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VALUATION

Rational Pricing of Internet Companies

Eduardo S. Schwartz & Mark Moon

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Abstract

We apply real-options theory and capital-budgeting techniques to the problem of valuing an Internet company. We formulate the model in continuous time, form a discrete time approximation, estimate the model parameters, solve the model by simulation, and then perform sensitivity analysis. We report that, depending on the parameters chosen, the value of an Internet stock may be rational if growth rates in revenues are high enough. Even with a real chance that a company may go bankrupt, if the initial growth rates are sufficiently high and if this growth rate contains enough volatility over time, then valuations can reach a level that would otherwise appear dramatically high. In addition, the valuation is highly sensitive to initial conditions and exact specification of the parameters, which is consistent with observations that the returns of Internet stocks have been strikingly volatile.

Probably no recent investment topic elicits stronger feelings than Internet stocks. The skyrocketing valuations of these companies have made millionaires and billionaires

out of many Internet entrepreneurs while the actual companies were generating significant and often growing losses.

We developed a simple model to value an Internet company that is fundamentally based on assumptions about the expected growth rate of revenues and on expectations about the cost structure of the company. Because these expectations are likely to change continuously as new information becomes available, the model generates company values and stock prices that are highly volatile, but it provides a systematic way to think about the drivers of value of Internet companies and directs analyst attention to the critical parameters in the valuation.

The model basically applies real-options theory and modern capital budgeting to the problem of valuing an Internet stock. We formulate the model in continuous time, form a discrete time approximation, estimate the model parameters, solve the model by simulation, and then perform sensitivity analyses. We found that, depending on the parameters chosen, the value of an Internet stock may be rational if growth rates in revenues are high enough. Even with a real chance that a company will go bankrupt, if the initial growth rates are sufficiently high and if there is enough volatility in this growth over time, valuations can be what would otherwise appear to be unbelievably high. In addition, we found a large sensitivity of the valuation to initial conditions and exact specification of the parameters, which is consistent with the observation that the returns of Internet stocks have been strikingly volatile.

To implement the model, we make many assumptions about possible future financing, about future cash distributions to shareholders and bondholders, about the horizon of the estimation, and so on. Alternative assumptions are possible and easily incorporated in the analysis. We expect that potential users of a model such as the one presented will have a deep-enough knowledge of the company and its industry to make more reasonable (perhaps!) assumptions.

We illustrate the methodology by applying it to Amazon.com. The basic data used for the valuation included quarterly sales, cost of goods sold, and other expenses for the last 15 quarters. We also used balance sheet data to estimate the loss carry-forward and the amount of cash available at the valuation date. Given the profitability assumed in the valuation (through the cost function), we found that Amazon equity is overpriced. Substantially higher profitability would be needed to obtain model prices that are consistent with those observed in the market.

We intend to extend the analysis along a number of important dimensions. One is to make the cost function stochastic to reflect, for example, the uncertainty about future

potential competitors, market share, or technological developments. Another is to take into account seasonality. If seasonality is not taken into account when estimating parameters for those industries in which it is characteristic, the volatility of the growth rate in revenues will be overestimated, which can significantly affect company valuation.

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