

Applying the Options Framework to a Value-based Model of the Firm

Jan Vlachý

Czech Technical University in Prague, MIAS School of Business

Abstract

This paper develops the value-based model of a firm from a conventional accounting-based approach to one that acknowledges individuals' human capital and firms' competences as fundamental creators of value. Both have distinctive characteristics, but may be integrated from the perspective of their holders through various contracts, which then constitute contractual assets enhancing a firm's capital. Product ownership constitutes another vital component of value determination and is one of the reasons firms enhance its value, either by taking protective action, or by designing hard-to-replicate strategies.

This paper addresses a current issue and presents potential means by which to determine firms' strategies in highly competitive business environments driven primarily by innovations, as well as for the design of appropriate types and terms of contracts. In its reasoning, the paper is exceptional by aggregating the findings of firm theory with those of modern financial theory, proposing real and embedded options within an appropriate quantitative framework.

Keywords: business valuation, human capital, strategy, options theory

Introduction

Conventional valuation methods originated in times when firms directed most of their capital investments into tangible means of production, such as machines, equipment and real estate, as premised by Babcock (1932) or Williams (1938). The value of a business therefore broadly corresponded to the intrinsic value of its tangible assets. However, since the mid-20th century, theoreticians as well as practitioners have started to acknowledge the gap between the traditional intrinsic value-based perspective and the fact that growing numbers of successful firms have made substantial investments in intangibles by means of research and development, registering trademarks, acquiring market share or

developing human resources. A historical outline of this development has been provided by Rubinstein (2006) and Carson (2011).

The potential magnitude and diversity of this gap can be illustrated by comparing the book and market values of several large companies in different markets according to recently audited reports (see Table 1). The results clearly suggest that there is a need to employ new approaches in both academia and practice.

Table 1: Book values and market capitalisations of selected firms

Company	Exchange	Book Value	Market Value	Mkt/Bk
General Electric Co. ⁽¹⁾	NYSE	\$75.8 bil	\$272.7 bil	3.6
Deere & Co. ⁽²⁾	NYSE	\$6.5 bil	\$27.7 bil	4.3
Citigroup Inc. ⁽¹⁾	NYSE	\$225.1 bil	\$166.0 bil	0.7
Microsoft Corp. ⁽³⁾	Nasdaq	\$72.0 bil	\$385.1 bil	5.3
Volkswagen AG ⁽¹⁾	Xetra	€184.9 bil	€67.9 bil	0.4
Nestlé AG ⁽¹⁾	SIX	SFr66.0 bil	SFr228.1 bil	3.5
ČEZ, a.s. ⁽¹⁾	BCPP	Kč261.4 bil	Kč229.7 bil	0.9

Source: Vlachý (2018, p. 19); ⁽¹⁾As of fiscal year ending on 31-12-2016; ⁽²⁾ditto 31-10-2016; ⁽³⁾ditto 30-6-2016.

Penrose (1959) initiated pioneering work in the domain of firm theory with her resource-based perspective. In contrast to her predecessors, influenced primarily by Schumpeter (1912), rather than looking at the external environmental effects, she focused on an organization's internal environment, resources and skills, highlighting the creation of value within a firm, rather than its redistribution. In the late 1980s, this line of reasoning became one of the factors contributing to the development of the concept of the targeted creation of comparative advantage and its protection in order to draw entrepreneurial rent, as demonstrated by Hodgson (1988) and Barney (1991).

Another important highlight relates to the key competences proposition, as formulated by Hamel and Prahalad (1994). These are capabilities that are essential for the implementation of strategies facilitating the discovery of potentially valuable courses of knowledge that fill in existing gaps. Ghoshal et al. (1999) introduced a broader and deeper insight into the value of people as an essential component of firms' resources by highlighting the importance of management skills.

In parallel, Kogut and Zander (1992) developed their knowledge-based theory of the firm, claiming that the primary resource is actually people's capabilities. This ultimately supports the concept of a "learning firm" (Lundvall and Johnson, 1994), evoking the impression of a collective, rather than individual learning process.

Summarily, all of these frameworks have led to a general understanding that factors such as business licences, development potential or know how are qualitatively important.

However, as argued by Ortiz (2006), Saaty (2009) or Wang et al. (2014), in actual decision-making, such intuitive reasoning is a poor substitute for a robust valuation model that enables the comparison of alternative opportunities for the allocation of scarce resources.

Last but not least, as explained by Anderson et al. (2014) or Birdi et al. (2016), there is a clear conceptual benefit to separating an individual's generation of new ideas from the implementation of those ideas, which is even more critical whenever decisions need to be made in respect to valuation, contracting or transaction pricing.

The objective of this paper is to therefore define the position and role of assets representing a particular form of knowledge within the framework of a structured value-based model of the firm, and coupling that role with the personal endowment, development and contracting decisions of an individual. It is innovative in integrating financial theory with the theory of the firm, providing a sound theoretical contextualisation in an area which has commonly been based mainly on heuristic approaches.

It will be shown that the factor, commonly designated as human capital, constitutes a particular source of value, manifest in a firm's intangible assets. This combines managerial, technical and economical perspectives and may constitute a useful lead in strategic decision-making, as well as various types of contracting. Real options are proposed as the preferred means of quantitative analysis.

Relating Contractual Assets and Human Capital

The theory of the firm does not primarily focus on which types of assets should be attributed primarily to individuals, or to firms. In the following discussion, a point is therefore made of consistently distinguishing between human capital as an attribute of individuals and competences constituting part of a firm's intangible assets, while capabilities constitute a bundling of resources (which can be generated by firms as well as individuals), which only becomes a competence upon attaining a competitive advantage (Sirmon, Hirt and Ireland, 2007).

Moreover, besides competences, sometimes designated as knowledge assets, intangibles also include contractual assets, whose value is determined by the existence of a contract, be it private, public, written or implicit, and its enforcement potential (Vlachý, 2010). Contractual assets therefore include intellectual property (patents, licenses, copyright, trade secrets, trademarks, software), as well as various kinds of commercial, employment and other contracts.

This framework is illustrated in Table 2, which presents a conventional accounting view (in particular regarding the specification of intangibles), and compares the perspectives of firms as well as individuals.

Table 2: Conventional structure of assets

Firm		Individual
Financial assets		Financial assets
Tangible assets		Tangible assets
Intangible assets	Contractual assets	Contractual assets
	Knowledge assets (competences)	Human capital

Source: Author

Note that financial assets and tangible assets can be owned (by endowment or acquisition) by either, i.e. firms as well as individuals may be parties to contracts constituting value.

However, when considering overall value, it is much more practical to adopt a framework that fully utilises the comprehensive notion of contracts, as illustrated in Table 3.

Table 3: Alternative structure of assets

Firm		Individual
Tangible assets		Tangible assets
Contractual assets	Rights to tangible assets	Human capital
	Rights to the product of human capital	Contractual assets (rights to tangible assets, opportunities and the product of human capital)
	Rights to opportunities	Strategy (portfolio of tangible and contractual assets, and human capital)
Strategy (portfolio of tangible and contractual assets)		

Source: Adapted from Vlachý (2009)

Essentially, such a structure distinguishes between the fundamental concepts of asset ownership and rights, each of which has distinct characteristics.

While tangible assets can possibly become a firm's or individual's ownership, as well as the subject of rights, this is normally not the case for human capital, at least since the abolition of slavery (Lindgren 1995). Another person, physical or legal, can only become the holder of rights on its product. Furthermore, tangible assets and human capital constitute goods, while contractual assets are derivatives, i.e. contracts representing particular rights and obligations (on aggregate, they may therefore have a negative value). Contractual rights can be derived from goods (such as a contract to sell a commodity, lease land or employ human capital), but also from future opportunities.

Under this framework, it becomes redundant to specifically characterise knowledge assets because, clearly, any intangibles arise only due to the utilisation of human capital. This is the case even when individuals or firms cannot actually acquire and use them, which

would make them contractual assets. Effectively, these are the factors that Porter (1985) called complementors, constituting capability synergies that cannot be easily replicated by competitors, therefore strengthening a firm's market position.

This remaining part of intangible value, if any, represents a competitive advantage due to an incapability of the competition to replicate a particular combination of resources, which is usually temporary. Nevertheless, the fundamental reason for such an incapability would still constitute a particular contractual right, information asymmetry (sometimes enjoying the protection of a trade secret), or the scarceness of an essential resource in such a combination.

Generally speaking, such a competitive advantage is brought about by the unique - systematically or incidentally created - combination of resources contracted by a firm (to some extent, the same competitive advantage can be developed by individuals), which may be called strategy, whereby its value is determined by the current state of the market. Notably, that value can be negative, as well as positive, because portfolios of contracts include obligations and, under certain circumstances, these can reduce a firm's value by more than the worth of the rights being held.

Incidentally, it also becomes unnecessary to characterise financial assets because, under this framework, they are nothing but contractual entitlements to goods, be they scarce (gold or some other assets), or less so (political assurance).

A firm's value therefore consists of tangible assets, contractual assets (some of which derive directly from the product of human capital) and their particular combination, i.e. strategy, whose design also ensues from the application of human capital. We may therefore conclude that a firm's value eminently derives from contracted human capital in various forms (such as employment contracts, managers, entrepreneur-owners, consultants) and that an appropriate structure for such contracts (i.e. strategy) constitutes a key parameter for business success.

Using the Options Framework for Valuation

Applying Options to Value Contracts and Opportunities

The financial assessment of business situations that are characterised by the utilisation of opportunities that arise from changes in the external environment, and which become matched with particular competences, can be facilitated by using the options framework, in particular embedded and real options (Vlachý 2018, pp. 78-81). As explained by Dixit and Pindyck (1994), real options may be used for the assessment of capital budgeting decisions, featuring an element of uncertainty, irreversibility and flexibility. In contrast to the regular assumption of general risk aversion, real options assume an active response to uncertainty.

Conventional financial analysis, using the net present value criterion, stipulates that any capital budgeting decision can either be completely reversible, or completely irreversible

over the life of the project or asset. In the real world this is not realistic, and the decision-maker usually has some discretion regarding future choice, with the uncertainty decreasing over time. In other words, we speak about the process of the gradual accumulation of knowledge and experience, i.e. learning (Payzan-LeNestour and Bossaerts 2011). Combined in a portfolio with embedded contractual options, real options therefore constitute the essence of a firm's strategy, which applies continuous flexibility in response to newly acquired knowledge (Luehrman 1998).

Once real options are related to firms' strategies, it becomes quite intuitive to translate this framework to the concept of knowledge and learning. Kogut and Kulatilaka (2001) applied options to firms' competences, claiming (p. 3) that "A real option is the investment in physical assets, human competence, and organisational capabilities that provide the opportunity to respond to future contingent events." As an example, they quoted an investment into a loss-making distribution network in a developing country, which brought with it an improved understanding of the local environment, therefore facilitating rapid business expansion once the economy started to grow.

Competences within a firm include individual knowledge and the capabilities of its managers and staff (i.e. contracted human capital), as well as social relations ensuing from the firm's procedures, management processes and communication and cultural norms. This enables Pandza et al. (2003) to conclude that in general, the building up of competences is analogous to the application of real options to strategy because a firm's competences, similarly to its resources, create future opportunities. Berg and Kaše (2005) endeavour to value human capital accordingly by applying an option-based model to the assessment of human resources management policy.

The earliest applications of real options, pioneered by Myers (1984) and Brennan and Schwartz (1985), tended to focus on problems with a clear analogy to financial options, facilitating their valuation using known analytical methods, such as variants of the Black-Scholes model. This requires, among other constraints, exclusive ownership of future opportunities by the option holder, which may be due to legal or regulatory factors hindering competitors' entry (mining or broadcasting rights, patent or trademark protection), as well as temporary economic barriers.

More recently, researchers have started addressing situations where the value of real options may be actively impacted by the behaviour of competitors. Typically, an investment delay with such shared (competitive) options may substantially reduce future incomes due to competitors' entry into the industry. The value of various strategies can then be assessed using game theory, as shown by Smit and Trigeorgis (2004).

Applying Options to Value the Product of Human Capital

The most obvious case of an individual utilising their capabilities (i.e. human capital) to generate future incomes arises when they become an entrepreneur, taking decisions on their own account and at their own risk. In a broader sense, however, they also take

entrepreneurial decisions when they become employed or acquire an equity stake in a company; the incomes resulting from their decisions then only become subject to a particular type of contract.

In fact, individuals take entrepreneurial decisions even when making choices that - from the perspective of their actual capabilities - do not maximise future incomes (such as when a nuclear scientist uses their personal savings to spend the remainder of their life travelling and studying exotic insects); such a choice can be assessed based on opportunity costs. All such scenarios are part of an individual's strategy with regards to human capital, as noted in Table 3.

Human capital has several specific features. An individual's capabilities may be indigenous (which is an analogy to the endowment of goods commonly considered in macroeconomic analysis); it is possible to develop them through investment (for example, in education), and they determine opportunities for future incomes or other gains. Capabilities, once acquired, become irrevocable, which makes investments in human capital risky in terms of its change in value due to external environmental changes. Capabilities therefore constitute real options and investments in human capital can be considered purchases of real options.

For all intents and purposes, such an option is proprietary, in some cases, however, it is possible to transfer the rights to its pay-outs. The forms of such transfer may include employment contracts or partnership deeds. Nevertheless, in contrast to tangible assets, there is no ownership title, but rather a bilateral contractual arrangement, where the holders of capabilities have their own rights, including that of leaving a firm or deciding whether to invest in their own capabilities. Such rights, similar to firms' rights, therefore always constitute a set of embedded options.

It is important to note here that the transfer of rights to the options' pay-outs need not always be completely voluntary from the holder's point of view. One typical example involves income tax, as explained in a similar context by Vlachý (2007).

The Value of Discovering Options

The most valuable component of human capital is its capability to discover new real options because this is the one option that is, in comparative terms, the least competitive. This is what most people would describe as creative capabilities in the broadest sense, and contrasts with the highly competitive commodity component of human capital ("manpower"), which is essentially a substitute for tangible assets (such an assumption is made by Becker 1975).

In some specific, and rather unique cases, as with inventors or artists, the product of their creative activity constitutes a contractual asset, which can be sold outright. In this context, Tunaru et al. (2005) consider professional sports clubs, whose own value derives from the ownership of negotiable rights on individual athletes.

Notwithstanding all other things, valuation principally depends on whether the real option can be exercised by the particular individual, who therefore retains its protected ownership, or whether its discovery or publication makes the option publicly available, i.e. shared. The discoverer is then often left with the only choice of associating with a stronger partner, such as a firm, capable of taking the necessary steps to safeguard the value of the option, at the cost of forsaking part of its pay-outs. This explains why many capable individuals work as employees, even though ostensibly at a disadvantage from the perspective of profit sharing.

Finally, some options can be discovered only by teams of capable individuals, or using tangible assets not available to the individuals themselves. This may relate to research laboratories for scientists, but also large firms when the capabilities are borne by managers. This creates incentives to retain such groups of individuals, or their particular pairings with the tangible assets.

Conclusion

Option analysis, which on the one hand describes contractual relationships (embedded options), and on the other hand intangible assets (real options), all constituting products of human capital, may be used for the optimisation of contracting. From the perspective of a firm, it indicates that different forms and terms of contracts must be used for different ways of using human capital.

The most valuable product of human capital relates to the discovery of real options, which also determines the value of investment in human capital. However, the principal's actual behaviour will be determined by the extent to which their options are owned or shared. Provided there is an ownership potential, the person will be strongly motivated to invest in their capabilities, not only with regards to the options' time to expiry, but also with regards to the uncertainty of future incomes, in analogy to financial options.

In contrast, when the options are typically shared, as with commodity labour or scientific research, which is published rather than patented, value is enhanced by comparative advantages (unique skills) and early market entry. Higher incomes from real options then tend to be realised by individuals with capabilities acquired at an earlier stage, for example, by getting their training or education at an earlier age, or skipping non-essential phases (note the successful entrepreneurs who did not graduate in order to develop their businesses). In such cases, the value of the options need not be determined primarily by future uncertainty, but by sunk costs. There is also a much greater role for firms to enhance the value of an individual's human capital product developing strategies that may be hard to replicate.

A similar line of reasoning can be taken in regard to public policies. In the first case, when the options are mostly owned, it can be shown that any government policies aimed at mitigating uncertainty, including a generous social security system, industrial interventions or pro-active education capacity planning, may have a detrimental effect on

an individual's investment in their own human capital. Any subsidies supporting the development of human capital can therefore be perceived as a net rent appropriated to individuals, who were granted real options (for example through tuition waiver). In the second, where shared options prevail, the outcome is similar, however, the rent is allocated primarily to firms that take advantage of an increased supply of skilled workforce, which diminishes the incentive to share in the product, either through profit-sharing or by investing in the development of human capital themselves.

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Contact address of the author:

doc. Ing. Jan Vlachý, Ph.D., Czech Technical University in Prague, MIAS School of Business, Koleční 2637/2a, 160 00 Praha 6, Czech Republic, jan.vlachy@cvut.cz

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