Theoretical and Practical Aspects of the Patents Cost of Capital Estimate[#]

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Introduction

One of the most challenging tasks in corporate finance is the valuation of intangibles. Unlike tangibles, where the valuation theory is quite developed, problems arise in this field due to specific intangible assets features. Among these specific features the most important ones are (Dixon – Greenhalgh, 2002; Lev, 2001):

- *originality* – intangibles are often very unique a that's why hardly comparable,
- *non-tradability* – markets for intangibles are thin and not organised,
- *non-rivarly* – intangibles can be deployed simultaneously in many uses by many users; their use is connected with increasing returns to scale,
- *relative excludability* – ownership of an intangible is not total; there are still some benefit spillowers to non-owners,
- *specific risk profile* – generally, higher risk is connected with intangibles compared to tangibles.

An intangible whose value is frequently estimated is patented invention (patent). The patents valuation approaches are cost, market and income approach (Smith – Parr, 2000; Reilly – Schweihs, 1998) sometimes the option-based approach is referred (Pitkethly, 1997). Within those approaches, the most frequent patent valuation methods are income a market-income, both of them based on discounting future net benefits from patent. One of the key estimates in these techniques is the *cost of capital.*

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The state of the art

The corporate finance theory states that the cost of capital is equal to the rate of return required on the risk-comparable investment (Penman, 2001). In the valuation theory no exact methodologies how to measure the risk of a patent and how to convert this risk into the required rate of return exist. (Smith – Parr, 2000) hold the view of using the weighted average cost of capital (WACC) for intangibles. (Reilly – Schweihs, 1998) distinguish valuation within the company (using WACC) and for transaction purposes (using capital assets pricing model – CAPM) of the most probable licensee's industry. Also (Neil, 1997; Gosset, 2004; Meinhart – Gaffen, 2004) consider the CAPM. Neil (1997) recommends to estimate project's β, Gosset (2004) estimates β comparing stock exchange returns with license portfolio returns, Meinhart and Gaffen (2004) use β of intangible-intensive companies plus risk premium for stock-intangible differences. Meinhart and Gaffen (2004) also refer a build-up model constructed with risk-free rate, market risk, investment size, industry risk and specific intangible asset risk premium. (Degnan, 1998; Razgaitis, 1999) offer risk classes for intangibles discount rate (directly for patents). While Degnan (1998) forms the risk classes (10 – 80 %) purely according to patents maturity, Razgaitis (1999) offers more complex risk classes (10 – 70 %). For intangibles in the early stage of development (Smith – Parr, 2000; Razgaitis, 1999; Allen – Rigby, J. – Zameeruddin, 2002) recommend using venture capital rates of return (20 – 70 %).

Objectives

Looking at the literature review, in general terms one can distinguish three ways of estimating the cost of capital for intangibles (and patents as well): (i) *models for tradable real and financial assets (companies, stocks) – WACC, CAPM, (ii) build-up models, (iii) risk-classes (including venture capital rates of return)*.

Building on the literature review, one can make a conclusion that the principal question is "How many per cent?" or "Which model is most appropriate?" With regard to very specific patents characteristics, these questions could be quite narrow. This paper makes an enlargement of the questions above and analyses two connected levels in the patents cost of capital estimate:

1. Which are theoretical aspects of estimating the cost of capital for patents? What does the term "cost of capital" mean for a patent?

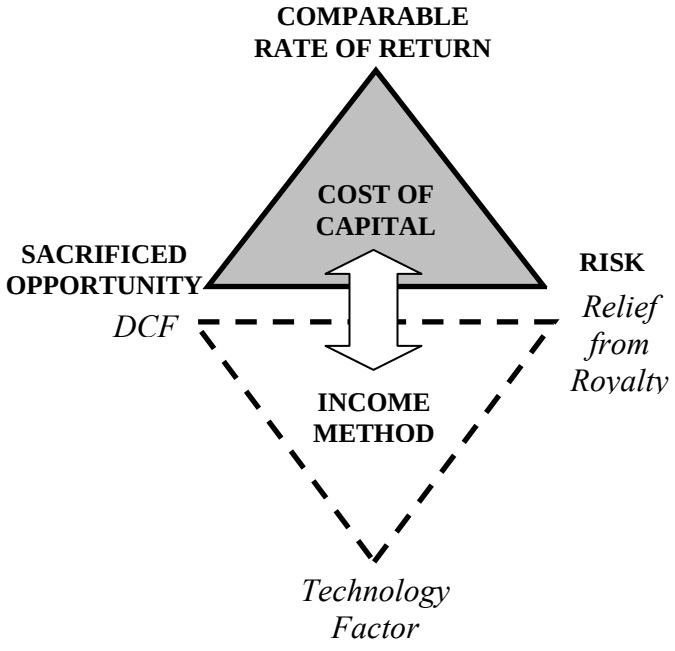
2. How particular patent income valuation methods work with the *risk* of a patent as a key factor in the cost of capital estimate?

Methodology

As consistent with objectives, the paper is divided into two optically separate parts (see Fig. 1):

1. Analysis of the term cost of capital for patent from three complementary viewpoints: (i) *comparable rate of return*, (ii) *sacrificed opportunity* and (iii) *risk*.
2. Analysis of the cost of capital in three income valuation techniques: (i) *Discounted Cash-flow (DCF)*, (ii) *Relief from Royalty* and (iii) *Technology Factor Method*.

Fig. 1: Methodology of the paper



Comparable rate of return

The probability of finding such a return for an asset is given basically by these factors:

- degree of originality,
- degree of being strategy-fixed,
- degree of non-tradability.

Degree of originality. The estimate of a comparable rate of return requires the existence of comparable opportunities (assets). Unlike tangibles the patent must be in its essence very original (world novelty). On one hand such feature promises high value creation, on the other hand it causes great difficulties in finding comparable rates of return.

Degree of being strategy-fixed. The ownership of tangibles is not principally tight to any particular strategy (e.g. alternative uses of a real estate). Deployment of an intangible usually relates to some firm vision and strategy. "Vision sets the benchmark against which corporations may measure the value of their intangibles" (Sullivan, 2000). Some intangibles could be deployed only in their current company because of availability of appropriate complementary assets (Sullivan, 2002). For patents we can generally suppose their deployment also within other firms of the same (or even other) industry.

Degree of non-tradability. Patents are not traded in organised markets. The following conditions are not fulfilled: (a) *large number of homogeneous assets*, (b) *publicly available transaction information*, (c) *the ease of setting price mechanism*. Problems with patents homogeneity are largely given by their originality. The availability of public data is made harder by the tendency of firms to hidden the information about their key competitive advantage. Difficulties in setting an effective price mechanism for patents is caused by (Lev, 2001): (i) defining and measuring precisely the risk of a transaction, (ii) high degree of information asymmetry between buyer and seller, (iii) troubles in setting a price for an asset with high fixed and negligible marginal costs (Price = Marginal Costs).

Sacrificed opportunity

Analyzing this meaning of patents cost of capital I distinguish two factors:

- nonrivalry,
- opportunities asymmetry between buyer and seller.

Nonrivalry (non-scarcity, ubiquity). Unlike tangibles, this feature enables the owner of a patent to make more investments with the same asset without sacrificing one investment for another. The only restriction

of "investment generation" is the patent market potential (Lev, 2001). All cost of capital models assume the rivalry of an asset.

Opportunities asymmetry between buyer and seller. This factor is related to nonrivalry, it is only an attempt to view the nonrivalry separately from owner's and buyer's viewpoint. The creation of nonrivalry investments is connected mostly to the owner's rights (licensor). For the buyer (licensee) the acquisition of a license usually means sacrificing some financial (tangible) capital, which is a rivalry investment.[1]

Risk

Comparing the risk of tangibles and intangibles, there are generally some additional risks associated with patents:

- inherent risk,
- risk of non-exclusive ownership.

Inherent risk. Investments in intangibles are generally more risky than tangible ones. Lev (2001, p. 37) calls this risk *inherent risk*. Inherent risk is based on the following factors:

- *Additional risk*. Not only commercial success risk, but also technical and implementation risks inhere to patents. The volatility of earnings attributed to long-lived tangible investments is three times lower compared to R&D investments (Kothari – Laguerre – Leone, 1998).
- *Development of risk in time*. The risk of patent decreases with the increasing probability of commercialization (Lev, 2001).
- *Irreversibility of intangible investment*. In the case of unsuccessful development or commercialization the probability of recovering at least some part of sunk costs is lower compared to tangible investments due to difficult selling (Shapiro – Varian, 1999, p. 21).

Non-exclusive ownership. The substance of intangibles causes serious difficulties in ensuring the rights and associated benefits totally to the owners of rights. This applies also to patents despite their relatively strong intellectual property rights. The risks of re-engineering (Lev, 2001, p. 34), infringement (intentional or unintentional) or speculative legal proceedings are still present.

[1] Compare the nonrivalry "pure intangible exchange" in cross-licensing.

The summary of previous analyses drawn in Fig. 2 shows very strong differences in the cost of capital aspects between tangibles and patents. These partial conclusions raise the question about how to construct the cost of capital for patents.

Tab. 1: Comparison between tangibles and patents cost of capital aspects

Cost of capital aspect	ASSETS	
	TANGIBLES	PATENTS
I. Comparable rate of return		
• degree of originality	–	+
• strategy-fixed	–	– / +
• non-tradability	–	+
II. Sacrificed opportunity		
• nonrivalry	–	+
• opportunities asymmetry	–	+
III. Risk		
• inherent	–	+
• ownership non-exclusivity	–	+

Income methods and cost of capital estimates

The first part of the paper shows difficulties in defining theoretically the content of the parameter "cost of capital". The second objective of the paper is to demonstrate how particular patent income valuation methods work with the estimate of the cost of capital and particularly how do they work with the estimate of patent risk. Within this context, DCF, Relief from Royalty and Technology Factor methods are analysed.

Discounted cash-flows (DCF). General formula for DCF patent valuation can be defined as follows:

$$NPV = -I + \sum_{t-1}^{n} \frac{CF_F^t \cdot PC}{(1+r)^t}, \qquad (1)$$

where CF_F^t = net company benefits in period t,

PC = patent contribution to net company benefits,[2]
I = initial investments before commercialization,
r = cost of capital.

From the cost of capital estimate perspective it is necessary to take into consideration that if e.g. licensee should pay the NPV as a lump-sum payment for patent, *r* represent the licensee's internal rate of return (IRR). That is the reason why the cost of capital *r* should reflect *all risks* associated with receiving incremental cash-flows from patent ($CF_F^t \cdot PC$).

Relief from Royalty. General formula for patent value is as follows (Parr, 2004):

$$PV = \sum_{t=1}^{n} \frac{R_t \cdot LP}{(1+i)^t}, \tag{2}$$

where R_t = revenues attributed to patented production,
LP = license payment (royalty) for comparable patent,
i = cost of capital.

For the cost of capital estimate it is necessary to understand that Relief from Royalty is a form of income-market method, that is why the size of parameter LP includes partly the parameter PC and partly some specific risk of the patent. From these arguments we can deduce that the cost of capital i should include only *partial risks* so as not to charge for the same risk twice.

Technology Factor. The formula for patent value in this method used in U.S. chemical industry is the following (Khoury, 2001):

$$PV = \sum_{t-1}^{n} \frac{CF_F^t \cdot PC}{(1+i_b)^t} \cdot TF, \tag{3}$$

where CF_F^t = net company benefits in period t,
PC = patent contribution to net company benefits,
i_b = cost of capital,
TF = technology factor reflecting the utility and competitiveness of the patent (0-100 %).

The logic of the Technology Factor method could be viewed as a mix of both DCF and Relief from Royalty. First, company's incremental cash-

[2] For techniques of *PC* estimates see Jakl (2001).

flows attributed to patent are estimated (analogously with DCF), then reflecting some specific patent risk directly to the cash-flows by TF (analogously with Relief from Royalty) and company (business) risk into the discount rate – cost of capital. So the cost of capital should include only *business risk* (compare Khoury, 2001).

The comparison of methodologies of estimating the cost of capital used in all analysed income methods is shown in Fig. 3.

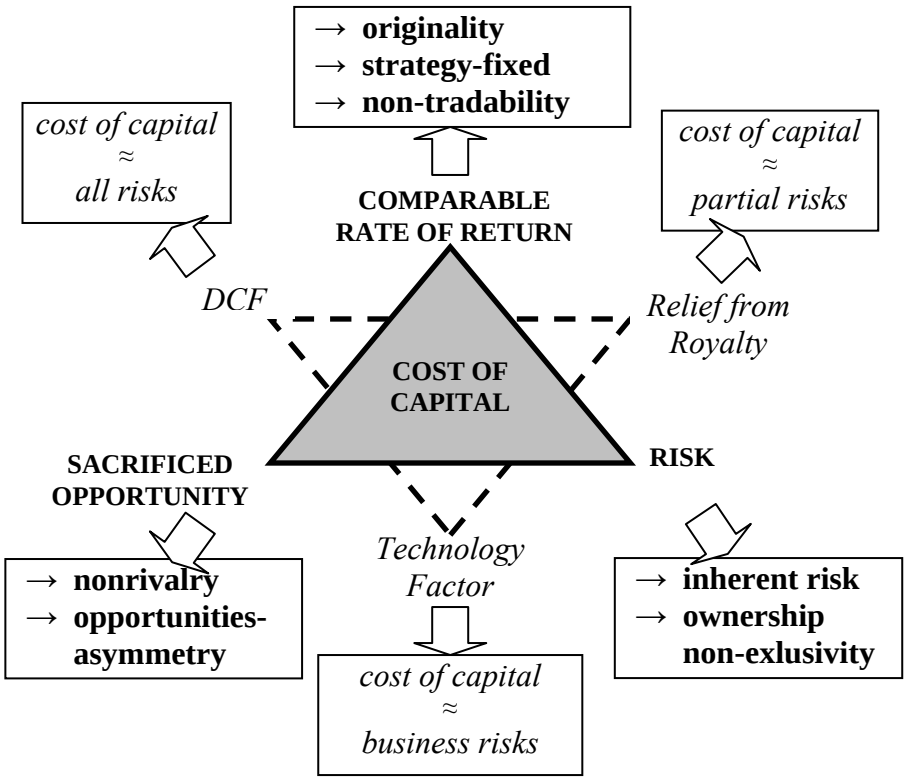
Fig. 2: Cost of capital estimate methodologies in income methods

	DCF	**Relief from Royalty**	**Technology Factor**
Approach	income	income-market	income-market
Cash-flows calculation	$CF_F^t \cdot PC$	$R_t \cdot LP$	$CF_F^t \cdot PC$
Risk calculation	all risks in discount rate	in part in cash-flows; in part in discount rate	in part in cash-flows (TF); in part in discount rate
Cost of capital	$r \approx$ all risks	$i \approx$ partial risks	$i_b \approx$ business risks

Conclusions

The paper shows that the estimate of patents cost of capital is a complex issue. First, there are theoretical doubts if one can use for patents which are hardly comparable, non-tradable, nonrivalry and more risky than tangibles automatically the same models as for tangibles. Secondly, choosing a particular income method for patent valuation, one has to take into consideration the methodology of reflecting the risk as one key aspect of the cost of capital estimate in the valuation formula.

Fig. 3: Review of theoretical aspects of the patents cost of capital



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ABSTRACT

Patents valuation methods are mostly income or income-market-based. In these methods one of the key estimates is the cost of capital. The paper analyses the question of the patents cost of capital from two complementary viewpoints: (i) theoretical aspects of estimating the cost of capital for patents as specific-featured assets, (ii) practical methodology of the patents cost of capital estimates in different income valuation techniques.

Key words: Patents; Valuation; Cost of capital.

JEL classification: M41.