strike price K). We can duplicate profile (b), as we will demonstrate later, by combining two options, namely a long call and a short call. Finally, the pay-off profile (c) corresponds to a *binary option*, which promises a fixed payment if the stock price exceeds the strike price at maturity. Using this analogy, we rely on the seminal *Black/Scholes* (1973) option pricing framework, which was developed for the valuation of European options.[3] The *Black-Scholes* model is widely accepted and used in the

[2] R. F. Bruner, *Applied mergers and acquisitions* (Hoboken: 2004), p. 613.

[3] F. Black and M. Scholes, *Journal of Political Economy* (1973), pp. 637–654; R. C. Merton, *Bell Journal of Economics and Management Science* (1973), pp. 141–183.

financial profession. However, since the model is based on restrictive assumptions, employing this analogy is not completely straightforward.

The key assumptions of the model are that the option's underlying has a lognormal distribution and that this underlying is traded at an active market. While the first assumption regarding the distribution may also be realistic for the performance measures (e.g., EBIT), these measures are usually not traded, which violates the second key assumption. However, by applying a *pseudo risk neutral* valuation approach,[4] we can circumvent this problem and obtain an approximation that is acceptable under many practical situations.

4.2 Proportional Participation

(1) Unlimited Participation

If the seller is participating in a performance measure, when this measure exceeds a certain threshold, we can say that the seller holds the equivalent of a European call option, with the respective performance measure as underlying. The predetermined threshold is analogous to the option's strike price, while the time until payment of the earn-out is analogous to the option's time to maturity. Employing this analogy, we can obtain the value of the earn-out option by using a modified version of the *Black/Scholes* (1973) option pricing model. According to this model, the value C of a European call option with strike price K and time to maturity T is given by[5]

$$C = E^Q[X_T]\,N(d_1) - K\,N(d_2) \qquad (1)$$

with

$$d_1 = \frac{\ln\left(\frac{E^Q[X_T]}{K}\right) + \frac{1}{2}\sigma^2 T}{\sigma\sqrt{T}},$$

$$d_2 = d_1 - \sigma\sqrt{T},$$

where $N(\cdot)$ is the cumulative standard normal distribution and σ denotes the volatility (standard deviation) of the changes in the underlying X. Furthermore, $E^Q[X_T]$ is the expected value of the underlying X at time T under the risk neutral probability measure Q.

[4] See L. Trigeorgis, *Real Options: Managing Flexibility and Strategy in Resource Allocation* (Cambridge, Massachusetts: 1996).

[5] See J. C. Hull, *Options, Futures and other Derivatives* (Upper Saddle River, 6th edition: 2006), p. 715.

For non-traded assets, we can obtain this expected value by adjusting the expected rate of growth in X. That is, we subtract a risk premium, which consists of the volatility σ multiplied by the market price of risk λ, from the growth rate μ. With the value X_0 of the performance measure at time $t = 0$, we obtain for the expected value under the risk neutral measure at time T the following:

$$E^Q[X_T] = X_0 \mathrm{e}^{(\mu-\lambda\sigma)T}. \tag{2}$$

Hence, the expected value is a risk-adjusted version of the real expectation. The market price of risk λ can be obtained by employing an equilibrium model, such as the capital asset pricing model (CAPM). According to the CAPM, the market price of risk λ is given by:[6]

$$\lambda = \frac{\rho}{\sigma_M}(\mu_M - r), \tag{3}$$

where ρ is the correlation of the market portfolio with the performance measure X. The parameter σ_M denotes the volatility of the market portfolio and μ_M the expected market return.

To circumvent the estimation of the correlation ρ and the volatility σ_M, we can approximate the risk neutral expectation by employing the company's beta β. Such an approximation is feasible if the measure of performance, e.g., EBIT, is correlated in a similar manner with the market portfolio as the equity value. In such a case, the risk neutral expectation is given by:

$$E^Q[X_T] = X_0 \mathrm{e}^{(\mu-\beta(\mu_M-r))T}. \tag{4}$$

Equation (1) implies that the option holder, i.e., the seller, receives a one-unit compensation for each unit by which the performance measure exceeds the value K. However, there are a many participation schemes for the seller. For example, the seller may participate with only 50%. We can achieve this by the factor α the option value C is multiplied with. Given this factor, the value EO of the earn-out option is:

$$EO = \alpha C = \alpha\big(E^Q[X_T]\,N(d_1) - K\,N(d_2)\big). \tag{5}$$

The factor α is the proportion by which the seller participates when there is a positive difference ($X_T - K$). For example, if the seller receives 50% of the EBIT exceeding the threshold K, then $\alpha = 0.5$.

[6] See J. C. Hull, *Options, Futures and other Derivatives* (Upper Saddle River, 6th edition: 2006), p. 716.

(2) Volatility Estimation

The volatility of the changes in the performance measure X is a crucial input parameter for the valuation. While it is not possible to observe this volatility directly, we can estimate it using the historically realized relative variations, e.g., based on the quarterly results of the last years:

$$\sigma = \sqrt{M} \times \sqrt{\frac{1}{N-1} \sum_{i=1}^{N-1} \left(\frac{X_{i+1} - X_i}{X_i} - \bar{X} \right)^2} \qquad (6)$$

with N being the number of observations X_i, and $\bar{X}$ the average relative change $(X_{i+1} - X_i)/X_i$. The variable M denotes the number of periods per year the estimation is based on. For example, if the quarterly reports are the source of the figures, the variable equals M = 4 (quarters); for monthly data M = 12 (months).

(3) Multiple Options

In many cases the seller does not only hold one single option but a whole portfolio of earn-out options with different maturities, e.g., if the seller has the right to participate over several years. Then, the total value of the earn-out clause is simply the sum of each single option's value, determined by equation (5). By using different options it is even possible to consider different threshold levels K for the performance measure, for example, if the hurdle for participation should increase over time.

(4) Restriction with Cap

If the variable payment is limited by a cap – as illustrated in case (b) in Figure 2 – the valuation can be carried out by combining two options. Figure 3 shows how the capped earn-out can be duplicated by using a call option with strike price K, less a second call, with strike price U (equal to the cap threshold). In contrast to the long position in the first call, the seller takes a short position in the second option (continuing our analogy with financial options, the seller is the option writer of the second call). Since both options exactly duplicate the earn-out's pay-off at maturity, the value of the option portfolio must equal the earn-out value at any time before maturity.

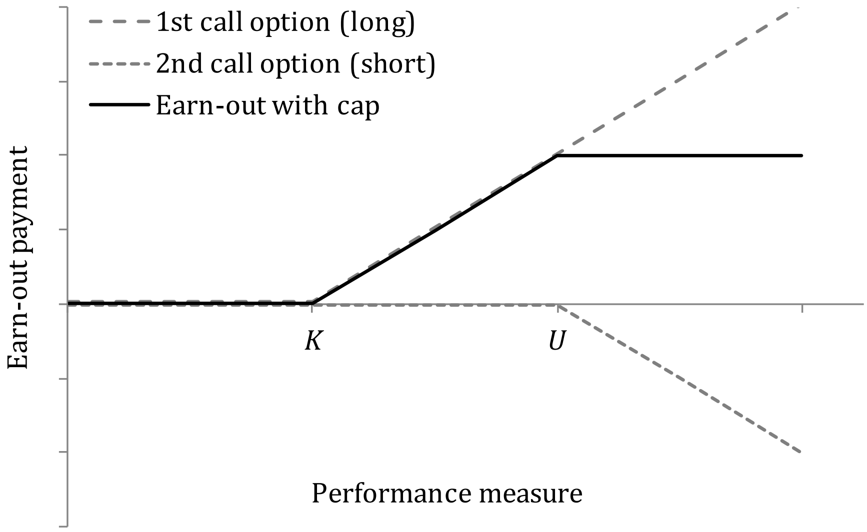

Figure 3: Earn-out payment with cap: duplication with long and short call

Combining both options, the value EO of the earn-out clause is:

$$EO = \alpha(C_K - C_U), \tag{7}$$

where C_K is the value of the (first) long call with strike price K, and C_U is the value of the (second) short call with strike price U. We can easily duplicate and value more complex structures by combining further long and short calls.

4.3 Fixed Subsequent Payment

The contingent claim on a fixed subsequent payment – as illustrated in Figure 2 by case (c) – corresponds to a binary call option. Such a „cash-or-nothing" option promises a fixed payment B if the underlying exceeds a certain threshold K at maturity. The value BC of the binary call can be obtained by relying on the same assumptions as in context of the modified *Black-Scholes* model presented above:[7]

$$BC = B\,N(d_2) \tag{8}$$

with

$$d_2 = \frac{\ln\left(\frac{E^Q[X_T]}{K}\right) - \frac{1}{2}\sigma^2 T}{\sigma\sqrt{T}}.$$

In case of an earn-out, the parameter B denotes the predetermined, fixed subsequent payment if the threshold K is exceeded. All other parameters are defined as above.

[7] See J. C. Hull, *Options, Futures and other Derivatives* (Upper Saddle River, 6th edition: 2006), p. 535.

5. Case Study

5.1 Exemplary Earn-out Variants

In this section, the model developed above is implemented in the context of a case study. Table 1 presents the relevant parameters, where the EBIT is employed as the measure of performance.

Parameter	**Symbol**	**Value**
EBIT at t = 0	X_0	$10,000,000
EBIT volatility	σ	25%
Expected rate of growth in EBIT	μ	5%
Beta	β	1,2
Market return	μ_M	9%
Risk free interest rate	r	3%

Table 1: Case study parameter values

We consider three different earn-out variants, which correspond to the cases exhibited in Figure 2:

a) At the end of each of the next four years, the EBIT is compared to a reference value of $10,000,000. The seller benefits from an excess EBIT by 50%.

b) If the EBIT exceeds $10,000,000 after three years, the seller receives a subsequent payment equal to five times the difference of the EBIT to a reference value of $10,000,000. The earn-out payment is capped at $10,000,000.

c) The seller receives a fixed subsequent payment of $10,000,000 if the EBIT exceeds $12,000,000 after three years.

5.2 Valuation

Case (a): In addition to the fixed initial payment the seller holds a portfolio of four call options on the EBIT (50% participation) with strike price K = $10,000,000. Formula (5) is used for the valuation, where $\alpha = 0.5$ and the time to maturity takes values from T = 1 to T = 4. The value of the earn-out clause is the sum of the four options and equals $2,452,226 with option values as follows (see the appendix for a detailed calculation):

Earn-out option $T = 1$	\$439,465
Earn-out option $T = 2$	\$584,119
Earn-out option $T = 3$	\$679,458
Earn-out option $T = 4$	\$749,184
Total	**\$2,452,226**

Case (b): We duplicate the structure by combining two call options. First, the seller holds a call with strike price $K = \$10{,}000{,}000$. Since the positive difference of the EBIT to the strike price is multiplied by 5, the factor α equals 5. The cap is reached at an EBIT of \$12,000,000. As a consequence, the seller also takes a short position in a second call with strike price $K = \$12{,}000{,}000$. Again, the factor α equals 5. Both options exactly duplicate the earn-out's pay-off structure. The total of both options, and therefore the value of the earn-out clause, equals \$2,804,282:

1st call option *(long)*	\$6,794,579
2nd call option *(short)*	–\$3,990,297
Total	**\$2,804,282**

Case (c): The provision corresponds to a binary „cash-or-nothing" call option with strike price $K = \$12{,}000{,}000$ and payment $B = \$10{,}000{,}000$ (if the EBIT after three years exceeds the strike). Employing equation (8) we obtain \$2,147,696 for the option value.

5.3 Sensitivity to Volatility

Beyond the features of the earn-out, such as time to maturity and strike price, which are negotiated between the seller and the buyer, the volatility of the performance measure significantly influences the option value. To analyze this parameter, Figure 4 displays the values of the earn-out variants defined above as a function of the EBIT volatility.

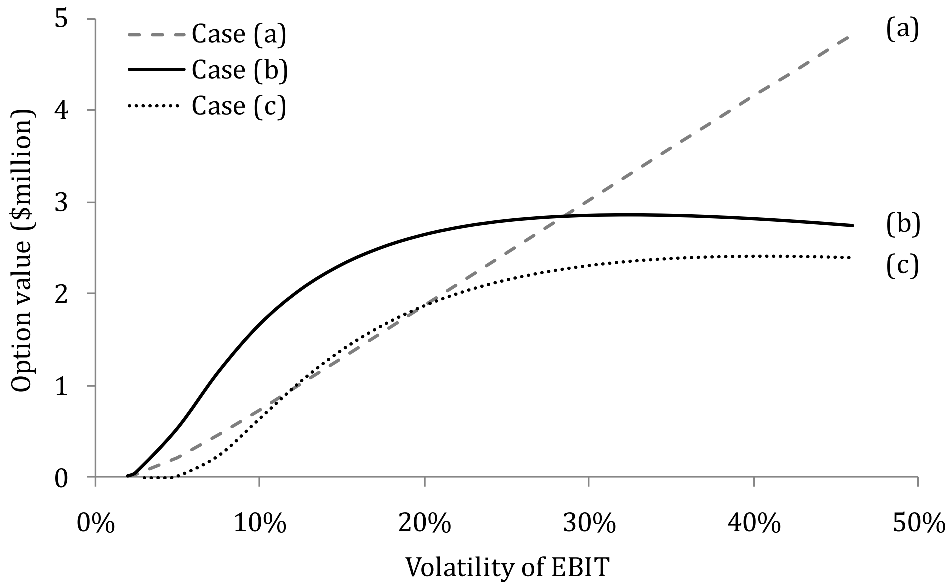

Figure 4: Earn-out option value for different EBIT volatilities

As can be seen in Figure 4, the uncertainty regarding the future EBIT significantly impacts the earn-out value in all three cases. While for (a) the value monotonically (almost linearly) increases with greater volatility, the earn-out value for case (b) slightly decreases from a certain volatility level. We see a similar pattern for (c). In contrast to plain vanilla financial options, where the option value always increases with the volatility, for earn-out options the direction is ambiguous and depends on the actual earn-out variant. However, we can summarize that the relative importance of the earn-out tends to increase as the uncertainty regarding the underlying measure of performance increases.

6. Summary and Conclusion

Earn-out clauses can help bridge the gap between buyer and seller and thereby facilitate a transaction. Particularly in times of high uncertainty with regard to the future prospects of a company, such clauses resolve differing expectations and asymmetric information between the parties involved in the transaction.

We present an easy-to-implement model for the valuation of earn-out clauses, which can be applied to different earn-out variants. The model allows for a quick estimation of the earn-out option value leaving only a few parameters to be estimated. The two parties can also use the model when structuring the purchase to estimate the value impact of different earn-out variants. In evaluating the model results, it is important to take into account the restrictive assumptions of the underlying option pricing theory. Given these limitations, the model value can be one criterion among several that buyers and sellers can use to determine a transaction’s merit and decide whether to proceed with the transaction.

Appendix: Detailed Calculation for the Case Study Examples

Case (a): Formula (5) is used for the valuation, where $\alpha = 0.5$, $K = \$10{,}000{,}000$ and the time to maturity takes values from $T = 1$ to $T = 4$. Applying the parameters stated in Table 1, we first calculate the expected value $E^Q[X_1]$ of the underlying X at time T = 1(first option) under the risk neutral probability measure using equation (4):

$$E^Q[X_1] = \$10{,}000{,}000\ \mathrm{e}^{(0.05-1{,}2\times(0.09-0.03))\times 1} = \$9{,}782{,}402.$$

By calculating d_1 and d_2 according to

$$d_1 = \frac{\ln\left(\frac{\$9{,}782{,}402}{\$10{,}000{,}000}\right) + \frac{1}{2}\times 0.25^2\times 1}{0.25\times\sqrt{1}} = 0.0370,$$

$$d_2 = 0.0370 - 0.25\times\sqrt{1} = -0.2130$$

we are able to obtain the value of the first earn-out option for $T = 1$ (see equation 5):

$$EO = 0.5\times\big(\$9{,}782{,}402\ \times N(0.0370) - 10{,}000{,}000\times\ N(-0.2130)\big) =\ \$\mathbf{439{,}465}.$$

The cumulative standard normal distribution $N(\cdot)$ can be evaluated, for instance, in Microsoft Excel by using the function NORMDIST.

The option values for T = 2, 3, 4 can be obtained analogously.

Case (b): The valuation of the long call (strike price K = \$10,000,000) and the short call (strike price K = \$12,000,000) is done by applying the same methodology as for case (a). Note that the time to time to maturity is $T = 3$ and the parameter α equals 5 for both options. We obtain \$6,794,579 for the long call and \$3,990,297 for the short call.

Case (c): Equation (8) is employed to value the binary „cash-or-nothing" call option with strike price K = \$12,000,000 and payment B = \$10,000,000 (if the EBIT after three years exceeds the strike).

Again, we start by calculating the expected value $E^Q[X_3]$ of the underlying X at time T = 3 under the risk neutral probability measure using equation (4):

$$E^Q[X_3] = \$10{,}000{,}000\ \mathrm{e}^{(0.05-1{,}2\times(0.09-0.03))\times 3} = \$9{,}361{,}309.$$

By evaluating the formula for d_2,

$$d_2 = \frac{\ln\left(\frac{\$9{,}361{,}309}{\$12{,}000{,}000}\right) - \frac{1}{2}\times 0.25^2\times 3}{0.25\times\sqrt{3}} = -0.7900,$$

we obtain for the binary call:

$BC = \$10{,}000{,}000 \times N(-0.7900) = \$\mathbf{2,147,696}.$