REAL OPTIONS MODEL FOR DECISION – MAKING IN PROJECTS WITH CO2 ABATEMENT COSTS

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Overview

The traditional economic evaluation model based upon the discount cash-flow accounts for uncertainty, but just by increasing the discount rate and, as a result, the higher the uncertainty, the lower the present value of a project. Because of the uncertainties, the performance of the rate of return of the project in the future may be different from what was initially planned. Then, it is important that managers have some flexibility to adapt the project to a new economic reality. Since the uncertainty has a potential upside and the loss is limited to investment, the traditional decision-making tends to recommend suboptimal decision-rules.

Petroleum exploration and production projects have characteristics that suggest using real option valuation models. Projects are effected by all types of uncertainties, creating flexibilities that cannot be evaluated by traditional methods. Projects also take some time to build the structure and at least part of the investments needed in this sort of project is irreversible. So the optimization of investment timing is a main issue due to irreversibility.

The Oil and Gas industry is an economic sector in which Real Options Models can be used for economic analysis of all kind of projects. Uncertainties influencing decision-making are an important part of business and require evaluation models with volatility parameters. Real Options have been approached in petroleum projects considering as uncertain variables mainly the oil prices, but costs, technical and technological uncertainties are also part of real option valuation in the oil industry.

Real Option Models can be used to evaluate projects involving greenhouse gas emissions in a few different energy industries. Projects such as coal fired power plants with capture and storage of co2 (Rohlfs, 2011), renewable electricity generation projects (Batista et al,2012), electricity generation technologies (Reedman, 2006), adoption of photovoltaic technology (Sarkis, 2008), petroleum production project (Sarkis and Tamarkin, 2008) and Laughton (2005).

Methods

Valuing management flexibility to choose the optimal moment to invest in a project with greater costs such as one with a carbon sequestration structures might be the difference between a viable and a not viable project. Besides the high costs there is an elevated potential for costs oscillation in the future years for CO2 abatement structures, which makes a Real Option Model a useful tool for decision-making. In this paper we have the application of a continuous time real options model.

The model's main idea is the definition of a trigger investment decision point in which the returns obtained from exploration and possible future development of an oil reservoir have an optimal value, which recompenses making high investment expenditures considering the value of project´s manager flexibility to investment timing. This analysis includes to an E&P project, a carbon sequestration structure cost. The Project´s estimated value is subject to one uncertain variable, which has a random behavior governed by the Geometric Brownian Motion stochastic process.

The uncertain variable is the benefit-cost ratio where we can join the oil prices uncertainty on the ratio´s revenue portion to the CO2 environmental cost uncertainty on the costs portion. Using project´s benefit-cost ratio we simulate expected decision-making scenarios for the variable´s future behavior, regarding its estimated volatility and possible trend. The estimations are made using data for historical oil prices and data for CO2 abatement costs and its future expectations. Based on the ratio values on the real option model its possible to estimate the optimal value at which the investment decision is optimized. Based on the data gathered, regarding project´s costs, revenues, volatility and trend parameters, we make a Monte Carlos Simulations to estimate the expected

future trajectories for the B/C Ratio. The evaluation model is applied to a simulation of oil field similar to the ones developed in Brazilian Southeastern coast. The Real Option model is a fundamental valuation tool in periods of high price volatility and higher sunk costs added to a project, such as the carbon sequestration structure.

Results and Implications

We compare the simulated scenarios and its decision - making using the Real Options Model to the same scenarios using traditional NPV analysis. In the results we can Notice an important difference in the decision - making considering the different methods of economic analysis. The uncertainty parameter is tem most important variable which impacts on the decision making, regarding both oil prices and CO2 abatement costs. Carbon sequestration projects have very high costs. Its of great importance that return from these projects are optimized. Real Option models is a tool that shows in a clear way a decision – making rule which includes an optimization of the moment to invest. This tool might show better possible market conditions in which costs impacts of the CO2 structure on petroleum production investments would be lower.

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