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TITLE OF THE THESIS

SUB TITLE

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Abstract

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Contents

Declaration

I declare that this thesis is the solely effort of the author. I did not use any other sources and references than the listed ones. I have marked all contained direct or indirect statements from other sources as such.

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1 Introduction

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1.1 Sub Intro 1

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1.2 Sub Intro 2

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2 Option pricing

2.1 The fundamental theorem of asset pricing

2.2 The Black-Scholes model

Consider a given probability space $(\Omega, (\mathcal{F})_t, \mathbb{P})$ supporting a Brownian motion $(W_t)_{t\geq 0}$. In the Black-Scholes model, the stock price process $(S_t)_{t\geq 0}$ is the unique strong solution to the following stochastic differential equation:

$$\frac{\mathrm{d}S_t}{S_t} = r\mathrm{d}t + \sigma \mathrm{d}W_t, \qquad S_0 > 0, \tag{2.1}$$

where $r \geq 0$ denotes the instantaneous risk-free interest rate and $\sigma > 0$ the instantaneous volatility.

2.2.1 No interest rates

2.2.2 Including interest rates

A European call price $C_t(S_0, K, \sigma)$ with maturity $t > 0$ and strike $K > 0$ pays at maturity $(S_t - K)_+ = \max(S_t - K, 0)$. When the stock price follows the Black-Scholes SDE (2.1), Black and Scholes [2] proved that its price at inception is worth

$$C_t(S_0, K, \sigma) = S_0 \mathcal{N}(d_+) - K\mathrm{e}^{-rt}\mathcal{N}(d_-),$$

where

$$d_\pm := \frac{\log\left(S_0 \mathrm{e}^{rt}/K\right)}{\sigma\sqrt{t}} \pm \frac{\sigma\sqrt{t}}{2},$$

and where $\mathcal{N}$ denotes the cumulative distribution function of the Gaussian random variable.

Here is an example of how to insert a picture:

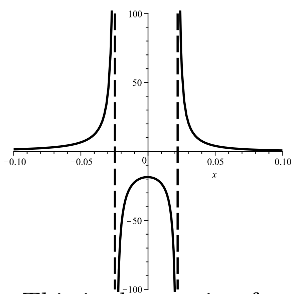

Figure 1: This is the caption for the figure.

or two side-by-side pictures:

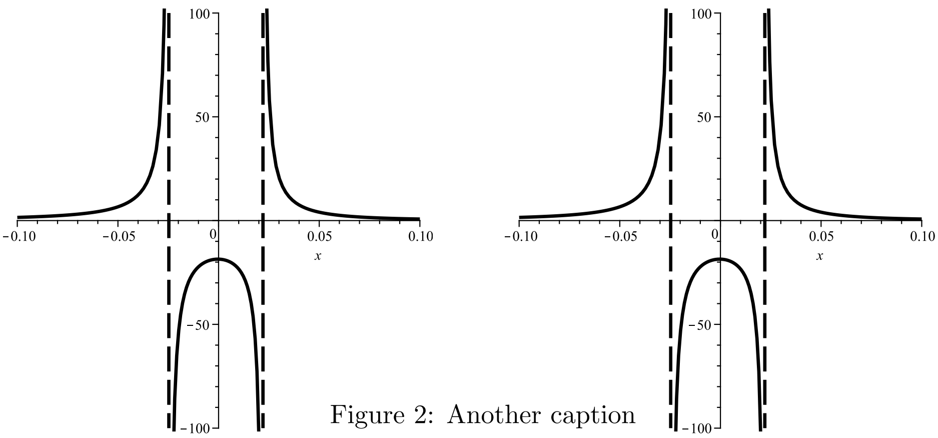

Figure 2: Another caption

2.3 The Heston model

In the Heston model, the stock price is the unique strong solution to the following stochastic differential equation:

$$
\begin{aligned}
\mathrm{d}S_t &= S_t\sqrt{V_t}\mathrm{d}W_t, & S_0 = s > 0, \\
\mathrm{d}V_t &= \kappa(\theta - V_t)\mathrm{d}t + \xi\sqrt{V_t}\mathrm{d}Z_t, & V_0 = v_0 > 0, \\
\mathrm{d}\langle W, Z\rangle_t &= \rho\mathrm{d}t,
\end{aligned}
\tag{2.2}
$$

where $\kappa, \xi, \theta, v_0, s > 0$ and the correlation parameter ρ lies in $[-1, 1]$.

3 Model calibration

3.1 What is calibration?

Here is an example of a matrix[1] in $A \in \mathcal{M}_n(\mathbb{R})$:

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & \vdots \\ a_{n1} & \cdots & \cdots & a_{1n}. \end{pmatrix}$$

3.2 Numerical methods for calibration

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4 Conclusion

Conclusion if needed...

A Review of stochastic calculus

A.1 Riemann integration

A.2 The Itô integral

Acknowledgements

I would like to thank my supervisor.....

References

[1] Fermentas Inc. Phage lambda: description & restriction map, November 2008.

[2] Rabbert Klein. Black holes and their relation to hiding eggs. *Theoretical Easter Physics*, 2010. (to appear).