LIMITATIONS OF REAL OPTIONS APPROACH FOR VALUEING IT INVESTMENT PROJECTS USING RMETRICS fOPTIONS PACKAGE

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Keywords: IT investments, real options, risk management, capital budgeting.

Extended Abstract:

Information technology investments possess intrinsic property of uncertainty and risk connected with technology, operational and implementation risk factors influencing the cash flow of a project. Traditional capital budgeting models do not face proper timing of the investment and the uncertainty of the outcomes for each risk factor. Real options approach makes it easy to handle IT investment project value for capital budgeting, continuous informed management decision making and proper risk accounting practices.

Some researches (Nichols, 1994; Trigeorgis, 1996; Benaroch – Kauffman, 1999) apply real options theory for IT projects in the way of embedding a real option into the project’s NPV when there is definite opportunity for management to take some future action (abandoning, deferring, scaling up) in response to endogenous or exogenous events. Their contributions in this context provides a formal theoretical grounding for the validity of the financial options pricing models (e.g. Cox – Ross – Rubinstein (1979), Black – Scholes (1973), Black – Scholes – Merton (1973)). For valuing these type of embedded options using Rmetrics fOptions Package we can simply substitute the parameters for each embedded option and apply functions CRRBinomialTreeOption(TypeFlag = c("ce", "pe", "ca", "pa"), S, X, Time, r, b, sigma, n, title = NULL, description = NULL) or GBSOption(TypeFlag, S, X, Time, r, b, sigma, itle = NULL, description = NULL) adding their returning value to project NPV calculated using simple capital budgeting technique.

This approach limits possibility to estimate and proactively manage total project value at any stage of the project and quantify total risk value for the project.

Remark by the Organizer of the Meielisalp Workshop:
Unfortunately, Andrey Bogomolov, couldn’t come to the Workshop, he asked us to make his extended abstract available to the participants.
Margrabe (1978) developed exchange-one-asset-for-another option model. It happen to be used in working papers for valuing R&D and IT-investments. Software development process in considered to be one asset to be exchanged and the following implementation cash flows are treated as another asset to be exchanged for. Rmetrics fOptions Package should make it easy to calculate exchange-one-asset-for-another option value using function EuropeanExchangeOption(S1, S2, Q1, Q2, Time, r, b1, b2, sigma1, sigma2, rho, title = NULL, description = NULL). But Margrabe (1978) model is unpractical for valuing IT-investment projects because software development and following implementation cash flows are not usually correlated as expected in correlation assumption between the two underlyings. Also $\rho$ seems not to be implemented (or at least documented) in fOptions package (241.68 release).

Another valuation approach is compound options valuation technique, also known as “option on option” developed by Carr (1988), Geske (1979). IT projects generally include multiple phases with multiple outcomes. If the investments are made in a phased manner with the commencement of subsequent phases being dependent on the successful completion of the preceding phases, it is known as sequential investment. Each stage provides information for the next one thus creating an opportunity (quantified as option) for subsequent investment in a new technological area. This type of IT-investment valuation problem can be solved using Rmetrics fOptions Package function OptionOnOption(TypeFlag, S, X1, X2, time1, Time2, r, b, sigma, doprint = FALSE, title = NULL, description = NULL).

Limitations of this approach are concluded around the practical findings that IT project phases very often take place in parallel and there are significant feedback loops between research and/or production stages (learning phenomenon – as defined in Bayesian approach).

Berk – Green – Naik (2004) developed advanced theoretical model focused on Bayesian approach for learning. This research is based on Schwartz – Moon (2000), Dixit – Pyndick (1994) approach results. Berk – Green – Naik model is structured with several objectives in mind. It is sufficiently tractable to admit closed-form solutions for important cases. It is sufficiently flexible to produce realistic profiles of expected cash flows, that could be calibrated to data in an applied setting. Finally, the model involves several distinct sources of uncertainty, in order to highlight how systematic and non-systematic risks interact to determine the magnitude of the risk premium required on the project, and its behavior through time. Rmetrics packages do not include direct implementation of Berk – Green – Naik models (Solution with Learning and Solution without Learning). As these models are widely used by academics and practitioneers, and they are quantitatively option-alike they should be included into fOptions package.
REFERENCES


Jones, R.E., Jacobs, L.W., and Van Spijker, W., 1992 , Strategic Decision Processes in International Firms, Management International Review, 32, pp. 219-236.


