VALUE CREATION AT ANHEUSER-BUSCH: 
A REAL OPTIONS EXAMPLE

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The history of Anheuser-Busch (BUD) is one of innovation and success. Dating back to 1875, BUD has grown from being merely one of 22 brewing companies in St. Louis to its current position of market dominance. The annual return to the company’s stockholders averaged 16.4% between its listing in 1972 and the end of 1999, as compared to a return of 10.6% for the S&P 500.¹

What makes BUD’s stock market performance particularly remarkable is the fact that there has been no real growth in the company’s product market: from 1990 to 2000, the domestic demand for beer has been essentially flat. Furthermore, as of 1996, only about 5% of BUD’s volume beer sales were outside the U.S. (5.1 million barrels foreign

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¹ Source: Center for Research in Securities Pricing, University of Chicago.
out of 96 million barrels worldwide). Yet 1996 marked the beginning of a period of substantial value creation for the company. Between 1996 and 1998, BUD’s invested capital grew by about $1.9 billion, while its enterprise value grew by around $13.4 billion.

How did BUD create $11.5 billion in market value added over only three years? Using data from Stern Stewart & Co.’s annual publications, we estimated the value of BUD’s “assets in place” (the capitalized present value of its current EVA) and the value of its “growth options” between 1996 and 1998. Our estimates are shown in the table under Figure 2. ²

![Figure 2: Anheuser-Busch Enterprise Value](image)

Over the period, the value of BUD’s assets-in-place grew only slightly in excess of invested capital – an observation that reflects the low growth in BUD’s existing market. The real value creation is found in the company’s generation of nearly $10

² The data for these calculations come from Stern Stewart & Co., which estimates the firm’s yearly EVA, MVA, WACC and invested capital. The assets-in-place value is capital invested plus the present value of EVA’s taken in perpetuity (using the WACC as the discount rate), and the growth options value is MVA minus PV of EVA. Enterprise value is capital invested plus MVA.
billion worth of growth options. What are these growth options, and how did the company create them so quickly?

A NEW BUSINESS MODEL

In the mid-1990’s, the management of Anheuser-Busch made a decision to sell some businesses (snack foods, the St. Louis Cardinals baseball franchise, and Busch Stadium in St. Louis) and focus its investment activity on “core” products. A substantial part of that strategy was the purchase of minority interests in brewing concerns in markets with growing demand for beer: Mexico (Grupo Modelo), Brazil (Antarctica Empreendimentos e Participacoes, or ANEP), Chile and Argentina (Companhia Cervecerias Unidas, or CCU), and the Phillipines (Asia Brewery, Inc.).

Most of these foreign investments followed a particular pattern. BUD would inject a few million dollars into the foreign company in exchange for a small equity stake. BUD and the local company would then form a joint venture (JV), and the local company (with the technical help of BUD) would brew and distribute Budweiser-family products while the JV (under the direction of BUD) would market the product.

It is hard to believe that the management of Anheuser-Busch could create billions of dollars of shareholder value by simply speculating on very small equity stakes in foreign breweries. BUD could obviously offer financial and human capital needed for production and distribution improvements, but one would expect the gains to be shared with the company’s venture partners. Furthermore, other well-known beer companies from Europe were also expanding into Latin America, Asia and Eastern Europe; in fact,
major European brewing concerns were establishing joint ventures with some of the same South American companies.

Why would BUD want to buy small equity stakes in markets where the risks were very high and the payoffs uncertain? We view the equity purchase/JV strategy as a technique for creating real options on larger scale investment in these foreign countries, and we believe that a substantial portion of the $11 billion growth option value achieved by BUD can be explained by their creation of these options.

HOW FOREIGN EQUITY INVESTMENTS CREATE “REAL OPTIONS”

In order to grow, BUD had to turn to markets where beer demand is expected to increase. One alternative would have been for BUD to enter a foreign market by buying and/or building out a complete brewing and distribution system. But such a strategy is very risky due to the huge amount of capital that a new system would require. Specifically, the buildout of a new brewing, packaging and distribution business would have cost as much as $2 billion (in 1995 to have given BUD a significant share in a geographic market like Argentina/Chile.3 Demand for a BUD product (or any new premium beer product, for that matter) would be tied to both consumer taste and economic conditions, and anything but strong acceptance could result in value destruction.

But BUD has found a way to limit its downside risk. By undertaking the equity/JV endeavor, BUD has given itself the ability to learn about the individual foreign beer markets in general, and the demand for premium BUD products specifically, before

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3 Source: Casewriter’s estimate.
committing huge sums of capital. In other words, the equity/JV investments have given BUD’s management the ability to refine their understanding of these markets and the flexibility to condition their investment strategy on what is learned.

Take, for example, BUD’s $4 million investment in return for a 4.4% stake of CCU in Argentina in 1996. For a very small sum of money, BUD has been allowed to “test the waters” and see whether or not the Chilean/Argentine market is worth a multi-billion dollar capital investment. As we will show below, the ex-ante NPV of a brewing/distribution facility in Argentina and Chile was probably negative in 1995. Nevertheless, the equity/JV investment may have created value many times its cost, due to the flexibility that it produced.

As illustrated by the diagram in Figure 3, the equity/JV investments have given BUD the right to spend the large sum of capital only if it appears valuable to do so. BUD can gauge the demand for its product, the price BUD will command, the cost of doing business, etc. before making the investment decision. So graphically, BUD’s strategy has a future payoff that looks like that shown in Figure 4:
This is, of course, the payoff diagram of a call option. In this sense, BUD’s “learning” strategy can be viewed as a call option on a fully-developed brewing/distribution business in the Argentina/Chile market, with a strike price equal to the required capital investment. By investing in CCU, BUD can learn the 2002 value of the business before making the investment decision. Thanks to the 1995 investments, BUD now has the right, but not the obligation, to invest several billion dollars in Argentina and Chile in 2002.

So we can estimate the value of BUD’s new Argentina/Chile strategy by valuing the option that the CCU JV has created. As we will show below, the value of the strategy is substantially greater than the $4 million cost of the equity stake in CCU even under very conservative assumptions.

THE REAL OPTION ON THE ARGENTINA/CHILE MARKET

We’ve done this analysis as best we can using public data (SEC filings and media reports), but the reader should be cautioned that the assumptions are rough and
(admittedly) uninformed estimates. Our point is not to place a specific value on BUD’s investment in CCU, but rather provide a framework that explains some of the recent value creation in the company and gives the reader a general outline of how one approaches these types of valuation problems.

The first step in working through any real option valuation is determining what the underlying asset actually is, and then determining the value of that asset if we were to commit to the investment immediately. The underlying asset is always what you get if you exercise the option. Here, exercising the option is the act of building out complete and full-blown brewing and distribution capacity in Argentina. So the underlying asset is a fully-built brewing and distribution business in Argentina.

We will need to make some assumptions about the timing of the future investment decision and about the future cost of building out a full-blown brewing and distribution operation. The JV agreement allows BUD to increase its investment in CCU to 20% by the end of 2002. We view this as a clue provided by BUD’s management about the expected amount of time required to learn about the Argentine market, and hence we set the exercise date on the real option at 2002 (or seven years out).

This implies that the underlying asset is a fully-built brewing and distribution business in 2002. But, in order to place a value on the real option, we need to know the value of the underlying asset as of 1995 – the date that the option is initiated. To do this, one simply asks the following question: if BUD were to have committed, in 1995, to exercise the option in 2002, what would have been the present value of the business?

What this calls for is a static discounted cash flow (DCF) analysis, which we present below. To avoid complications involving nominal cash flows in Argentine
Pesos, we’ve decided to perform the analysis in nominal U.S. Dollar terms. The first step was to calculate the PV of operating cash flows expected to be generated by the new enterprise in 2002, using only the information known in 1995. The second step was to discount this 2002 value back to 1995 using the appropriate cost of capital.\(^4\)

If investment were made in 2002, we assumed that the initial facilities would take one year to build, and distribution of the product would begin at that time. Production would grow quickly through 2005 as more facilities would be added. The complete strategy would take until 2013 to complete, and we estimated the 2002 nominal present value of the entire fixed capital commitment would be $2.5 billion. Working capital requirements were estimated to be 6% of sales, based on BUD’s existing US operations.

1995 beer sales in Argentina totaled 10,151 thousand barrels (BUD’s standard unit of measurement). Volume demand for beer was expected to grow at a 2.4% rate per year indefinitely. The 1995 price of BUD’s Argentine product was estimated to be $135.37 per barrel, which is based on actual 1995 prices for CCU products with a 15% premium added -- and this price was estimated to rise at 3% per year.\(^5\)

Given what BUD knew in 1995, a new brewing operation would sell an estimated 400,000 barrels in Argentina in 2003. Sales were estimated to follow a three-stage growth model, with increases of 116% per year in 2004 and 2005, then 15% per year through 2013, and at the market growth rate of 2.4% per year thereafter.

\(^4\) It is very important to perform the analysis only using the information that BUD had as of 1995. These should be unconditional estimates: that is, they must simply describe the situation in which BUD would expect to find itself if it immediately commits to the 2002 investment. They should not be “success path” estimates, or estimates of the value of the business conditional upon the actual exercise of the option.

\(^5\) We assumed that BUD would price its product as a premium brand. According to industry reports, BUD is “breaking with its American marketing strategy as the beer of neighborhood taverns and aiming to become the beer of sushi bars and nouvelle cuisine restaurants in South America...”. *Wall Street Journal*, 2/20/1997, page B1.
Making these assumptions (and others listed in Table 1), we came up with a static valuation of the 2002 decision shown in Table 2.

### Table 1

#### Demand Assumptions
- 1995 Domestic Demand: 10,151
- Demand Growth Rate: 2.40%
- BUD 2003 Volume (000 bbl): 400
- BUD Growth % 2003 - 2005: 116%
- BUD Growth % 2006 - 2013: 15%
- Perpetual Growth Post 2013: 2.40%
- Price per Barrel (real 1995 $): $135.37
- Price Inflation Rate: 3.0%

#### % of Sales Op. Assumptions
- Cost of Goods Sold: 46%
- General and Administrative: 18%
- Working Capital Requirement: 6.0%

#### Investment Assumptions
- 2002 Cost of Asset: $2,500,000
- Depreciation Life of Asset: 25

#### Other Assumptions
- Tax Rate: 38%
- U.S. WACC: 9.9%

### Table 2

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<td>$171.48</td>
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<td>$198.80</td>
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<td>$339,518</td>
<td>$402,158</td>
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<td>$564,245</td>
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<td>259,552</td>
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<td>364,163</td>
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<td>61,113</td>
<td>72,389</td>
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<td>Operating Cash Flows</td>
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<td>72,062</td>
<td>113,780</td>
<td>127,762</td>
<td>144,323</td>
<td>163,939</td>
<td>187,175</td>
<td>214,698</td>
<td>247,299</td>
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<td>11,215</td>
<td>3,758</td>
<td>4,452</td>
<td>5,273</td>
<td>6,246</td>
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<td>Change in Working Capital</td>
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<td>5,041</td>
<td>11,215</td>
<td>3,758</td>
<td>4,452</td>
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<td>TV of Change in WC</td>
<td>4,116</td>
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<td>7,399</td>
<td>8,764</td>
<td>10,381</td>
<td>12,296</td>
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### Summary
- 2002 Fixed Capital Investment: 2,500,000
- 2002 NPV: -3,441
- 1995 NPV: -1,777
The interpretation of Table 2 is this: given what BUD knew in 1995, the Argentina/Chile project would not be value-creating in 2002 (in fact, it would destroy about $3.5 million in 2002 value, or $1.8 million in 1995 value). This is why the option is important: the small investment in CCU gives BUD the ability to observe the demand for BUD products before committing the billions of dollars of capital for brewing, packaging and distribution facilities.

The importance of this analysis is that it gives us the 1995 value of the underlying asset. The underlying, as noted earlier, is what you have if you exercise the option, and (in this case) that is a fully-operating brewing facility. So in a real options sense, the value of the underlying is the present value of the free cash flows from operations. And we would offer one caveat here: When calculating the value of the underlying, do not subtract the investment cash flows – those are accounted for in the strike price, and are paid only if the growth option is exercised. The 2002 expected value of the underlying is $2.497 billion; and when we discount that value back 7 years at 9.9%, the 1995 value of the underlying is $1.289 billion.

We’ve settled on two parameters of the option analysis so far: the starting value of the underlying asset ($1.289 billion) and the time-to-exercise of the option (7 years). The final items to estimate are the strike price on the option, the risk-free rate of return, and the volatility of the underlying asset. The strike price on the option, which will be incurred in 2002, is the capital commitment required in 2002 to build a entire facility. So this is the 2002 nominal $ value of the investing cash flows, or $2.5 billion (as mentioned earlier). Since we are working in US$ nominals, we assume a US$ risk-free rate of return of 7%.
The final piece of the puzzle is the volatility of the underlying. From the perspective of financial options, the volatility represents the magnitude and probability of changes in the true value of the underlying over a period of time. That is, we know the current value of the stock, but we don’t know its future value. As time goes by, we watch the value of the stock as it evolves and approaches its expiration date value. What is unknown a priori is the exercise-date value of the stock, and our expectation about this value is modeled as a process that “converges smoothly” on its final value as time passes. In stock options, the volatility estimate hence represents a probability distribution of how our knowledge of the terminal value of the stock can change from the beginning date until the exercise date.

The interpretation changes only slightly when dealing with real options. In the real options perspective, we don’t know the “true” current (1995) value of the underlying (a fully-built brewing and distribution facility); all we have is a noisy estimate ($1.289 billion). But as time goes by, we will learn progressively more about the true 2002 value of the asset, and our understanding of its value will converge to a point estimate as time approaches the exercise date (2002). Thus, in the real options perspective, the volatility parameter is a description of how much we don’t know, or how wrong our initial estimate could be.\footnote{Volatility is actually measured as standard deviation of \textit{returns}, or \textit{changes} in our understanding.} This is exactly why real options are valuable – they allow us to learn and so avoid big mistakes.

At this point, we will just use a volatility estimate of 35%; later on, after working through the valuation, we will give a heuristic interpretation of this volatility, along with a sensitivity analysis.

In summary, the assumptions that go into our call option valuation are as follows:
Starting Value of the Underlying $1,289,312,000
Strike Price $2,500,000,000
Time in Years 7
Risk-free Rate Per Year 7%
Volatility Per Year 35%

Since the BUD project can be viewed as a simple European Call, (i.e., having a single exercise date), we can use the well-known Black-Scholes (1973) formula for the price of an option. The Black-Scholes model for the value of a call option is

\[
C = S \cdot N(d_1) - X e^{-rT} \cdot N(d_2),
\]

where

\[
d_1 = \frac{\ln \left( \frac{S}{X} \right) + (r + \frac{\sigma^2}{2})T}{\sigma \sqrt{T}}
\]

\[
d_2 = \frac{\ln \left( \frac{S}{X} \right) + (r - \frac{\sigma^2}{2})T}{\sigma \sqrt{T}}
\]

and \( N(\cdot) \) is the cumulative unit normal density. \( S \) is the starting value of the underlying, \( X \) is the strike price, \( r \) is the annual risk-free rate of return, \( \sigma \) is the return volatility of the underlying, and \( T \) is the number of years until expiration of the option.

Substituting the parameters assumed above and using Microsoft Excel’s “=normsdist( )” function to evaluate \( N(\cdot) \), we find that the value of the option on the Argentina strategy is about $390 million, even though the static NPV of the strategy is negative. In other words, the small $4.4 million investment in CCU has created a business strategy with a 1995 value of around $390 million. The reason that this is so valuable in comparison with the “static” analysis is that BUD will invest the $2.5 billion after observing the true value of the enterprise.

\[7\] The authors do not recommend that practitioners use the Black-Scholes model. The Black-Scholes model gives a very precise answer to a very precise question (the value of a European Call), but does not provide the flexibility to address valuations where there are multiple options, sequential options, or timing decisions. Our preference is for the binomial model (as developed in most option pricing texts), as we find that very few real-world real options are simple European Calls. We use the Black-Scholes here to streamline the presentation.
This helps to explain a couple of things. First of all, a part of the *growth option value* that has been created by BUD arose simply because BUD management has been able to create real options that are worth more than they cost (here, the cost of creating the real option was only $4.4 million). Furthermore, as BUD learns more about the potential value of the Argentina/Chile business, the option value can change quite rapidly. Suppose, for example, that during the first two years of the JV, BUD learns that the 2003 estimated volume sales is 500 thousand barrels (rather than the 400 thousand barrels assumed in the original analysis). At that point, there would be five years remaining to exercise the option, and (holding all other assumptions fixed) the value of the underlying would be about $1.9 billion and the value of the option would jump to $632 million!

Before we move on, we would like to make one further point. A very common misconception among practitioners (and more than a few academics) is that a “strategic” option such as the one discussed above cannot be valued by standard option-pricing techniques because the underlying is an untraded asset, and hence a “hedge portfolio” cannot be formed. This objection is completely mistaken. The only economic assumptions necessary for legitimate application of option pricing techniques to non-traded assets are 1) that the financial market is arbitrage-free and complete, and 2) that the new corporate investment is not large enough to change aggregate consumption in a material way. These are the *same* assumptions that are required for value-maximization to be the appropriate goal of the firm and for the NPV rule to be the proper investment
criterion. In other words, the assumptions necessary for “real options” valuation are already being made in standard corporate capital budgeting practice.  

INTERPRETATION OF THE VOLATILITY ESTIMATE

We have found that the greatest benefit of real options analysis is not in the point estimates of project values that result, but rather in the discipline that the options model imposes on management thinking. In other words, the real options model gives management the ability to go beyond arguing that investment have “strategic value” and helps them quantify the assumptions that are necessary for strategy to actually be valuable.

The key assumption in any option valuation is the volatility parameter. As shown in Figure 5, the valuation of BUD’s Argentina strategy is extremely sensitive to the volatility assumption.

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**Figure 5**

Option Value and Volatility

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8 For a more thorough review of this topic, see R. Shockley, “The Economic Foundations of Capital Budgeting, the NPV Rule, and the Real Options Model”, Indiana University working paper, 2001.
Notice that at very low volatility estimates, the option has no value. This can be best understood by recalling the notion of volatility in the real options context: volatility represents how wrong our current estimates could possibly be. If the volatility estimate is low, it means we have a great deal of confidence in our estimate of the value of the strategy – hence there is very little to be gained by learning. We have already determined that the project has negative NPV if viewed completely statically – and this means that if we learn nothing new between 1995 and 2002, we won’t invest. But as volatility increases, the strategy appears more valuable. The more uncertain the world, the more we gain from learning before investing. Volatility captures that uncertainty, and the option price reflects the potential value of learning.

Because the valuation depends critically on the volatility assumption, we’d like to spend a few paragraphs discussing an intuitively useful way to think about it. In financial option pricing, volatility is the annual standard deviation of returns (or changes in value from the valuation date until the exercise date). The volatility estimate actually describes a normal distribution of percentage price changes. It is generally easier to think in terms of values (as opposed to returns), and the assumption of normality of returns implies an assumption of lognormality of terminal values.

The Black-Scholes model gives us an easy way of mapping from the volatility estimate into management’s subjective view of the world – in particular, its broad assessment of the probabilities that specific future values will or will not be exceeded. If we know the required rate of return on the underlying asset μ (which, in our example, is the 9.9% cost of capital for BUD’s Argentina/Chile strategy), we can define a new quantity
where \( Z \) is some arbitrary 2002 value of the free cash flows on the business and all other variables are defined as before. By doing this, the quantity \( N(\hat{d}_2 | Z) \) gives us the cumulative probability\(^9\) that the 2002 value of the business is greater than or equal to \( Z \) under the manager’s subjective probability assessment. For example, a manager is likely to want to understand the model’s built-in assessment of the probability that the option will be exercised in 2002. To find this, simply set \( Z \) equal to the strike price on the option ($2.5 billion), set \( \mu \) equal to the cost of capital on the project (9.9%), and maintain all of the other inputs. This gives us \( \hat{d}_2 | Z = -.42973 \), and \( N(-.42973) = .333 \). The interpretation: given what was known in 1995, the 35% volatility assumption implies that there is about a one-in-three chance that the Argentina/Chile investment will be made in 2002.

This is very useful in helping management gain an intuitive understanding of the volatility estimate. Management may have some intuition about a reasonable “best case” scenario and its likelihood, or even a reasonable “lower bound”. By working through what the volatility estimate implies about the likelihoods of these outcomes, management can focus the volatility estimate through an iterative process.

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\(^9\) In the Black-Scholes model, \( N(d_2) \) gives the probability that the option will be exercised \textit{under the risk-neutral probability measure}. In option pricing methodology, the \textit{change of measure} is necessary in order to get around the impossibility of knowing the required rate of return on the option. By substituting the ‘subjective’ drift \((\mu - .5\sigma^2)\) for the term \((r - .5\sigma^2)\) in \( d_2 \), one can state the probability that the option is actually exercised (i.e. the probability, under the manager’s ‘subjective’ measure, that the terminal value of the underlying exceeds the strike price). This can be repeated for different strike prices \( Z \) to get the cumulative probability that the underlying ends up exceeding \( Z \). Please note that if \( \mu \) is the expected (arithmetic) return on the underlying asset, then \((\mu - .5\sigma^2)\) is the asset’s expected log (geometric) return. A discussion of equivalent martingale measure to this effect can be found in S. Neftci, \textit{An Introduction to the Mathematics of Financial Derivatives} 2\textsuperscript{nd} edition (New York: Academic Press, 2000) p. 351.
For example, BUD management might believe that the “best case” scenario might be a 2003 volume demand of 500,000 barrels at a price of $150/bbl (with the same growth assumptions), a 40% cost of goods sold and a 15% G&A expense. Together, these assumptions imply a $4 billion business value in 2002 (before the capital expenditure). The 35% volatility assumption implies that

$$N\left(\hat{d}_2 \mid Z\right) = N\left(\hat{d}_2 \mid $6\ billion\right) = N\left(-.93728\right) = .17.$$  

In other words, the 35% volatility estimate implies a roughly one-in-six chance of the “best case” scenario. If this is too rosy a priori, management can refine the volatility estimate. Figure 6 plots the probability that the 2002 value of the free cash flows is greater than or equal to different values given the 35% volatility assumption.
This probability is simply one minus the cumulative distribution function. For those more comfortable with the marginal density, the above figure can be presented to demonstrate the lognormality of the underlying asset (as shown in Figure 7):\(^\text{10}\)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure7.png}
\caption{35\% Volatility of Returns Assumption}
\end{figure}

In a decision-making situation, a manager can use these pictures to ensure that their volatility assumptions are consistent with their prior intuition. For example, management might conclude that the implied probability of the “best case” (as we described it above) is either too high or too low. Increases in the volatility estimate imply higher probability that values greater than the median are achieved, and decreases in the volatility estimate imply lower probability that values above the median are achieved. To show this, we have plotted the cumulative probabilities that various values are exceeded for volatilities of 20\%, and 50\% in Figure 8.

\(^{10}\) On request, the authors will be happy to demonstrate how this lognormal distribution of values can be generated from the estimates of mean return and volatility of returns in a simple Excel spreadsheet.
CONCLUSION

The market valuation of most firms cannot be explained by the present values of their current free cash flows. The present value of growth options – future opportunities to invest in positive NPV projects – represents a substantial fraction of the value of many firms.

Anheuser-Busch Companies, Inc. created about $11.5 billion in market value added for investors between 1996 and 1998. Of that amount, only a very small amount is attributable to increases in the value of their assets in place; nearly $10 billion is accounted for by the growth options created or expanded by the company during that period. We show that BUD’s small joint venture investments in growing markets are actually investments in information – information that will be used to make better investment decisions at a later date.
Investments in information are investments that create options, and we show that BUD’s $4.4 million investment in a JV in Argentina and Chile is worth many times that amount when one recognizes the option value that the investment creates. Further, we show how management can build an intuitive understanding of the volatility estimate that so critically drives option valuation. We hope that this simple case study will help managers in identifying, valuing, and managing their own strategic investments.

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