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# Valuing Internet Ventures

George Athanassakos*

*The University of Western Ontario, gathanassakos@ivey.uwo.ca

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## Abstract

This article attempts to demonstrate that Internet venture valuations are not subject to different valuation standards and rules, even though one needs to expand on the traditional valuation approach to make it applicable to internet valuations. It is shown that traditional valuation methods (such as the discounted cash flows approach) understate value twice; first, when risk changes over time and second, when flexibility matters to an investment decision. As a result, when analysts use traditional valuation approaches to value Internet companies, they may arrive at estimates of very low P/E ratios vis-à-vis observed multiples. The observed high P/E ratios may make most investors turn away from such investments, although the high P/E ratios may be justified based on the option to great riches in the future and the lower risk associated with Internet ventures' cash flows in the future given successful progression through early phases.

**KEYWORDS:** internet, valuation, real options

*The author is the Ben Graham Chair in Value Investing at the Richard Ivey School of Business, The University of Western Ontario, London, Ontario, Canada. The author would like to thank two anonymous reviewers for helpful comments and Fuad Farooqi for excellent research assistance.

Commentaries in the popular press suggest that "the behavior of investors in technology stocks bear suspicious resemblance of those who bought into the Dutch tulip bulb craze in the 1700s" (Financial Post (1999, p. C9)). Other observers have compared Internet stocks to radio stocks "circa 1929". Not only did the stock market rocket to new highs before crashing that year, "but radio, the newest craze, and broadcast industry related stocks, started a slow decline that ended with the death of empires such as RCA" (Financial Post (1999, p. C9)). And yet, other analysts have suggested that the "new economy" has changed the rules of stock valuation and that new standards must now be applied when valuing, for example, Internet stocks (Business Week (1999)).

This article will attempt to demonstrate that while Internet stocks may be overvalued from time to time, Internet stock valuations have not changed valuation standards and rules, even though one needs to expand on the traditional valuation approach to make it applicable to internet valuations. To do this, the paper will proceed as follows. Section 2 reviews the academic literature on the valuation of Internet stocks. Section 3 discusses how risk and time interact and how value is understated when risk declines over time as is the case in Internet stock valuations. Section 4 explains the nature of the option embedded in the valuation of high-risk ventures and how value is understated when the option embedded in Internet valuations is ignored, as is the case with traditional valuation methods. Finally, Section 5 provides the summary and conclusions to this paper.

## Academic Research On Valuing Internet Companies

Academic studies have used a variety of approaches to value internet companies. Hand (2000) and Keating, Lys and Magee (2001) find evidence that basic accounting data are relevant for valuing internet companies, but the link between accounting numbers and internet valuation is not entirely clear. Demers and Lev (2000) examine the relevance of marketing expenses and product development and R&D expenses to internet company valuation. They find them both to be relevant to such valuation. Trueman, Wong and Zang (2000) and Rajgopal, Kotha and Venkatachalan (2000) consider the role of non-financial data to the valuation of internet companies by examining the impact of both accounting information and measures of internet usage. They find that book value and gross profits are positively related to stock price. They also find that web traffic levels predict sales one and two quarters ahead. However, they find that the market does not appear to value traffic merely because it predicts future sales. In this paper, we take a different approach to the valuation of Internet ventures which is more intuitive and practical. It deals with the documented reduction in risk of Internet ventures as they evolve over time and the future growth opportunities that involvement in Internet ventures open up.

## Interaction of Risk and Time

Consider we are trying to value a pure play company that is deciding to invest in a large Internet project that could either make or lose lots of money – most likely lose. Using a traditional valuation approach, we will forecast the company's free cash flows and discount them by the company's weighted average cost of capital. As we shall show later, this way we may assign a low (if any) value to this company and hence a low P/E multiple (or P/EBIT, or P/Sales).

Valuation analysis of high-risk ventures should not proceed with valuing the free cash flows of the venture all in one step. Valuation analysis should break down the timeline of free cash flow forecasts into phases and evaluate each phase on its own. This is because management does not have to stay invested in the high-risk project to infinity. Investments in high risk ventures proceed in phases. For example, according to Pinches, Narayanan and Kelm (1996) research and development projects evolve over three phases: the initiation or innovation phase, the progress or continuation phase and the final outcome phase, which leads to the commercialization of a new product or process. Similarly, Athanassakos and Spenler (2003), in analysing Research In Motion, consider three phases of company evolution, namely market definition, market development/growth and market maturation. In both papers, project evolution over time (phases) affects the market's assessment of the risk associated with the expected cash flows.

### *Sequential (In-Phases) Investing*

In the initial phase, phase one, the company's outlook and free cash flows are quite risky. In early phases, projects of this nature are highly sensitive to the economy and the business cycle and, hence, have high systematic risk. But as a project progresses successfully from phase one to phase two and so on, the project's systematic risk should decline. The purpose of phase one is for the company and the investors to understand the existence, size and potential of a product's market. If at the end of phase one the company has discovered that indeed there is a market for the product and there is potential then the company will commit more funds to the continuation of the investment and phase two will ensue. If we continue with phase two, the project's risk will be lower, as there will now be a determined market and demand for the product, and its systematic risk will be reduced, as the project's sensitivity to the economy will have declined.[1]

In other words, management has an option to proceed assuming phase one is successful and if it proceeds the project will now have less systematic risk. Lower systematic risk will reduce the risk premium embedded in the discount factor. In general, in the traditional Discounted Cash Flow (DCF) valuation exercise, we assume that systematic risk remains, on average, constant over time and, as a result, the discount factor we use to translate future cash flows into current values does not change. This may not be an appropriate assumption to make in high-risk ventures when investment is taking place sequentially and the purpose of this in-phases-investment is to determine the systematic risk of the venture as we move through the various phases.

### *An Example*

An example will demonstrate this point. Consider we wish to launch an e-commerce business. We assume for simplicity that the investment in this venture will proceed in two phases. The first phase will involve setting up a web site. This first phase will last for 3 years. The second phase will involve the full-fledged launch of the e-commerce venture and we will continue to infinity with this venture. The annual earnings per share from the web site are expected to be $.01, $.05 and $.10 for years 1, 2 and 3, respectively.[2] The company will retain all cash flows from the web site for investment purposes over the first 2 years of phase one and only pay a dividend of $.01 a share in year 3. In phase two, if all works out well (and there is a 40% chance of success), the e-commerce business will produce cash flows that will be increasing at an average growth rate of 10% a year to infinity.[3] Beginning in year 4, the company will pay dividends that will also grow at the rate of 10% per year to infinity with the year-4 dividend expected to be $.011 a share. We assume all equity financing, as such projects tend to be all

[1] As it will be discussed later, an established product's sensitivity to the economy, especially if the product becomes a necessity, is reduced significantly and so is its beta, or systematic risk.

[2] This represents an average geometric growth rate of 115% a year which is consistent with the growth rate of Yahoo EPS in its early days (See Donaldson, Lufkin and Jenrette (1999)).

[3] It would have been more realistic to assume the second phase encompasses periods of many different growth rates, namely, an EPS growth rate of 75% over the next 5 years (similar to Yahoo following the early years of super fast growth), then 25% for the following 5 years, 20% for the next 6 years, 15% for seven years after that and 7% growth thereafter. In our example, to keep things simple, we are using an average growth rate of 10% from year 4 to infinity.

**Table 1**
**In Phases Valuation of an E-Commerce Venture: Risk Remains Constant vs. Risk is Changing Over Time**

**Panel A: Risk Remains Constant Over Time**

| 0 | 1 | 2 | 3 | $4 \rightarrow \infty$ |
|---|---|---|---|---|
| EPS | .01 | .05 | .10 | $\overline{g} = 10\%$ to infinity |
| DPS | 0 | 0 | .01 | $\overline{g} = 10\%$ to infinity |

$K_s = .05 + 2\ (.08) = .21$

$$P_3 = \frac{D_4}{k_s - \overline{g}} = \frac{.011}{.21 - .10} = \$.10$$

$$P_0 = \frac{D_3 + .40xP_3}{(1 + k_s)^3} = \frac{.01 + .40x.10}{(1 + .21)^3} = \$.028$$

$$P/E = \frac{.028}{.01} = 2.8$$

**Panel B: Risk is Changing Over Time**

| 0 | 1 | 2 | 3 | $4 \rightarrow \infty$ |
|---|---|---|---|---|
| EPS | .01 | .05 | .10 | $\overline{g}* = 7.5\%$ to infinity |
| DPS | 0 | 0 | .01 | $\overline{g}* = 7.5\%$ to infinity |

$K_s = .21$ $\quad K^*_s = .05 + .5\ (.08) = .09$

$$P_3 = \frac{D_4^*}{k_s^* - \overline{g}} = \frac{.0108}{.09 - .075} = \$.72$$

$$P_0 = \frac{D_3}{(1 + k_s)^3} + \frac{.40xP_3}{(1 + k_s^*)^3} = \frac{.01}{1.21^3} + \frac{.40x.72}{(1.09)^3} = \$.228$$

$$P^*/E = \frac{.228}{.01} = 22.8$$

**Note:**
$\overline{g}$ = Constant Growth Rate to Infinity
$D_4$ = Expected Dividend Per Share in Year 4
$K_s$ = Cost of Equity
Probability of Success = 40%
DPS = Dividends per Share

equity financed. The cost of equity is estimated to be 21%. This is derived using the Capital Asset Pricing Model (CAPM) and reflects a risk free rate of 5%, a market risk premium of 8% and a beta coefficient of 2 for this kind of investments (i.e., $k_S = .05 + 2\ (.08)$).

Table 1, Panel A demonstrates the valuation of this venture, using the traditional valuation approach that assumes systematic risk does not change over the life of the venture. Using the simple constant growth valuation model, we find that the price per share of the stock at the end of year 3 is $0.10 (i.e., .011/(.21-.10)). If we discount 40% (the chance of success) of this to the present and add the present value of $.01 a share in dividends received at the end of year 3, we find that the current price per share that reflects these assumptions is $.028. The resulting P/E ratio is then 2.8x (i.e., .028/.01). Assuming the risk of the web site and e-commerce will remain high forever will result in a P/E ratio of 2.8x. This is what the "old" school of thought, using traditional DCF valuation techniques, would conclude. As a result, the proponents of this school of thought would tend to scoff at investments with P/E multiples that are about 10 times higher than what they would have expected. Based on these "old" school of thought calculations, stocks that have P/E multiples of 23x are extremely overvalued.

### *Risk vs. Time*

Analysts often express the opinion that because distant cash flows are riskier they should be discounted at higher discount rates. They are forgetting that any risk-adjusted discount rate automatically recognizes that more distant cash flows have more risk. Higher discount rates should be applied to more distant cash flows only if there is good reason to believe that the venture's beta will be higher in the distant future. In high-risk projects, the opposite is true, whereby phase two will only proceed when phase one is successful.

Are Internet stocks extremely overvalued? Internet companies, if successful, will dominate the market and become like utilities, a necessity rather than a luxury good with significantly reduced sensitivity to the economy and business cycle.[4] The Internet is changing not just the way people communicate but also how industries are set up. The Internet is spawning a new class of companies providing services that will replace the way companies use computers and the Internet today. The Internet is quickly becoming the infrastructure for all sectors of the economy, in the same way that utilities have been over the years (Globe and Mail (2004)). According to the CEO of Sun Microsystems Inc. Scott G. McNealy: "Information is becoming a utility. This utility-like service is spreading rapidly. Customers are beginning to outsource basic computing tasks to

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[4] For example, the beta of the consumer products industry in Canada is .90, as opposed to the utilities industry which has a beta of .46 (See Smith (1993, p. 82)).

other companies. Think utilities. Customers pay for services as they use them – much as they now pay for phone service. When you pick up the phone, it simply works – you do not have to boot it up. It is obvious how to use it and it rarely crashes. That is, the level of service and functionality that Internet services such as e-mail and web access are evolving to" (Business Week (1999, p. 68)).

The public has already embraced this new technology. Over seventy percent of all households in the US have been using the Internet, and the number is rising.[5] By 2011, an estimated two billion people will be connected to the Internet worldwide.[6]

If we discount by using the same risk adjusted discount rate over the life of the venture, we are implicitly assuming that the venture will have the same systematic risk (i.e., the same beta) each year of its life. This may be a valid assumption in stable companies that are close to the maturity phase. It may be, however, an invalid assumption for companies in high risk business, such as Internet ventures, which tend to be highly sensitive to the health of the economy during the initial years of operations and much less sensitive as they mature.[7]

As a result, there is a problem with the valuation approach presented in Table 1, Panel A. It falsely assumes that the e-commerce venture, which has a high risk now due to market uncertainty, will always remain high risk. The reason for proceeding in phases is to reduce uncertainty. There is a 40% chance that the venture will be successful after phase one and a 60% chance that it will not. If the project is shut down, the cash flows are known with certainty to be zero and value is zero. If the venture is successful, the beta will be lower in phase two than in phase one. Assuming a beta similar to that of a utility, say .5, and same risk free and market risk premium parameters as before, we end up with a cost of equity of 9% that we will now use to discount future cash flows generated in phase two.[8] We also assume a lower growth rate than originally, say 7.5%, to reflect the new nature of the industry. The price per share at the end of year 3 is now estimated to be \$.72 (i.e., .0108/(.09-.075)). The current price per share will now be \$.228 given that continuation has only a 40% chance, and also including the present value of the \$.01 a share in dividends expected to be paid in year 3. This price gives a current P/E ratio of 23x. Table 1, Panel B, demonstrates this derivation.

The revised analysis indicates that a P/E multiple of 23x is not irrationally high; rather it is reasonable, if risk and time interactions are evaluated properly.

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[5] http://www.pewinternet.org/pdfs/PIP_Internet_Impact.pdf

[6] http://www.c-i-a.com/pr0106.htm

[7] See Boque and Roll (1974), Fama (1977) and Myers and Turnbull (1977) for more on the validity of the CAPM in a multi-period framework. See also Davis and Pinches (2002, p.319).

[8] The average beta of 15 utilities in Canada is .46 (Smith (1993, p.82)).

## The Value of the Embedded Option and Real Options

### *Internet Valuation and the Embedded Option*

In this section, we will see that even when the discount rate is accounted for properly, traditional valuation methods may still undervalue Internet companies as they tend to overlook the flexibility provided at decision nodes during the life of a company. For pure play high tech companies, this is a very important consideration. In these cases, the discounted cash flows approach understates value twice; first, when risk changes over time and second, when flexibility matters to an investment decision.

Traditional valuation methods are readily applied to relatively stable businesses. These methods, however, are less helpful for valuing investments that have substantial growth opportunities. These high growth ventures should be valued as options, and more specifically as real options. As long as there is some probability of success and high payoffs, investors will be willing to pay a price for such an investment even though traditional valuation may assign no value to this investment.

### *Academic Research on Real Options*

Many academic studies find evidence to indicate that managers and the markets consider real options when they make investment decisions. In some studies real options have been used to explain observed prices. Paddock, Siegel and Smith (1988) use real options methodology to value oil lease tracks. Moel and Tufano (2002) use real options in the context of a decision to open and close a gold mine. Berger, Ofek and Swary (1996) apply a real options methodology to examine whether abandonment value is reflected into stock prices. Quigg (1993) and Cunningham (2006) use real options to examine real estate prices in Seattle. They all find that real options considerations help explain asset price variations.

Internet valuation seems to benefit by the use of non-financial information, which may suggest that the markets attempt to estimate future growth opportunities. A key approach to that valuation is the application of real options to valuing internet companies. Schwartz and Moon (2000, 2001) and Perotti and Rossetto (2000) argue that internet companies have characteristics similar to call options as they have larger potential upside and limited downside and hence a real options approach can be used to such valuation. Schwartz and Moon (2001) apply real options to the valuation of e-Bay and find that the e-Bay market price was 75% below the model price. They suggest that the market may be implying higher margins and growth rates, as well as volatility of the growth rate than their model. Alternatively, they simply admit that e-Bay may be actually overvalued at the day of the estimation, which was April 11, 2000.

*Real Options*

Options are contracts that give their holder the right (not the obligation) to buy (a call option) or sell (a put option) an asset (the underlying asset) at a predetermined price (the exercise price) for a given period (the time to expiration). The option of interest in this paper is the call option (Schwartz and Moon (2000, 2001) and Perotti and Rossetto (2000)). If the underlying asset is above (below) the exercise price the call option is said to be in the money (out of the money). The typical options that trade in the markets are referred to as financial options. However, what is of interest to us is real options, which are similar in nature to financial options with the main difference that while financial options are written on underlying assets that trade in various markets, the underlying asset in real options applications does not actually trade. Real options arise when a project or a venture has uncertain benefits and there is an opportunity to delay or expand or abandon the project contingent on information that will be revealed in the future.

Traditionally, the NPV calculation (i.e., the traditional valuation approach) involves projecting free cash flows and discounting them at the cost of capital of the firm. However, this approach understates the true value of the project as it assumes that the firm is locked into this project until the end of the project's life or that after the project expires no other investment opportunity arises as a result of having undertaken the project in the first place. In reality this is not what happens. The project manager has the option to reconsider the project upon revelation of new information, and then decide whether to continue, expand or abandon the project. This flexibility has value. In other words, the true NPV of a project is not just the present value of the future cash flows. It is rather the sum of the present value of the future cash flows and the value of the flexibility, which gives the right to continue, expand or abandon the project at any point in the future when deemed beneficial. The value of the flexibility (i.e., the value of the option) can be estimated using a real options approach. Because this option (i.e., the flexibility) is embedded into the value of the project, it is referred to as an embedded option. The underlying asset in these applications is the present value of the free cash flows (FCFs) of the project and the exercise price is the expected investment that is going to be made at some future point in time, if phase one is successful, and a decision is made to continue or expand. Should phase one be unsuccessful and the project is abandoned then the exercise price is the project's salvage value. As in financial options, identifying the underlying asset and exercise price are critical to the real options valuation.

### *Example*

Consider we wish to value the previously mentioned venture that involves setting up a web site as a precursor of an e-commerce business. Such a venture may have no value looking at it from a traditional point of view. However, setting up the web site gives the company the opportunity, but not the obligation, to later launch the e-commerce venture. In a year, the company will know better whether the e-commerce opportunity is worth pursuing. If it is not, the company has lost its investment in the web site. However, the e-commerce venture has immense potential value. In other words, the first phase of web site development and investment is equivalent to buying an out of the money option, very cheap. And this option has value to the company. This value has to be explicitly considered when valuing this pure play high tech venture. Traditional valuations will assign a very low price (P/E ratio) to this company and the observed high price (P/E ratio) will make most investors turn away from such an investment, although the high price (P/E ratio) may be justified based on the option to great riches in the future. When the future is highly uncertain it pays to have many options. In such cases, there is a small probability of a high pay-off; investors are willing to pay for this.

A slightly different example will reinforce the point. A newly established pure play Internet firm and its venture capital providers are faced with an opportunity to accept or reject a 3-year R&D proposal requiring an immediate \$100,000 investment ($I_0$) but providing only a small chance (30%) of discovering a killer application. For the first three years, the project, on average, will produce \$10,000 a year. If at the end of the year 3 the R&D project is successful, management may then make a further investment at an expected cost of \$3 million and generate expected cash flows of \$500,000 a year starting at the end of year 5 for an explicit forecast period of 11 years and, from year 15 on, producing cash flows of \$100,000 a year to infinity. Given the high risk of the project, the venture capitalists estimate the beta for this project to be 2. The risk free rate, the market risk-premium and the cost of equity are estimated as earlier to be 5%, 8% and 21%, respectively. Given the above, what is the value of this pure play Internet firm?

The cost of equity accounts for both time value of money and risk, as it is composed of the risk free rate, representing the time value of money, and a risk premium. In traditional valuation exercises, the discount factor is assumed to remain constant over the life of the project, and as a result a constant discount rate is applied to translate future cash flows into current values. In this case, the value of this project ($V_0$) or the value of this Internet firm is (\$188,000) and its net present value ($NPV_0$) is (\$288,000), as shown in Table 2, Panel A. The venture capitalists will tend to reject such an investment.

**Table 2**
**Net Present Value Estimation of an Investment in an Internet Venture: Risk Remains Constant vs. Risk is Changing Over Time**

**Panel A: Risk Remains Constant Over Time**

$$V_0 = \sum_{t=1}^{3} \frac{.01}{1.21^3} + 0.3x \left[ \frac{-3}{1.21^3} + \frac{\sum_{t=1}^{11} \frac{0.5}{1.21^t}}{1.21^4} + \frac{\frac{0.10}{.21}}{1.21^{15}} \right]$$

$$= \text{-}\$0.188 \text{ million}$$

$$NPV_0 = V_0 - I_0 = \text{-}\$0.288 \text{ million}$$

**Panel B: Risk is Changing Over Time**

$$V_0 = \sum_{t=1}^{3} \frac{.01}{1.21^3} + 0.3x \left[ \frac{-3}{1.074^3} + \frac{\sum_{t=1}^{11} \frac{0.5}{1.074^t}}{1.074^4} + \frac{\frac{0.10}{.074}}{1.074^{15}} \right]$$

$$= \$0.2622 \text{ million}$$

$$NPV_0 = V_0 - I_0 = \$0.1622 \text{ million}$$

**Note:**
$I_0$ = $0.10 million
$I_4$ = $3 million
Probability of Success = 30%

However, is the assumption of the constant discount rate justified? Changes in an investment's inherent riskiness may not be properly accounted for when a constant discount rate is used over the life of an investment. The traditional valuation approach assumption that beta and the cost of equity remain, on average, constant over time may not hold true in cases such as the one described above. This happens when the risk actually changes as the success or failure of the venture is revealed in three years, and also in the presence of managerial flexibility in the form of an embedded option, which changes further the nature of risk. Both of the above invalidate the use of a constant discount rate in the example given.

Assume now that once the success of the project is revealed, the systematic risk of the project declines resulting in a lower beta of say .30.[9] Using a beta of .30 rather than 2, we find the cost of equity to be 7.4% (i.e., $k_{S}$= .05 + .30 (.08)). In this case, the value of the project is \$262,200 and its $NPV_0$ is \$162,200, as shown in Table 2, Panel B. The Internet firm is now economically viable and the R&D project is a good project.

But remember, our analysis should not stop at this point. There is also a call option embedded in this project that further increases the value of high tech projects, such as the one under consideration. This option gives the management the right to proceed assuming the first phase shows encouraging results. Both the decline of risk over time and the embedded (call) option will produce a sharp increase in the value of the project (and a high P/E multiple) as opposed to low or no value (and a low P/E multiple) for the traditional valuation approach. The interaction across time (i.e., opening up the opportunity to invest in the future) creates a strategic source of value. Since the project's future value is uncertain, this investment is even more valuable. It creates an option for management to invest in the normal project in three years if the phase one project does well, but not to invest if it does poorly. Suppose that the phase two project's value of expected cash flows at the end of year 3, currently $V_4$= \$4.2 million,[10] is expected to move up to $V_{4,up}$ = 7 or down to $V_{4,dn}$ = 3 with 30% probability to go up and 70% to go down. The required investment of $I_4$ = \$3 million will be incurred at the beginning of year 4 if phase one shows that the project turns out to be favorable, but will not be incurred otherwise. Given $V_4$, $V_{4,up}$ and $V_{4,dn}$ and that the risk free rate is 5%, we can calculate what is referred to in the real options literature as a risk neutral probability. This is estimated as follows:[11]

$$p = ((1+R_f) \times V_4 - V_{4,dn})/( V_{4,up} - V_{4,dn} ) = (1.05 \times 4.2 - 3)/(7 - 3) = 0.3525$$

9 See Brealey and Myers (2003, p. 242) and Trigeorgis (1996, p. 39).
10 $V_4$ is equal to the sum of the last two terms in the squared bracket shown in Table 2, Panel B.
11 An excellent discussion of this derivation and its theoretical underpinnings can be found in Trigeorgis (1996).

In options-based valuations, the risk free rate is used for discounting and the probabilities used are the calculated risk neutral probabilities. The total net present value ($NPV_0$*) resulting from this investment is then:[12]

$$NPV_0{}^* = NPV_0(\text{Phase I}) + (p \times \max(V_{4,up} - I_4, 0) + (1 - p) \times \max(V_{4,dn} - I_4, 0))/(1 + R_f)^3$$

$$= -.008 + (0.3525 \times \max(7 - 3, 0) + (1 - 0.3525) \times \max(3 - 3, 0))/(1 + .05)^3$$

$$= -.008 + (0.3525 \times 4 + 0.6475 \times 0)/(1 + .05)^3 = \$1.21 \text{ million.}$$ [13]

This result contrasts with the earlier result of \$0.1622 million. Project value uncertainty and the discretionary-option aspect account for the higher value (See Trigeorgis (1996)).[14]

## Conclusions

This article has attempted to demonstrate that Internet venture valuations are not subject to different valuation standards and rules, even though one needs to expand on the traditional valuation approach to make it applicable to internet valuations. It has been shown that traditional valuation methods (such as the discounted cash flows approach) understate value twice; first, when risk changes over time and second, when flexibility matters to an investment decision. If we discount high-risk projects by using the same risk adjusted discount rate over the life of the project, we are implicitly assuming that the venture will have the same systematic risk (i.e., the same beta) each year of its life. This may be a valid assumption in stable companies that are close to maturity phase. It may be, however, an invalid assumption for companies in high risk business, such as the Internet ventures, which tend to be highly sensitive to the health of the economy during the initial years of operations and much less sensitive to the business cycle as they mature. However, even when the discount rate is accounted for properly,

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[12] It should be recalled that a call option gives the holder the right, but not the obligation, to buy the underlying asset by paying the exercise price. That is why, at maturity, the call option is equal to the maximum of zero or the difference between the underlying asset and the exercise price. The maturity of the option here is 3 years, the underlying asset is $V_4$ (up or down) and the exercise price is $I_4$. In our example, the option has value only when the project's value is expected to move up.

[13] $NPV_0$(Phase I)= .0207 - .10

[14] The real options approach discussed here is operationally identical to decision tree analysis, with the key difference that the probabilities are transformed so as to allow the use of a risk free discount rate. The error in the decision tree approach arises from the use of a single (or constant) risk adjusted discount rate. Asymmetric claims on an asset do not have the same riskiness (and hence expected rate of return) as the underlying asset itself. The real options approach corrects for this error by transforming the probabilities.

traditional valuation methods may still undervalue Internet ventures as they tend to overlook the flexibility provided at decision nodes during the life of a company. Traditional valuation methods are readily applied to relatively stable businesses. These methods, however, are less helpful for valuing investments that have substantial growth opportunities, such as Internet ventures, where a large part of the value is derived from an embedded option.

As a result, when analysts use traditional valuation approaches to value Internet companies, they will arrive at estimates of very low P/E ratios vis-à-vis observed multiples. The observed high P/E ratios will make most investors turn away from such investments, although the high P/E ratios may be justified based on the option to great riches in the future and the lower risk associated with Internet ventures' cash flows following phase one.

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