THE THREE BASIC VALUATION METHODOLOGIES

The three basic valuation methodologies are income methods, market methods, and cost methods. Sometimes different names are used or some new valuation methodology is claimed, but all valuation methodologies can be traced back to these three fundamental approaches to valuation analysis. What differentiates the three methodologies is the source of information inputs each uses to generate a valuation result (see Figure 1.3). Income methods seek to measure directly the future economic benefits that will flow from a given asset. Income methods are forward-looking exercises in that the valuator *looks ahead* and uses projections of future benefits as the data for the model. Market methods seek to determine the value of an asset by reference to how other buyers and sellers have valued the same or similar assets. With a market method, the valuator *looks around* and uses contemporaneous market transactions as the data for the model. Finally, cost methods seek to determine value by using some measurable cost for the asset as a proxy for value. Cost methods are backward-looking exercises in that the valuator *looks behind* and uses historical costs as the data for the model.

The following brief overview of the basic methods (see Table 1.1) is meant to provide readers with a cursory understanding of the economic foundation for each approach. Each method is also the subject of a later chapter (or in the case of the income methods, chapters) that will provide a detailed explanation of the method, its strengths and weaknesses, and how to use the method to value a patent.

Income Methods

Income methods attempt to measure the net economic benefits that will come from the asset being valued. The most common form of income

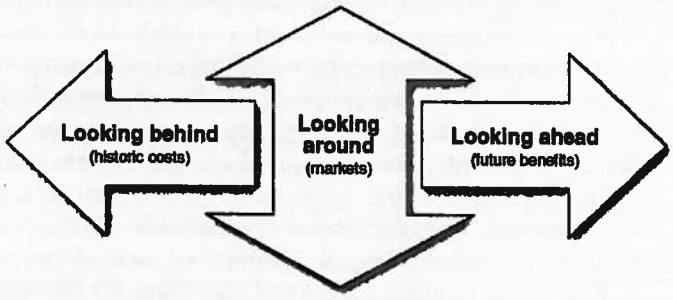

FIGURE 1.3 The Three Valuation Methods Use Three Different Types of Information Inputs

TABLE 1.1 Overview of the Three Methods

	Income Methods	Market Methods	Cost Methods
Focus of the approach	Measure the future economic benefits that will flow from a given asset	Consider how other buyers and sellers have valued the same or similar assets	Use some measurable cost for the asset as a proxy for value
Common examples of the method	Discounted future economic benefits (or discounted cash flow) analysis Real options analysis	Competitive exchange methods ▪ Auctions ▪ Less formal competitive exchanges Comparable transactions ▪ Valuation ratios ▪ Industry royalty rates Other methods ▪ Shadow pricing ▪ Surrogate valuation measures ▪ Stated preference methods	Cost of development Cost of reasonable alternative

Source: This table was inspired by a figure on the traditional valuation methods produced by Heinz Goddar and Ulrich Moser, "Traditional Valuation Methods: Cost, Market and Income Approach" in *The Economic Valuation of Patents: Methods and Applications,* eds. Federico Munari and Raffaele Oriani (2011), 111.

method involves projecting the asset's future net economic benefits—which will usually be expressed in terms of free cash flow or net profits—and then adding up the various benefits. Because these benefits will be received over time, a discount needs to be applied to take into account, among other things, the time value of money and the risk that actual benefits will be less than anticipated. The most common form of income method is referred to as a discounted cash flow (DCF) analysis, a term used because the analysis focuses on the future free cash flow that is projected for the valued asset. In this book, however, we do not use the DCF nomenclature, but instead refer to the standard discount method as a discounted future economic benefits (DFEB) analysis. We believe that DFEB analysis is more descriptive of the overall valuation approach that a

valuator should take because free cash flow is not the only relevant measurement of future net economic benefits. Whether one uses the term DFEB or DCF, this income method tries to determine how much a firm should pay today for net economic benefits it may receive in the future. The DFEB method is the subject of Chapter 6.

One limitation of traditional net present value calculations using the DFEB method is their failure to capture future flexibility and choices. Patents provide their holders with the option to make informed choices in the future. Having those options can be extremely valuable and can also be difficult to incorporate into a standard, linear DFEB analysis. There have been a few attempts to incorporate the value of future flexibility into patent valuation analysis. The approach that has garnered the most attention has been the *real options* approach, but it is not the only viable one. Incorporating the value of future decision opportunities into a patent valuation analysis will be the subject of Chapter 7.

Market Methods

As a valuation tool, market methods seek to determine the value of an asset by using the wisdom and experience of self-interested buyers and sellers. The self-interested buyers and sellers can employ any number of valuation techniques to determine the value of a given transaction. The market then helps to aggregate the findings of these individual determinations. There are two core market methods for valuing assets:

1. **Competitive exchange:** The market of potential buyers is identified and encouraged to compete for the purchase of the asset, which helps to identify who ascribes the highest value to the asset. In effect, the seller polls the market to determine what buyers are currently willing to pay for the asset being valued.
2. **Comparable transactions:** The value of an asset is determined by looking at the range of prices paid in past or current transactions for similar assets. The value stems from the premise that a reasonable buyer "would not pay more for property than it would cost to purchase a comparable substitute."[4] Furthermore, if the comparable transaction took place in the past, it is assumed that the information derived from that past transaction remains relevant for the transaction under review.

In addition to these two core methods a number of derivative market techniques for valuing assets can be employed. Market methods are the subject of Chapter 8.

Cost Methods

Cost methods can be boiled down to this simple statement: The cost of an asset tells you something useful about its value. Despite their simplicity (or more likely because of their simplicity), cost methods tend to be the most widely criticized of the three types of valuation methods. Cost methods do not appear to make any effort to measure an asset's future net economic benefits, which makes them an easy target for criticism. When used for valuing patent rights, there are two primary cost methods:

1. **Cost of development:** A patent should be worth at least the amount it cost to develop the patented technology and obtain (and maintain) the patent rights.
2. **Cost of reasonable alternatives:** An economically rational technology acquirer will not pay more for a patent than the cost of a reasonable alternative technology.

There is a tendency to lump both of these cost methods together and criticize their validity as useful valuation tools. Such criticisms, however, are overbroad and can be misguided. The cost of reasonable alternatives method, for example, can be a surprisingly useful valuation tool. Cost methods are the subject of Chapter 9.

Interrelationship of the Three Basic Methods

Although the three basic methods are typically discussed as three wholly distinct valuation approaches, they are not, in fact, completely independent of one another. Business valuation experts Shannon Pratt, Robert Reilly, and Robert Schweihs provide the following explanation of the interrelationship of the three basic methods in the context of valuing a business:

> *The income approach requires some kind of a rate of return at which to discount or capitalize the income. The forces of the market drive these rates. All comparative valuation approaches relate some market value observation to either some measure of a property's ability to produce income or to some measure of the condition of its assets. The [cost] approach uses depreciation and obsolescence factors that are based, to a certain extent, on some measure of market values of assets.*[5]

The same interrelationship applies when using the three basic methods to value patents.

(Optional)

BOX 7.2: COMPARING A STOCK CALL OPTION TO A REAL OPTION

Information about Call Option Needed to Run a Black-Scholes Calculation	Real Option
1. Current price of the underlying stock	NPV of the cash flow that will result from the future decision
2. Exercise price of the option	Capital investment required to pursue the future decision
3. Time until option expires	Time when the future decision will expire (length of time the future decision can be deferred)
4. Estimate of the risk-free interest rate now and in the near future	Same
5. Estimate of the volatility of the underlying stock's price	Estimate of the volatility of the cash flow that will result from the future decision

This box is based on, and borrows liberally from, a table prepared by Raffaele Orinani and Luigi Sereno, "Advanced Valuation Methods: The Real Options Approach" in *The Economic Valuation of Patents: Methods and Applications*, ed. Federico Munari and Raffaele Oriani (2011), 143.

As Box 7.2 demonstrates, the Black-Scholes inputs can be matched to comparable real option information. The difficulty, however, is in coming up with sufficiently accurate estimates for those real option inputs to run a meaningful calculation. One of the strengths of the Black-Scholes method for financial options contracts is the relative ease with which the necessary inputs can be gathered and the reliability of that information (see Box 7.3). When it comes to real options, such convenient and reliable sources for the necessary information inputs may not exist.

VALUING PATENTS USING OPTION-PRICING INSIGHTS

Patents are embedded with real options. Researchers have modeled a number of different real options that exist within a patent.[8] Each of these real options, at its core, is an option to wait to make a decision until more

BOX 7.3: INFORMATION SOURCES FOR THE BLACK-SCHOLES INPUTS

Black-Scholes Inputs	Information Source
1. Current price of the underlying stock	Publicly disclosed stock market prices, which benefit from the market's wisdom
2. Exercise price of the option	Strike price will be listed in the financial contract
3. Time until option expires	Expiration date will be listed in the financial contract
4. Estimate of the risk-free interest rate now and in the near future	The Treasury bill rate is frequently used
5. Estimate of the volatility of the underlying stock's price	There are many techniques for estimating volatility, but they all depend on historic and recent trades in the specific stock, comparable stock, and the stock market in general

(optional)

information becomes available. For valuation purposes, the two most relevant subcategories of this option to wait are the option to wait to use the patent (option to use) and the option to wait to enforce the patent's exclusive rights (option to exclude).

Patents and Real Options

If we disassemble real options into their core qualities, there are three:

1. The net economic benefits that may flow from the opportunity are uncertain and depend in part on future decisions by the option holder.
2. The current uncertainty that surrounds those future decisions decreases over time as more information becomes available.
3. The opportunity provides the decision maker with flexibility to defer decisions to a later date.

Those same three qualities are embedded in any given patent:

1. The net economic benefits that may flow from the patent are uncertain and depend in part on future decisions by the patent holder.

2. The current uncertainty that surrounds those future decisions decreases over time as more information becomes available.
3. The patent's right to exclude provides the patent holder with the ability to defer investment decisions about the patent until a later date.

Option to Use The ability to defer decisions about how to use the patented technology can generate significant value for a patent holder. To illustrate this point, consider the following example.[9] A firm (Acme) holds a patent with 17 years of remaining protection. Acme believes that commercializing the patented invention has a 30 percent chance of generating $1 million in annual profits for the life of the patent and a 70 percent chance of generating no profits. Acme will need to invest $4 million to pursue this opportunity. Based on these assumptions, Acme should not pursue the opportunity. The expected net benefits from the project (before discounting to present value) would be 30 percent of $17 million, or $5.1 million. Once those benefits are discounted back to present value (assume a 10 percent discount rate), the opportunity would generate an NPV of roughly $2.4 million, which would not justify the capital investment.

Just because the invention is not worth practicing today, however, does not mean that it will not be worth practicing in the future. Based on these facts, the firm could simply wait to commercialize the invention and continue to gather information about the commercialization opportunity. Let us assume that the firm continues to gather information and after one year, the uncertainty about the opportunity greatly decreases. Because the firm has waited one year, the potential profits from the opportunity will have decreased to $16 million (16 years times $1 million), but let us assume that the probability of success has increased to 80 percent. At this point, the opportunity looks very attractive for the firm as the expected net benefits from the project (before discounting to present value) would be 80 percent of $16 million, or $12.8 million. With a 10 percent discount rate, that would translate to an NPV for the commercialization opportunity of roughly $6.2 million, which justifies the $4 million capital investment. By allowing the firm to defer the commercialization decision for a year, the patent's embedded real option allows the net economic value of the commercialization opportunity to increase from $0 to $2.2 million.

This option to wait to use the patent can apply to any number of patent-related decisions. Licensing decisions, assignment decisions, decisions to market the patented technology in foreign markets, decisions to develop improvements to the invention, and decisions to renew the patent are all examples of future use decisions that may benefit from deferral. When analogizing a patent's option to use to financial option contracts, one can think

of the option to use as a call option. The patent holder has the option to purchase the future opportunity.

Option to Exclude The most basic right that comes with a patent is the right to exclude others from "making, using, offering for sale, or selling the invention."[10] To enforce this right, the patent holder can use the legal system to enjoin infringing activity and sue for damages caused prior to the injunction (see Chapter 11). Not surprisingly, some refer to this option to exclude as an "option to sue."[11] The right to exclude exists regardless of whether the patent holder has a meaningful right to use the invention, such as when an effective blocking patent exists (see Chapter 5).

The ability to defer a decision on whether to exercise this right to exclude another from practicing an invention can have value that can be captured under option analysis. The right to exclude can be modeled as the net present value of the cash flows that come from others *not* practicing the invention. Those cash flows may come, for example, from having greater pricing power on a patented product, from encouraging another party to license the patented technology or from potential patent damages awards. If the present value of exercising the right to exclude exceeds the cost of pursuing the exclusion, it makes economic sense to exercise the embedded option and pursue the exclusion. In some cases, the option to exclude has more value than the option to use.

The option to exclude can be modeled as a put option.[12] The patent holder has the option to sell cash flow from the patented technology in exchange for obtaining a damages award against an infringer (see Chapter 11).

Trying to Adapt Black-Scholes to Patents

Recognizing that real options are embedded within patents is one thing, coming up with a reasonable value for them is altogether another matter. One of the more popular attempts to value these embedded real options is by adapting the Black-Scholes options pricing model to the patent context. Although the Black-Scholes options pricing model has proven to be a highly effective valuation tool for securities-based option contracts, translating this success to patent assets remains largely theoretical. The reason that Black-Scholes is not widely used in the patent context is an input problem. The methodology of Black-Scholes is fine, but if you cannot generate sufficiently accurate inputs to feed the equation, the methodology loses much of its usefulness.

As we explained earlier in this chapter, a strength of the Black-Scholes method for financial options contracts is the relative ease with which the necessary inputs can be gathered and the reliability of that information.