Review of: "A connection between Gompertz diffusion model and Vasicek Interest Rate model"

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Potential competing interests: No potential competing interests to declare.

Abstract

All occurrences of the word *„new“* are misleading and should be removed. The connection between the Gompertz diffusion model (= Black-Karasinski model in the mathematical finance literature) and the Vasicek model via the logarithm is already known (see Brigo, Mercurio: Interest Rate Models – Theory and Practice (2006), chapter 3.5.1, or Ferrara, Nezzamoddini: Interest Rate Swaps – An Exposure Analysis (2013)). Otherwise, I am certainly fine with presenting these calculations.

Section 1

„The model describes the movement of an interest rate as a composite of market risk, time, and equilibrium value, where the rate tends to revert to the average of these factors over time.“

This sentence sounds a bit vague. What is the average of market risk, time, and equilibrium value?

Section 2

Definition 2.1: The state values of a Vasicek process x(t) are not bounded from below by 0.

Section 3

After eq. (3.2), you define parameters a, b, c, but they are not used therein. The notation a(t, y) and b(t, y) is confusing, since they do not explicitly depend on t (the same holds for the definition in the proof of Theorem 3.3).

Having sections 3.2 and 3.5 at once seems circular. Equation (3.3) is stated without referring to the preceding derivation. Further, in these steps, the inequality signs are not at the correct position, and a small letter „p“ is used instead of „P“ for a probability (the same holds for section 3.5).

Naturally, one would derive the density of the VIR model given in (3.3) using the Itô formula, and then deduce the density

of the Gompertz diffusion model using the connection via the logarithm. Therefore, I recommend deleting section 3.2 and keeping section 3.5.

The step *„Hence, the equation (2.3) can be written as…“* might be skipped.

Conclusion

I would not say the Vasicek IR model *„is“* a Gompertz diffusion process, but it is a transform.

General remarks

The text contains some typos, e.g., *„These connections focus“* (abstract), *„introduced new computational aspects“* (section 1), *„transformation in a diffusion process“* (section 1), *„and to determine“* (section 1), and some more. Please double-check.