List of Changes and Responses

The page numbers are from the revised draft, and the page numbers in brackets are from the original draft.

1. Numerical Experiments Details

- **Added in Chapter 2, Page 44(46):** Added a paragraph to explain the numerical experiments in Chapter 2.
- **Added in Chapter 2, Page 45(47):** Added a paragraph to explain maturity date of the options in the numerical experiments in Chapter 2.
- **Added in Chapter 2, Page 45-46(47):** Computing platform details for the numerical experiments in Chapter 2.
- **Added in Chapter 2, Page 56(58):** Added a paragraph to explain the Heston model parameters.
- The numerical experiments in Chapter 3 and Chapter 4 now have sufficient details.

2. Appendix Addition

- **New Addition (After Page xiv):** Added an appendix for all acronyms.
- After careful consideration, only one acronym table is added. The reason is that the number of acronyms used in this thesis is relatively small, making a single consolidated table more appropriate and efficient.

3. Clarification of Expected Values

- **Chapter 3, Pages 72-74(72):**
  - Clarified definition for GMMB liability, showing how the conditional expectation works.
  - Added explanation for pathwise delta calculations.
- **Chapter 3, Page 75(74):**
  - Corrected the mistake in the definition H_t^{bf}.
  - Showed the derivation of the formula for loss random variable L.

4. Neural Network Approximation Clarification

- **Chapter 3, Page 66**
  - Added a paragraph to explain how the neural network approximates the relationship between the outer scenarios and the VA loss.
- **Chapter 3, Page 78(76):**
  - Added explanation that neural networks approximate L in Equation (3.4).
  - Added explanation that L depends on all hedging weights ($\Delta_0,...,\Delta T_{-1}$) and each Δt depends on St.
  - Explained that $L(\mathbf{S}_T)$ is both a random variable and a function of the underlying path.

5. Regression References

- **Chapter 2, Page 52(54):**
  - Added one line to explain the high empirical convergence rate reported in the graph legends.
  - I think in the thesis, the high empirical convergence rate is well-explained using a separate set of experiments.

6. Multi-level Monte Carlo Sections

- **Chapter 2, Page 21(21):** Rewrote sections on multi-level Monte Carlo with clearer descriptions.
- **Chapter 2, Page 57(59):** Added more implementation details for replication purposes.

7. Cauchy-Schwarz Inequality

- **Chapter 2, Page 30:**
  - Added explanation between the inequality:

$$\mathbb{E}[(\hat{\rho}_{M,N} - \rho)^2] \leq 2\mathbb{E}[(\hat{\rho}_{M,N} - \rho_M)^2] + 2\mathbb{E}[(\rho_M - \rho)^2]$$

  - Included proper explanation for Cauchy-Schwarz inequality.

8. Taylor Expansion Clarification

- **Chapter 2, Page 31(33):**
  - Clearly defined variable z when applying Taylor expansion.
- **Global check, Pages 34(36):** Verified all other Taylor expansions are clearly explained.

9. Section 2.3.1 Rewrite

- **Chapter 2, (Page 28-30):** The section is completely rewritten.
  - The original section was not clear and the proof of Theorem 1 was not rigorous.
  - The section is moved to the appendix due to the lack of theoretical contributions.
  - Chapter 2 is rewritten to be more consistent with the rest of the thesis.
    - **Page 17, 35, 37**: Deleted the part about the connection between the convergence rates.
    - **Page 19, 28, 44**: Reworded a sentence to be more consistent with the rest of the thesis.
    - **Page 25**: Added a sentence to be more consistent with the rest of the thesis.
    - **Page 27**: Deleted sentences that are not relevant to the thesis anymore.
    - **Page 63**: Added a sentence to clarify the contribution of this chapter.
- I am fully aware that these changes do not fully address the comments from the committee. A supporting document is provided to show the difficulty in drawing the connections between the convergence rates. I suggest that the connection between the convergence rates to be left for future consideration.

10. Minor Items

- **Page i:** Moved copyright statement to first page.
- **Page ii:** Added paragraph under the "sole-author" declaration noting that part of this thesis has been published in a WSC proceeding.