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Time Value of Money: A Case Study
by T. Senechal

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Time Value of Money: A Case Study

By Thierry Sénéchal*

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Time Value of Money: A Case Study

1. Background

In this article, we wish to examine the possible methods of adjusting the value of damages to reflect current day monetary values. The main question is: What reasonable rate of interest accruing from the date of loss needs to be applied to account for the passage of time? Thus the principal aims of the article are: (1) to identify standards from the fields of economics and finance that may be employed to achieve this purpose; (2) to recommend the most appropriate financial basis on which the actualization may be carried out; and (3) to formulate arguments to support the recommended financial through a case study.

In the following pages, we distinguish between the use of compensation ("prejudgement" or "pre-award") interest, the interest that is used to account for the lapse of time between the original injury and the arbitral award, and the use of moratory interest, often referred to as "post-judgment" or "post-award interest" because it is related to the delay in acting upon the judgment or award. Our main concern has been to present this complex material in a manner that is readily understood. An article such as this is intended to stimulate thought. As a result, we have chosen to illustrate our analysis by a concrete case study.

2. Setting up the context for our case study

An expert has been appointed by an arbitration tribunal as a neutral expert over an investment dispute in the Oil & Gas sector. Claimant and Respondent were co-contracting parties of a so called Service Agreement since 1st January 1994. The Respondent unilaterally terminated the Service Agreement as of 31 December 1997 invoking its invalidity due to its alleged character as an entrepreneurial contract not approved by the Respondent's general shareholders' assembly. The Claimant disputed the validity of this unilateral termination and by the request for arbitration sought declaratory relief as well as damages. The claimant is based in the UK and the operations under the Service Agreement are mostly conducted in the UK. The scope of work for the expert involved the estimation of the aggregate value of damages (lost of profits) suffered by the Claimant as a result of the termination of a Service Agreement by the Respondent.

The Arbitral Tribunal agreed on a final award at the end of 2006 for the amount of Pound Sterling (GBP)120,000,000. This valuation is done on the basis of GBP at the time of termination of the Service Agreement, which is 31 December 1997. Then, the

Tribunal asked the expert to adjust the amount from the date of injury (end of 1997) to the date of the arbitral award (end of 2006). At this stage, it is asked to do an analysis of what should be the compensation interest and present the options available to the Arbitral Tribunal. The question is drafted as follows: "Does the Expert's knowledge and experience provide methods to recommend, in the light of economic and financial considerations, any precise interest rate(s) in a founded way regarding the adjustment of the award calculated on a 1997 valuation basis to present value and, more precisely, to the date of 31st December 2007, as instructed by the arbitration tribunal?"

3. Methodology rationale

It is a standard business practice to charge interest to people and organizations willing to give up the temporary use of their money. The concept of interest dates back to the Sumerian and Egyptian cultures. Not surprisingly, references to the concept can be found in the religious text of the Abrahamic religions such as the counsel against excessive interest. As we will argue in the following pages, it should be mentioned at this stage that, in the investment world, interest is rarely equivalent to the rate of inflation.

Interest should be considered as an amount due or paid for the temporary withholding of money, bearing in mind that the investor has always a certain risk profile in mind when making the investment decision. The level of political, economic, business risks to be undertaken by an individual investor is indeed a matter of preference. As a result, an investor is right in asking for a rate of return commensurate to the risk undertaken. As such, it can be easily argued that risk-free rate does not exist since even the safest investments carry a very small amount of risk.

3.1. Basic principles

Before developing our case study methodology for adjusting the award to a value at the end of 2006, we review a few principles:

- **Date from which interest may run.** It is crucial to determine the period over which the interest will run. A fundamental question has to be asked regarding the exact date of loss, which can be difficult to estimate in some circumstances, i.e. in the context of a business interruption claim, the loss taking place over different periods of time.

- **Date on which interest ceases to accrue.** In the case of compensation interest, this date is often assimilated to the date of the final award. Other options are available, i.e. the closure of the arbitration determining the claim. Once the two dates described above have been established, it is possible to precisely define the period of reference for application of the interest. In our case, the period extends over 31 December 1997 and 31 December 2006. Without clear determination of this period, it is impossible to run a actualization simulation.

- **Real versus nominal interest rates.** Above, we have argued that the inflation rate should not serve as a proxy for deriving the interest rate. However, it was also noted that the interest rate to be used in adjusting to present day value should have inflation embedded. Please note that real interest rates include only the systematic and regulatory risks and are meant to measure the time value of money (Real rates = Nominal rates minus inflation). On the other hand, the nominal interest rate disclosed by financial institutions already includes the inflation factor, plus the time value of the money itself. The real interest rate is often assimilated as the rate of return on a risk free investment, such as US Treasury bills, minus an index of inflation, such as the CPI.

- **Simple interest versus compound interest**. One of the most difficult issues confronting an Arbitral Tribunal is whether to award simple or compound interest. There is no real international consensus in arbitration as to whether or not interest should be awarded on a simple or compound basis. Still, in the finance world, compound interest is the international standard applied in most time value applications. This type of interest computation is determined on the principal and any interest earned over a period of time. Compound interest differs from simple interest in that the principal balance grows by the amount of interest earned in past periods depending on the stated compounding period (See below). In the simple interest scenario, the interest that accrues each period is not added to the base that is used to calculate interest in future periods. Let's take an example. We want to calculate the interest on USD10,000 at 6% interest per year after 5 years. The formula we'll use for this is the simple interest formula, or:

$$I = P\ r\ t$$

Where:

a. P is the principal amount, USD10,000
b. r is the interest rate, 6% per year, or in decimal form, 6/100=0.06
c. t is the time involved, 5 year time period

To find the simple interest, we multiply 10000 × 0.06 × 5 to get that the interest is: USD3,000. Usually now, the interest is added onto the principal to figure some new amount after 5 years or 10,000 + 3,000 = 13,000

For illustration, the following table shows a final principal amount, after 5 years, of an initial investment amount of USD10,000 at an annual 6% interest rate, with the given compounding periods. As is shown, the various methods of compounding over a one-year period have little effect when using monthly, daily or continuous compounding.

Rate = r	**6,00%**
Principal (P)	**10 000**
Duration (Y: years)	**5**

Periodic compounding P(1 + r/n)Yn						
1	2	4	12	52	365	Pe^{Yr}
Yearly	Semi-annually	Quarterly	Monthly	Weekly	Daily	Continuous
13 382	13 439	13 469	13 489	13 496	13 498	13 499

- **Compounding period.** As shown in the above table, different options are available (annually, quarterly, monthly or daily are the most common options). The choice of the compounding period is crucial. The shorter the compounding period, the faster the principal amount will grow. All other things being equal, compound interest has also a larger effect as the time period increases and as the interest rate increases. There are no prescribed standards for choosing one particular compounding period over another. The following practice can be of some help to determine the compounding period:

    a. Bonds are often compounded on a yearly or semi-annual basis. Corporate bonds are most frequently payable on the semi annual basis. The amount of interest paid (each six months) is the disclosed interest rate divided by two (multiplied by the principal), the yearly compounded rate being higher than the disclosed rate.

    b. Mortgage loans are generally referring to semi-annual compounding (but sometime the monthly compounding basis is used, i.e. in the US market).

    c. Most financial institutions worldwide award interest on a daily (and sometimes bi monthly) compounded basis for money on deposit.

    d. Continuous compounding is not widely used. In financial engineering, the valuation of derivatives may use continuous compounding, which is the limit as the compounding period approaches zero.

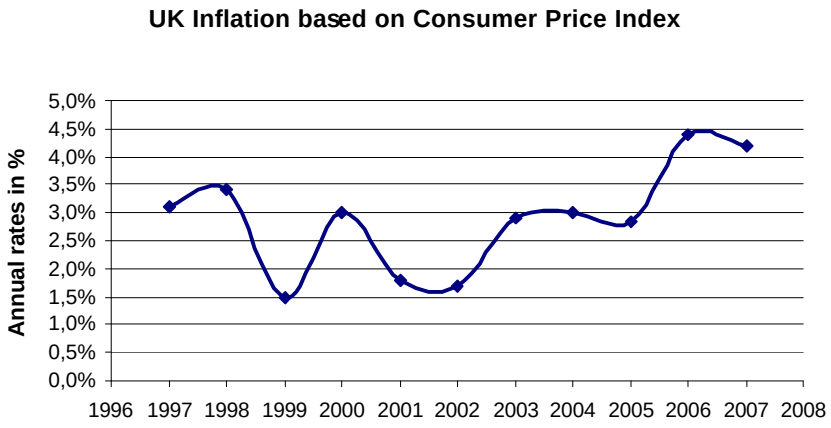
- **Interest rate parity and foreign currency adjustment.** We should discuss the impact of foreign currency exchange rate. Generally speaking, to avoid any confusion, the arbitration tribunal should try, if possible, to calculate an award based on the currency and interest rate prevailing in the place where the harm has been caused. If it is not possible to do so, the theory of the interest rate parity could come to play a role and have an impact over the overall computation of the award, i.e. in the case of a loss valued in Euros and an award made in USD. According to interest rate parity the difference between the interest rates paid on two currencies should be equal to the differences between the spot and forward rates. If interest rate parity is violated, then an arbitrage opportunity exists and it should be taken into account. The rule can be as follows: When the parties do not operate in the same market and currency, we advise to compute the loss in the Claimant's currency (assuming that the loss is claimed for Claimant's country of operation in which the harm is made), apply an interest rate from that country or market and convert the final award into the appropriate destination currency only at the end.

3.2. Four options for selecting an interest rate

In the following paragraphs, we now introduce four concepts that may be used to derive the appropriate interest rate.

Option 1: Inflation as a proxy for the interest rate
Prices go up every year, so a claimant will seek to be compensated, at minimum, for that loss of purchasing power. This statement is obvious in the finance world. Without interest at least equal or above the inflation rate, lenders wouldn't be willing to lend, or to temporarily give up the ability to spend, and savers would be less willing to defer spending.

Let's take an example on how inflation rate are computed. For determining the UK inflation rate, we can refer to the UK Consumer Price Index (or CPI) based on a composite consumer price index showing changes in purchasing power between 1997 and today. The source of information is widely available and we can use, for instance, a composite price index for analysis of consumer price inflation, or the purchasing power of the pound, over long periods of time. The CPI is a statistical measure of a weighted average of prices of a specified set of goods and services purchased by wage earners. It is an index which tracks retail prices of a specified set of consumer goods and services, providing a measure of inflation. The CPI is a fixed quantity price index and effectively represents a cost-of-living index. The index is based on both official and unofficial sources and, in our case, it replaces previous long-run inflation indices produced by the Office for National Statistics, the Bank of England and the House of Commons Library. In the following graph, we show fluctuations in the CPI over the period of reference for our case study.



We do not recommend using inflation itself as a proxy of interest rate. One major drawback of an inflation-based method is its vulnerability to macroeconomic shocks and turbulence, i.e. devaluation and exchange rate exposures. Such turbulence can impact inflation and interest in different proportions. Furthermore, in the investment world, interest is rarely equivalent to the rate of inflation. An individual who invests money for repayment at a later point in time expects to be compensated for the time value of money, or not having the use of that money

while it is invested. In addition, the investor will want to be compensated for the risks undertaken in making the investment, Therefore, the investor should not only be compensated for inflation risks but also for systematic and regulatory risks. Such risks include the possibility of default or inability to fulfil the originally agreed upon terms.

Having said all that, we can easily conclude that the inflation-based approach is flawed for the following reasons: 1) Inflation is a monetary phenomenon not related to interest rate policy only. In fact, inflation is influenced by the relative elasticity of different variables, including wages, prices and interest rates; 2) Consumer price indices (CPIs) which measures the price of a selection of goods purchased are not always representative; and 3) Inflation in itself does not account for the time value of money.

Option 2: The cost of capital and borrowing rate as a proxy for the interest rate

Some experts or lawyers may be tempted to propose that the appropriate interest rate for adjusting an award to present day value could be derived from the Claimant's cost of capital or internal borrowing rate. We are not recommending using the cost of capital or the internal borrowing rate for adjusting an award to present day value. The cost of capital is defined as the return that needs to be earned by a firm in order that the financial markets be prepared to invest in that firm's security. It is not appropriate to use the cost of capital because such rate reflects the average of the cost of equity and debt of individual companies or projects weighted according to their relative contributions. The cost of capital is a measure used for discounting investment cash flows on specific projects and for pricing of products. Furthermore, most of the cost of capital models are constructed on the assumption that financial market are dominated by rational, risk-averse investor, who seek to maximise satisfaction from return on their investment. Other cost of capital assumptions may include that the market is efficient, frictionless, and without imperfections like transaction costs, taxes and restrictions on borrowing and short selling. In addition, it assumes that investors base their judgment on a common time horizon. Clearly, in our case, the interest rate to be proposed cannot be based on such assumptions.

The Claimant or Respondent's borrowing rate is not appropriate as well. The reasons are as follows. First, it is sometimes difficult to estimate the borrowing rate or cost of debt for a particular company. The 'total debt' ratio of a firm is defined as the ratio of short-term and long-term debt, finance leases and preferred stock to the value of the firm (Market capitalization plus book value of debt). In other words, the cost of debt is equivalent to the risk-free rate plus a margin that reflects the credit and market risk of the debt issued by a company. This market risk of debt is often difficult to estimate and depends on many assumptions and variables that could lead to arbitrary results. Second, there is no international standard to arrive at a precise figure for the cost of borrowing. Three methods can be suggested to estimate it:

- Method 1: The first method would consist in taking into account the observed interest margins payable over the risk-free rate over the years, average them, and add them to the risk-free rates in each year that debt finance is raised. However this is not so straightforward because it is indeed cumbersome to apply a series of different risk-free rates to individual borrowings according to the years in which they are made.

- Method 2: The second method would consist in finding the cost of debt capital based on bond ratings for each of the selected firms. Then the cost of debt can be found by assuming an average debt profile for the company under review and getting an average rating. The average rating is indeed difficult to estimate in some cases and, when information is lacking (i.e. because the firm is not publicly trade), it is necessary to estimate the borrowing spreads by comparing corporate issues of similar standing.

- Method 3: An intuitive - but not absolutely accurate - method would consist in obtaining the ratio of finance charges over the total (or net) debt for similar individual firms over a period of time and then get an weighted average. However, this method can only give a crude approximation of the borrowing rate: Using book value for finance charge is a risky business especially when firms are involved in 'creative accounting'. Furthermore, such measure doesn't make the difference between short-term and long term debts or doesn't take into account the different risk-free rates in each year that debt finance is raised. Interest charge on zero-coupon bond would also not appear on the balance sheet of the firms.

Having said all this, we do not recommend using the borrowing rate as a benchmark.

Option 3: Risk free rate of return

At minimum, the rate of interest to be used for adjusting the award to present day value should is equal or above the risk-free rate. This rate represents the interest an investor would expect from an absolutely risk-free investment over a specified period of time. It usually includes inflation. In theory, the risk-free rate is the minimum return an investor expects for any investment since he or she would not bear any risk unless the potential rate of return is greater than the risk-free rate. The question becomes: How to obtain the risk-free rate? First, it should be noted that, in practice, the absolute risk-free rate does not exist since even the safest investments always carry a very small amount of risk, including the UK Gilts or the US Treasury Bill.

Second, in terms of methodology, the risk-free rate of return should be assessed on a forward looking basis to reflect returns which investors could obtain in the market. The appropriate maturity to consider for the risk-free rate should equal the investor's investment horizon for the risk bearing asset. Generally speaking, it is wise to use conventional medium term yield to maturity on government securities (e.g. Treasury bonds) in the country of reference. The advantage of this is that

with government securities, default risk is relatively low. It is important to choose the appropriate interest rate (risk-free) by reference to the period of applicability of the interest. For instance, for adjusting an award to present day value over 10 years, one may choose a ten-year Treasury note.

Option 4: Interest as the opportunity cost
It would be correct to assume that the award of interest be envisaged at the opportunity cost for the claimant. This argument is based on the assumption that the claimant could have invested the foregone resources elsewhere in order to earn a similar rate of return. This concept is based on the premise that an investor prefers to receive a payment of a fixed amount of money today, rather than an equal amount in the future, all else being equal. The theory is also based on the premise that investors should earn incremental returns on their investments that are proportional to the amount of additional risk those investments add to their portfolio. The amount of additional risk is measured relative to the return on a risk-free asset (e.g., long-term, highly-rated government bonds), and the return on the equity market as a whole. Indeed, the amount invested with the respondent could have been deposited in an interest-bearing bank account (instead of being invested) or in projects of the claimant's business to yield interest.

4. Finding the correct interest for our case

With the above caveats in mind, and the context provided on our case, we are now proposing a methodology to arrive at a reasonable rate of return accruing from the date of loss. We have first estimated a rate based on a risk-free instrument (the UK Gilts) and then added a risk premium to account for the risk profile of our investment. This is a standard method to account for the time value of money and it does not involve too much speculation and judgmental calculations.

We are also rejecting the notion of simple interest on the grounds that 1) the finance industry is barely using such approach and prefer compounding interests on all financial instruments and 2) awarding simple interest is assuming that interest cannot be re-invested (Simple interest is the interest calculated on the original amount only while compound interest is the interest calculated on the sum of an original amount plus the previous interest).

We propose the following approach:

Step 1: Determining the period of reference
In our case, the date from which interest run would be 1st January 1998, the day following the date of breach of the Service Agreement. We assume that the date on which interest ceases to accrue is the date of the award (31 December 2006). In our case, our period of reference for making the calculation extends over 9 years.

Step 2: Determining the country and currency of reference
In our case, the Service Agreement is related to operations and investment opportunities taking place in the UK. As a result, it is decided to compute the quantum in GBP as of 1st January 1998.

Step 3: Analysis of the term structure of interest rate

It is important to look at the term structure of interest rate in the country under study. The modern fixed income market includes bonds and all kinds of financial securities sensitive to market and business conditions. This is why the term structure of interest rates is rarely flat over time. If interest rates varied over the time period under consideration, then this would also impact on the final total award, making it possible to estimate an over estimated award under the compound rule if, for example, lower interest rates applied at some points in time than others. In an environment which does not show continuity in the financial system as a whole, we may safely argue that different interest rate may apply to different periods of time. As a result, we may decide to adopt an average interest rate for the period of reference. If the term structure of interest rate is flat over the period of reference, we may choose any point on the curve without creating any problems.

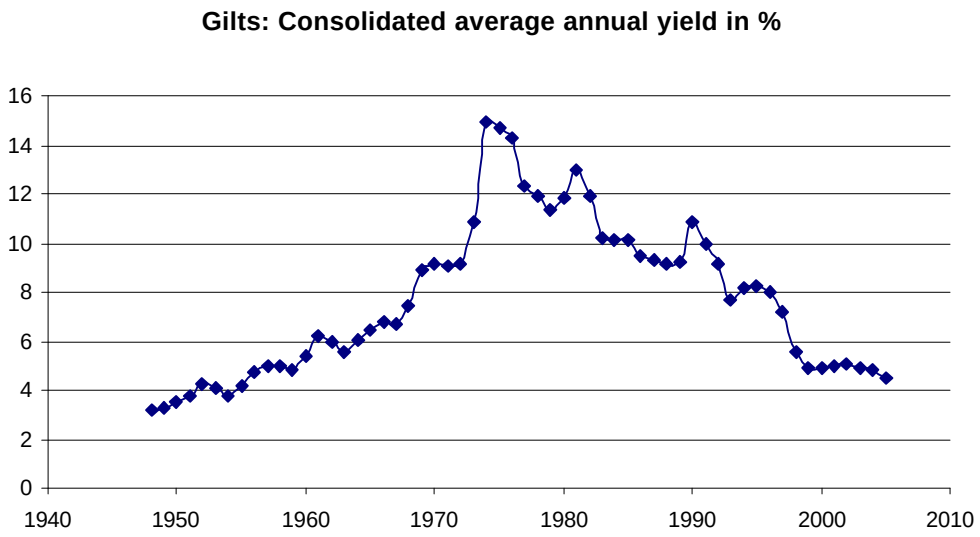
Step 4: Interest rate determination

The question of which rate to use is important. Interest rates can vary a lot from one instrument to the other, depending if they are short-term or long-term. Clearly, as we have seen in the earlier section, there is a wide variety of options available to the Arbitral Tribunal. It should also be mentioned that many different instruments carry different rates: Inter-bank rates; demand, savings and time deposits; bonds; equities; managed accounts; loans and mortgages; etc.

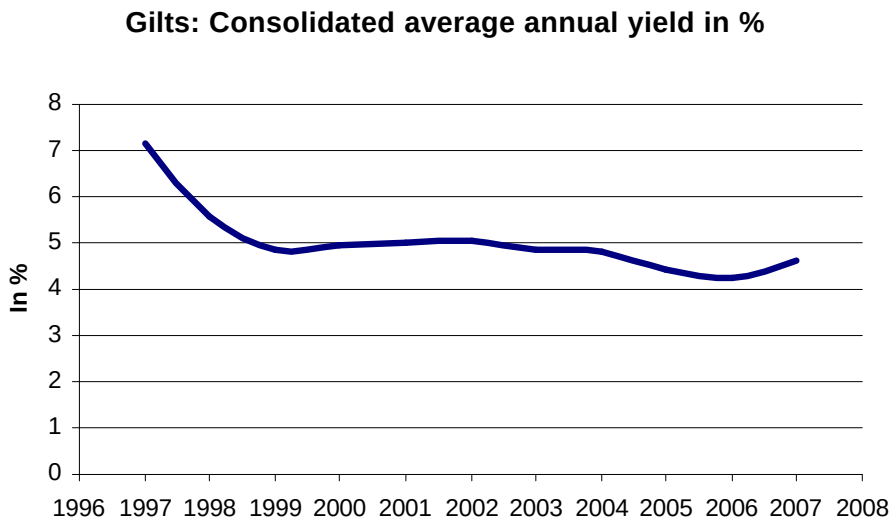
We propose to use a rate derived from a risk-free instrument to which is added an average market risk premium. Such rate would include all risk factors (systematic, regulatory, and inflation), plus the time value of the money itself. A risk-free rate represents the rate of interest an investor would expect from an absolutely risk-free investment over a specified period of time. Such a rate is made up of the inflation rate plus the minimum additional level of return required by an investor.

For instance, gilts refer to UK Government bonds, that is, all types of government coupon bonds. UK government securities are known as ‘gilt-edged’ bonds or simply ‘gilts’. They are widely regarded as one of the safest bond investments because they are backed by the UK government. The British gilts market is one of the most liquid and well-organized government bond markets in the world and, as such, it could be found suitable for use as a proxy to derive an appropriate rate of return.

The Gilts rate can be found for long periods of time as illustrated in the following graph.



However, we are interested to determine the rate on only our period of reference. From UK gilt market data between 1997 and 2007, we obtain a consolidated average annual yield of 4.86% for the period of reference. We could have equally proposed to use a LIBOR rate, the LIBOR being a daily reference rate based on the interest rates at which banks offer to lend unsecured funds to other banks in the London wholesale money market. The average LIBOR rate on our period of reference is 4.03%.



As said earlier, investors expect to earn incremental returns on their investments that are proportional to the amount of additional risk those investments add to their portfolio. In our case, the Claimant had not decided to hold its cash into relatively 'safe' investments, such as cash, index linked bonds or conventional bonds held to maturity. Instead, he had entered into an investment contract with expectation of higher returns. The "amount of additional risk" is measured relative to the return on a risk-free asset (e.g., in our case the UK Gilt market). In our case, we propose to add a market-risk premium on the rate derived above (4.03%). The question is: How to

derive such a premium? We argue that the expected market risk premium is the difference between the risk-free rate and the market-risk (Rm-Rf). The extreme volatility of the stock and bond markets makes long measurement period essential. Therefore, this risk premium must be a historical average of the excess of the market return over the risk-free rate.

For instance, the London Business School has estimated risk premia in the UK at around 4.5% (geometric mean of risk premia relative to Bills). We do not intend to cover in great details the technical aspects of deriving the risk premium and we refer to the excellent study done by London Business School (Global Evidence On The Equity Risk Premium, Dimson, Marsh, Staunton, 2002). Different institutions provide their statistics and analysis of risk premium, mostly for equity risk premium.

In our case, we conclude that the interest rate would be: 9.36% (Risk-free rate of 4.86% + market-risk premium of 4.5%). We must admit that this rate is above quoted rate in the UK for deposits or bonds. But again, we should recognize the lost opportunity cost or loss of return and the fact that the value lost could otherwise have been used during the course of the years in similar investment with identical risk profile.

Step 5: Simple or compounding interest

Compound interest is an international standard applied in most time value applications. As we explained in the earlier section, compounding can be calculated according to a wide range of options, from a quarterly or a bi-weekly basis to a continuous basis. The shorter the compounding period, the faster the principal amount will grow. Most financial institutions worldwide award interest on a compounded basis for money on deposits. There is no prescribed standard for choosing one particular duration over another. All other things being equal, compound interest has a larger impact as the time period increases and as the interest rate increases. Over a long period of time, say 20 or 30 years, the choice of the compounding rest period would lead to greater impacts.

In the following table, we summarize the present day values that we obtained from the different compounding approaches. The final award of GBP120,000,000 has been actualized from 1st January 1998 to 31 December 2006 by using the rate of 9.36%.

Rate = r	**9,36%**
Principal (P)	**120 000 000**
Duration (Y: years)	**9**

Periodic compounding P(1 + r/n)Yn						
1	2	4	12	52	365	Pe^{Yr}
Yearly	*Semi-annually*	*Quarterly*	*Monthly*	*Weekly*	*Daily*	Continuous
268 477 417	273 355 677	275 940 916	277 722 765	278 421 038	278 601 863	278 631 952

5. Conclusion

In international commercial and investment arbitration, the charging of interest is now a well-established component of compensation. The charging of compensation interest is logical. A failure to adjust values between the date of the loss and the date of the award would be contrary to the well established international principle that compensation must be full. As a result, it is not rare for the tribunal and the expert to have to adjust the award to present day value over long period of time, three, five, ten years and sometimes much more.

Although we must admit that there is a line of arbitral authority that has generally awarded simple interest, we strongly advocate to revert to compounding, which is the standard in the financial community. Indeed, the adoption of compound interest reflect the majority of commercial realities in that a loss of value incurred by a company, active in normal trading operations, implies the loss of use of that value. Not recognizing this reality would lead to awarding a windfall to the Respondent.

We have also argued that it is not correct to use inflation as a proxy for interest rate. The risk-free rate can serve as a basis to determine the final interest rate but we do not suggest adjusting awards to present value by using a risk-free rate. We advocate adding a market risk premium on the top of the risk-free rate to account for the lost opportunity cost and the risk profile of the original investment.