Stochastic Terminal Times in G-Backward Stochastic Differential Equations

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Abstract

In this paper, we study G-backward stochastic differential equations with random terminal time . We explain how to extend the results of the case of fixed terminal time to the case of a random terminal time. We present the existence and uniqueness of a solutions for G-backward stochastic differential equations with a random terminal time.

Keywords: G-expectation, G-Brownian motion, G-Backward stochastic differential equations, Random terminal time.
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1 Introduction

We consider the G-backward stochastic differential equations with the random terminal time τ in the following form:

$$Y_t = \xi + \int_{t\wedge\tau}^{\tau} f(s, Y_s, Z_s)ds + \int_{t\wedge\tau}^{\tau} g(s, Y_s, Z_s)d\langle B\rangle_s - \int_{t\wedge\tau}^{\tau} Z_s dB_s - (K_\tau - K_{t\wedge\tau}), \tag{1}$$

where τ is a stopping time with respect to natural filtration $\mathbb{F}$, the processes Y, Z and K are unknown and the random functions f and g , said generators, and the random variable ξ, said terminal value, are given. We present the existence and uniqueness of a solution (Y, Z, K) for G-BSDE (1).

2 Preliminaries

Let Ω be a given set and let $\mathcal{H}$ be a linear space of random variables defined on Ω. We assume the functions on $\mathcal{H}$ are all bounded. Let $(\Omega, \mathcal{H}, \mathbb{E})$ be the G-expectation space. We denote by $lip(\mathbb{R}^n)$ the space of all bounded and Lipschitz real functions on $\mathbb{R}^n$.
In this paper we set $G(a) = \frac{1}{2}(a^+ - \sigma_0^2 a^-)$, where $a \in \mathbb{R}$ and $\sigma_0 \in [0, 1]$ is fixed. We extend some notations and conditions of the case of fixed terminal time to the case of a random terminal time.

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