Constrained optimal stopping/control and its application to liquidity risk modelling

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With a few exceptions, models of optimal stopping/control assume that the player is able to take actions (terminating underlying stochastic dynamics/implementing control policies) immediately after the decision is made. In fact, both stopping underlying stochastic dynamics and implementing control policies take time. Moreover, there may exist restrictions on stopping times and control policies, known as the liquidity effect. This also has a profound effect on the modelling of bank runs in finance (see [1])

In this project, the student is expected to establish a mathematical theory for optimal stopping/control with two types of constraints. The first one is a delivery lag when the player makes her decision (see [2]), and the second one only allows stopping/control taking place at a sequence of signal times, e.g. Poisson arrival times (see [3]).

The student is expected to be familiar with stochastic calculus and preferably stochastic control theory. However, the latter (stochastic control theory) is not a requirement.

References

[1] Gechun Liang, Eva Lütkebohmert and Wei Wei, Funding liquidity, debt tenor structure, and creditor's belief: An exogenous dynamic debt run model, *Mathematics and Financial Economics*, Vol.9, No.4, (2015), 271–302.

[2] Gechun Liang and Zhou Yang, Analysis of the optimal exercise boundary of American put option with delivery lags, *Journal of Mathematical Analysis and Applications*, Vol.497, No.2, (2021), 1-21.

[3] Gechun Liang and Haodong Sun, Dynkin games with Poisson random intervention times, *SIAM Journal on Control and Optimization*, Vol.57, No. 4, (2019), 2962–2991.