
Case Study

# IIMK/CS/131/FIN/2021/01

**March 2021**

## Case study on a cancellable option

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**Abstract:** *Can we design and price an American option where the seller of the option i.e. your client, can also exercise early and exit the contract in order to stop her losses? If yes, then does the optimal exercise strategy for the seller depend on what the buyer is going to do?*

Mr. Ashish is a senior quant in the structured products group at Tech Kapital, a large investment bank headquartered in Mumbai. A week ago, he received a short cryptic mail from his manager, who is currently abroad on a work related travel, with the following question: *"Can you design an American Put in which the seller can also exercise it early and terminate the contract (may be with a penalty)? Will explain the details once I come back."* Ashish was initially puzzled by this request and started searching their exotic option and structured product databases. He was surprised to find a product named "Cancellable options" and a reference to a discussion of that product in an academic journal. He at once started learning the details of the product, its pricing etc.

Once his manager returned, he explained that the background for such an option was a request during a client phone call, where the client wanted to get into a short option position (over-the-counter) with her supplier on a particular raw material and at the same time wanted some flexibility to exit the contract, if the market prices were moving against her favour.

When Ashish showed his manager his finding in their in-house database, the latter felt somewhat relaxed by the fact that they already have a product which can be modified according to the client's need rather than designing it from scratch. However, both of them realized quickly that pricing such a product is going to be challenging since they have to incorporate the dynamics of both the buyer and the seller of the option. In fact, they thought the cancellable feature is going to take them away from option valuation and let them pour over various strategies of two person games from Game theory.

Beside the above complication, various other questions came up during the meeting of Ashish's group with the client viz. *'What will be the optimal strategies from the buyer's and seller's points of view?', 'How to value these options with finite expiry and with discrete exercise opportunities?'* (since the journal reference mostly talks about perpetual options and with continuous time exercise), *'How much lower will the price of this option be compared to its non-cancellable version?', 'Does it matter who (among the buyer and the seller) gets the first right to exercise at every exercise date or do we have to design it in such a way that exercise dates are kept separate for the two parties?', 'What is the relation between penalty and price reduction?'* (so that this can help the client to choose an appropriate penalty level).

At the end of this meeting, one central question that Ashish and his colleagues had was *'Whether they can do all of this in the simple Binomial framework (at least to start with) so that the answers to some of the client's questions can be explained to her intuitively?'*

Post this meeting, the quant group also got curious on *'Whether the cancellation feature will make it optimal to exercise early for calls?'*, since they have all studied that a plain vanilla American call on a non-dividend stock is for all practical purposes same as its European counterpart.

Can you help Mr. Ashish and his team to find answers to the above questions from their client?

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