Entropy Martingale Optimal Transport and Nonlinear Pricing-Hedging Duality

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We develop a duality between a novel Entropy Martingale Optimal Transport problem (A) and an associated optimization problem (B). In (A) we follow the approach taken in the Entropy Optimal Transport (EOT) primal problem by Liero et al. "Optimal entropy-transport problems and a new Hellinger-Kantorovic distance between positive measures", Invent. math. 2018, but we add the constraint, typical of Martingale Optimal Transport (MOT) theory, that the infimum of the cost functional is taken over martingale probability measures, instead of finite positive measures, as in Liero et al. The marginal constraints, typical of Optimal Transport (OT) problems, in (A) are relaxed by introducing a functional D which may have a divergence formulation. In Problem (B) the objective functional, associated via Fenchel coniugacy to the terms D, is not any more linear, as in OT or in MOT. This leads to a novel optimization problem which also has a clear financial interpretation as a non linear subhedging value. Our results allow us to establish a novel nonlinear robust pricing-hedging duality in financial mathematics, which covers a wide range of known robust results.

Joint work with Alessandro Doldi.