

Mississippi State University

## Scholars Junction

---

Standards and Templates for Thesis and  
Dissertation Formatting

Theses and Dissertations

---

2019

### Standards for preparing theses and dissertations

Office of Thesis and Dissertation Format Review

Follow this and additional works at: <https://scholarsjunction.msstate.edu/td-standards>

---

#### Recommended Citation

Office of Thesis and Dissertation Format Review, "Standards for preparing theses and dissertations" (2019). *Standards and Templates for Thesis and Dissertation Formatting*. 3.  
<https://scholarsjunction.msstate.edu/td-standards/3>

This Text is brought to you for free and open access by the Theses and Dissertations at Scholars Junction. It has been accepted for inclusion in Standards and Templates for Thesis and Dissertation Formatting by an authorized administrator of Scholars Junction. For more information, please contact [scholcomm@msstate.libanswers.com](mailto:scholcomm@msstate.libanswers.com).

Standards for preparing theses and dissertations

Eighth Edition

2019

Mississippi State University

## PREFACE

The thesis or dissertation is a formal research paper presented by a graduate student to the Graduate Faculty at Mississippi State University, who certify that the presented work meets the standards of the academic discipline. The Graduate School of Mississippi State University would like to extend to you, the student, a special welcome as you undertake the development and writing of your thesis or dissertation, an exciting and critical part of your academic achievement.

Personnel in the Library's Office of Thesis and Dissertation Format Review are available to assist you in understanding the various policies and procedures necessary for submitting your thesis or dissertation for format approval.

## TABLE OF CONTENTS

### CHAPTER

I. INTRODUCTION .....	1
II. POLICY STATEMENT .....	2
III. LEGAL AND REGULATORY REQUIREMENTS.....	4
3.1 Previously Published Material .....	4
3.2 Copyrighted Material .....	4
3.3 Restricted Material.....	5
3.4 Research Protocols and Regulatory Compliance.....	5
IV. SUBMISSION OF THE THESIS OR DISSERTATION.....	6
4.1 Enrollment in LIB 9010 .....	6
4.2 Submission Deadlines and Requirements.....	6
4.2.1 First submission deadline.....	6
4.2.2 Final submission deadline.....	8
4.3 Extensions .....	8
V. WEB ACCESSIBILITY .....	10
VI. FORMAT AND APPEARANCE.....	11
6.1 Thesis or Dissertation General Information.....	11
6.1.1 Page Size and Margin Requirements .....	11
6.1.2 Type Fonts and Print Quality .....	12
6.1.3 Line Spacing .....	12
6.1.4 Paragraph Requirements .....	13
6.1.5 Pagination .....	14
6.1.6 Footnotes, Endnotes, and Bibliographical Material.....	15
6.2 Preliminary Pages .....	16
6.2.1 Title Page .....	16
6.2.2 Copyright Page (Optional).....	20
6.2.3 Abstract.....	22
6.2.4 Dedication (Optional) .....	27
6.2.5 Acknowledgements (Optional).....	29

6.2.6	Table of Contents .....	31
6.2.7	List of Tables .....	38
6.2.8	List of Figures .....	42
6.2.9	List of Symbols, Abbreviations, Special Nomenclature, and Other Preliminary Pages .....	46
6.3	Main Body .....	49
6.3.1	First Page of Each Chapter .....	49
6.3.2	Headings .....	52
6.3.2.1	Templates A, B, C, and C with Schemes .....	52
6.3.2.2	APA Template .....	58
6.3.3	Lists .....	60
6.3.4	Block Quotes .....	60
6.3.5	Tables .....	61
6.3.5.1	Templates A, B, C, & C with Schemes .....	61
6.3.5.2	APA Template .....	67
6.3.5.3	Specifying a Table Headers .....	70
6.3.5.4	Adding Alternate Text for Tables .....	70
6.3.6	Figures and Other Labeled Illustrations .....	70
6.3.6.1	Template A, B, C, & C with Schemes .....	70
6.3.6.2	APA Templates .....	76
6.3.6.3	Adding Alternate Text for Figures .....	80
6.3.7	Landscape Pages .....	80
6.3.8	Equations .....	80
6.3.8.1	Adding Alternate Text for Equations .....	81
6.3.9	Bibliographic Materials .....	84
6.3.9.1	Templates A, B, C, and C with Schemes .....	84
6.3.9.2	APA Template .....	88
6.4	Checking Document for Accessibility .....	91
6.5	Appendices .....	91
6.6	Supplemental Files .....	95

## LIST OF SAMPLE PAGES

Title Page .....	19
Copyright Page.....	21
Abstract Page .....	25
Dedication Page .....	28
Dedication Page .....	28
Acknowledgements Page .....	30
Table of Contents .....	32
Table of Contents with Numbered Headings.....	35
List of Tables (Numbered Sequentially).....	39
List of Tables (Numbered by Chapter) .....	40
List of Tables (Numbered by Chapter in a Document with Numbered Headings) .....	41
List of Figures (Numbered Sequentially) .....	43
List of Figures (Numbered by Chapter).....	44
List of Figures (Numbered by Chapter in a Document with Numbered Headings) .....	45
Miscellaneous Preliminary Page.....	47
First Page of Chapter .....	51
Page with 1st and 2nd Level Headings .....	54
Page with 2nd and 3rd Level Headings .....	55
Page with 1st and 2nd Level Numbered Headings .....	56
Page with 2nd and 3rd Level Numbered Headings .....	57
Page with 2nd and 3rd Level Headings .....	59

Page with Table.....	61
Page with Table.....	61
Page with Table.....	61
Page with Table.....	64
Page with Table and TextPage with Table .....	64
Page with Table and TextPage with Table .....	64
Page with Table and TextPage with Table .....	64
Page with Table and Text .....	65
Templates A, B, C, & C with Schemes.....	65
Page with Two TablesPage with Table and Text.....	65
Page with Two TablesPage with Table and Text.....	65
Templates A, B, C, & C with Schemes.....	65
Page with Two TablesPage with Table and Text.....	65
Page with Two Tables.....	66
Page with FigurePage with Two Tables .....	66
Page with TablePage with Two Tables.....	66
Page with FigurePage with Two Tables .....	66
Page with Table.....	69
APA Template .....	69
Page with Table and TextPage with Table .....	69
Page with FigurePage with Table .....	69
APA Template .....	69
Page with Table and TextPage with Table .....	69
Page with Figure .....	73
Template A, B, C, & C with Schemes .....	73

Page with Figure and Text	Page with Figure	73
Page with Figure and Text	Page with Figure	73
Template A, B, C, & C with Schemes		73
Page with Figure and Text	Page with Figure	73
Page with Figure and Text		74
Template A, B, C, & C with Schemes		74
Page with Figures Side-by-Side	Page with Figure and Text	74
Page with Figures Side-by-Side	Page with Figure and Text	74
Template A, B, C, & C with Schemes		74
Page with Figures Side-by-Side	Page with Figure and Text	74
Page with Figures Side-by-Side		75
Template A, B, C, & C with Schemes		75
Page with Figures Side-by-Side		75
Page with Figure and Text	Page with Figures Side-by-Side	75
Template A, B, C, & C with Schemes		75
Page with Figures Side-by-Side		75
Page with Figure and Text		78
Page with Figures Side-by-Side	Page with Figure and Text	78
Page with Figures Side-by-Side	Page with Figure and Text	78
Page with Figures Side-by-Side	Page with Figure and Text	78
Page with Figures Side-by-Side		79
Page with Figures Side-by-Side		79
Page with Centered Equations	Page with Figures Side-by-Side	79
Page with Figures Side-by-Side		79
Page with Centered Equations		82



Page with Aligned Equations	Page with Centered Equations	82
Page with Aligned Equations	Page with Centered Equations	82
Page with Aligned Equations	Page with Centered Equations	82
Page with Aligned Equations		83
Page for Bibliographic Material (end of chapter option)	Page with Aligned Equations	83
Page for Bibliographic Material (end of chapter option)	Page with Aligned Equations	83
Page for Bibliographic Material (end of chapter option)	Page with Aligned Equations	83
Page for Bibliographic Material (end of chapter option)		86
Page for Bibliographic Material (end of document option)	Page for Bibliographic M	
PREFACE		ii
TABLE OF CONTENTS		iii
LIST OF SAMPLE PAGES		v
CHAPTER I		1
CHAPTER II		2
CHAPTER III		4
VII. 3.1	Previously Published Material	4
VIII. 3.2	Copyrighted Material	4
IX. 3.3	Restricted Material	5
X. 3.4	Research Protocols and Regulatory Compliance	5
CHAPTER IV		6
XI. 4.1	Enrollment in LIB 9010	6
XII. 4.2	Submission Deadlines and Requirements	6
4.2.1	First submission deadline	6
4.2.2	Final submission deadline	8
XIII. 4.3	Extensions	8

CHAPTER V .....	10
CHAPTER VI .....	11
XIV. 6.1 Thesis or Dissertation General Information.....	11
6.1.1 Page Size and Margin Requirements .....	11
6.1.2 Type Fonts and Print Quality .....	12
6.1.3 Line Spacing .....	12
6.1.4 Paragraph Requirements .....	13
6.1.5 Pagination .....	14
6.1.6 Footnotes, Endnotes, and Bibliographical Material.....	15
XV. 6.2 Preliminary Pages .....	16
6.2.1 Title Page .....	16
6.2.2 Copyright Page (Optional).....	20
6.2.3 Abstract .....	22
6.2.4 Dedication (Optional) .....	27
6.2.5 Acknowledgements (Optional).....	29
6.2.6 Table of Contents .....	31
6.2.7 List of Tables .....	38
6.2.8 List of Figures .....	42
6.2.9 List of Symbols, Abbreviations, Special Nomenclature, and Other Preliminary Pages .....	46
XVI. 6.3 Main Body .....	49
6.3.1 First Page of Each Chapter .....	49
6.3.2 Headings .....	52
6.3.3 Lists.....	60
6.3.4 Block Quotes.....	60
6.3.5 Tables.....	61
6.3.6 Figures and Other Labeled Illustrations.....	70
6.3.7 Landscape Pages .....	80
6.3.8 Equations.....	80
6.3.9 Bibliographic Materials .....	84
XVII. 6.4 Checking Documents for Accessibility .....	91
XVIII. 6.5 Appendices.....	91
XIX. 6.6 Supplemental Files.....	95
aterial (end of chapter option).....	86

Page for Bibliographic Material (end of document option)Page for Bibliographic Material (end of chapter option) .....	86
Page for Bibliographic Material (end of document option)Page for Bibliographic Material (end of chapter option) .....	86
Page for Bibliographic Material (end of document option).....	87
Appendix Divider (Title) PagePage for Bibliographic Material (end of document option).....	87
Page for Reference Material APA TemplatePage for Bibliographic Material (end of document option) .....	87
Appendix Divider (Title) PagePage for Bibliographic Material (end of document option).....	87
Page for Reference Material APA Template .....	89
Appendix Divider (Title) PagePage for Bibliographic Material (end of document option).....	89
Appendix Divider (Title) PagePage for Reference Material APA Template .....	89
Appendix Divider (Title) PagePage for Bibliographic Material (end of document option).....	89
Appendix Divider (Title) Page.....	94

## CHAPTER I

### INTRODUCTION

*Standards for Preparing Theses and Dissertations* at Mississippi State University is intended to help graduate students organize and present the results of their research in the form of a scholarly document. This manual complements the current *Graduate School Bulletin* which provides uniform standards and contains general and program requirements for candidates pursuing advanced degrees as well as deadlines which candidates must meet. This updated Eighth Edition (2019) replaces all previous guidelines.

All candidates for advanced degrees must confer with their advisors and graduate coordinators to learn specific departmental requirements for preparation and presentation of graduate degree documents. Students should remember that these documents are checked by personnel in the Library's Office of Thesis and Dissertation Format Review to ensure conformity with this manual prior to final approval and publishing

## CHAPTER II

### POLICY STATEMENT

Master's theses, educational specialist's theses, and doctoral dissertations are formal written documents resulting from careful and extended research conducted by graduate students under the supervision of their major professors and with the advice of graduate advisory committees. Both documents must demonstrate the ability of the candidate to pursue scholarly research at an advanced level; however, a doctoral dissertation must demonstrate more fully the candidate's ability to plan and execute original research.

Writing and defending a thesis or dissertation is the culmination of a long period of sustained effort. The result should be a document in which the candidate, the advisor, the department, and the University can take pride. Theses and dissertations are representations of the standards of the degree-granting college and of Mississippi State University; these documents also reflect the standards of faculty members who sign the committee approval pages. Advisory committees are responsible for judging the technical and professional competency, writing quality, and professional appearance of these documents. All individuals involved in the preparation of theses and dissertations should ensure their work is of the highest quality possible.

The Graduate School and the Graduate Council understand that details and methods involved in thesis or dissertation preparation will vary among departments. However, theses and dissertations must adhere to certain general standards and therefore must:

1. Be the result of concentrated effort to solve a well-defined problem. A graduate document must not consist of several studies related only in a general way but must focus on a coherent theme.
2. Furnish evidence that the candidate is familiar with the canons of scholarship in the discipline. Candidates must show familiarity with bibliographic literature and research methods and must present research results in a formal manner appropriate to the discipline.
3. Be readily comprehensible by other scholars in the field. Unless the candidate's program focuses on mastery of a foreign language, the graduate document must be written in Standard English

CHAPTER III  
LEGAL AND REGULATORY REQUIREMENTS

**3.1 Previously Published Material**

Material previously published by the candidate while enrolled in the current degree program may be included in the document. Such material must be integrated into the body of the document, cited, and formatted to the guidelines listed in these standards.

**3.2 Copyrighted Material**

Mississippi State University sends all theses and dissertations to ProQuest Information and Learning to be microfilmed and made available to scholars. In compliance with ProQuest requirements, written permission of a copyright holder is required if substantial amounts of copyrighted materials are included. Requirements for gaining permission of a copyright holder are listed on the [ProQuest website](http://www.umi.com/assets/downloads/products/UMI_CopyrightGuide.pdf) at [http://www.umi.com/assets/downloads/products/UMI\\_CopyrightGuide.pdf](http://www.umi.com/assets/downloads/products/UMI_CopyrightGuide.pdf). Failure to gain permission in advance of reproducing copyrighted material may lead to charges of copyright infringement. Candidates are expected to read and abide by the copyright assurance and publication agreement in the ProQuest form they sign.

Copyrighting theses and dissertations is optional. Students desiring copyright protection should request the filing of copyright upon submitting their work to the publisher. Students should give serious consideration to copyright protection, and it is recommended that students seek advice from their major professor before making this important decision. Copyright

registration fees are charged to the student's University account and must be paid before graduation.

Further information on Copyrights may be found at: <http://www.copyright.gov/>

### **3.3 Restricted Material**

Thesis and dissertation documents should not include material restricted from publication by legal or proprietary considerations. Authors may request to restrict access or delay publication of their thesis/dissertation when completing the [ETD Rights and Permissions form](#) with their major professor's signature. If the author's major professor is completely unavailable to sign the form, then the author's graduate coordinator's, department head's, or dean's signature may be substituted.

### **3.4 Research Protocols and Regulatory Compliance**

Students must secure prior approval of research protocols involving human subjects (including those protocols which utilize only surveys), animal subjects, radioactive substances, hazardous materials, recombinant DNA, or other regulated research. For more information see the Office of Regulatory Compliance website at <http://www.orc.msstate.edu/>. Questions about human subjects research should be directed to [irb@research.msstate.edu](mailto:irb@research.msstate.edu) . Questions regarding other types of research should be directed to [compliance@research.msstate.edu](mailto:compliance@research.msstate.edu) .



CHAPTER IV  
SUBMISSION OF THE THESIS OR DISSERTATION

**4.1 Enrollment in LIB 9010**

Students that intend to submit a thesis or dissertation for graduation are required to enroll in LIB 9010 during their graduating semester. LIB 9010 is a free, zero hour course that is taught through Canvas. The course is solely the submission process for theses and dissertations to the library, so there are no required meetings or official grades for assignments. Enrollment is handled through Banner, the same as any other academic course.

Enrollment dates for LIB 9010 follow the academic calendar (please refer to the Registrar's Office for exact dates each semester). Students are expected to enroll in or drop the course before the 5<sup>th</sup> day of the semester. Any enrollment after the 5<sup>th</sup> day of classes will require an add/drop form to be signed by the instructor, the advisor, and the dean before the Registrar's Office will process the enrollment change. A forced drop will be initiated by the Office of Thesis and Dissertation Format Review for all students that do not meet the initial deadline and do not have an extension on file with the Graduate School.

**4.2 Submission Deadlines and Requirements**

**4.2.1 First submission deadline**

To meet the first submission deadline, the student must:

- Complete all content corrections from the committee.

- Follow the instructions in the Canvas course to upload your necessary documentation for review by the library (Modules 01-04).
  - Module 01: Committee Acceptance Form: Students are required to obtain signature approval from all committee members. All content-based corrections (not necessarily format) must be made prior to obtaining signatures. Any change in content as it relates to context or meaning after the submission of a fully signed acceptance form requires the student to obtain signatures again to allow for committee members to acknowledge the changes. This does not include such corrections as general formatting, typos, or spelling corrections. Typically, acceptance forms are signed after the defense if no revisions are requested. The form can be located in Canvas or the Office of Thesis and Dissertation Review website.
  - Module 02: Author Information: Students are required to provide contact information where they can be reached after graduation.
  - Module 03: Students are required to provide publication intentions and give notification of any required restrictions to their thesis/dissertation. Students are allowed to restrict access to their research for periods ranging from six months to two years. The Rights and Permissions form must be signed by both the student and the student's major professor. The form can be obtained through Canvas or the Office of Thesis and Dissertation Review website.
  - Module 04: Initial Thesis/Dissertation Submission: Students are required to submit a committee approved copy of their thesis/dissertation. All

students will submit a Word document, except for those students who used LaTeX to compose their thesis/dissertation.

- Doctoral candidates ONLY will complete Module 05 (Survey of Earned Doctorates and Graduation Card information).

#### **4.2.2 Final submission deadline**

- After initial submission, the library will review the thesis or dissertation and contact the student through Canvas with any necessary changes. Once all formatting corrections are complete, the student will complete Modules 06-07.
  - Module 06: Students are required to submit a copy of the correctly formatted thesis/dissertation to ProQuest UMI.
  - Module 07: Students are required to submit a copy of the correctly formatted thesis/dissertation to the university's Institutional Repository.
- The final submission deadline is the last day to obtain formatting approval for the student to submit their document to ProQuest UMI and Scholar's Junction, the MSU Institutional Repository. The Office of Thesis and Dissertation will review the final submission to UMI, make any necessary metadata corrections, and post any incurred [fees](#) to the author's Banner account. All incurred [fees](#) must be paid prior to graduation.

#### **4.3 Extensions**

The Graduate School establishes deadlines for the submission of documents to the Office of Thesis and Dissertation Format Review; these deadlines cannot generally be waived. If a student has a legitimate need for an extension to the deadline, they should formally request such

in writing to the Graduate School, including their committee chair's signature on the request.

The decision to extend the deadline for the student is the sole discretion of the Graduate School.

Extensions are granted for the initial submission deadline only and the submission of all

documents must be completed by the posted final deadline. The deadlines are posted on the

Graduate Academic Calendar in the current issue of the *Graduate Studies Bulletin*, on the

Graduate School's website, and on the Office of Thesis and Dissertation Format Review website.

## CHAPTER V

### WEB ACCESSIBILITY

Mississippi State University [Operating Policy \(OP\) 01.13](#) states that all University public web pages and content must be web accessible. Because theses and dissertations are submitted to Scholar's Junction, the MSU Institutional Repository, all documents are checked to ensure they meet the Web Content Accessibility Guideline (WCAG) 2.0 standards at the AA level of accessibility. The university provides Microsoft Word to students free of charge. Word has a built in accessibility checker that will allow students to evaluate how accessible the document is and provide information on how to correct any errors found. To check the accessibility of PDF files, a copy of Adobe Acrobat DC Pro is required (Acrobat Reader does not have a built in accessibility check function). It is recommended that students complete requirements for accessibility while writing their documents, and not waiting until the document is complete.

Accessibility issues that students are required to fix include:

- The document must use appropriate heading styles.
- Alternate text for all figures, tables, equations, and schemes.
- Images and tables cannot be text wrapped.
- Simple table structure and specified column header information.

The Office of Thesis and Dissertation Review will check and correct all documents to ensure defined reading order.

CHAPTER VI  
FORMAT AND APPEARANCE

**6.1 Thesis or Dissertation General Information**

Mississippi State University emphasizes the importance of conducting research to culminate in publication in the professional literature of the discipline. The thesis or dissertation may be written in a format acceptable to publication outlets in the candidate's discipline insofar as it does not conflict with the MSU's *Standards*. If this format differs from the *Standards* in this manual then a letter from the major advisor, detailing the requested exception(s) to the standards, must be submitted to the Graduate School prior to the initial submission to the Library. If a formatting situation is not covered or forbidden by the *Standards*, please format consistently. The Graduate Council and the Library have developed precise standards to ensure that MSU theses and dissertations will have a consistently professional appearance. Close attention to these standards during document preparation will save time during the review process conducted by the Library's Office of Thesis and Dissertation Format Review.

**6.1.1 Page Size and Margin Requirements**

All Theses and Dissertations should be on standard letter size pages (8.5" by 11"). The required margins are:

Top/Bottom: 1"  
Left/Right: 1"

No text or image should extend past the margins.

### 6.1.2 Type Fonts and Print Quality

- Font size must be 12 points. Acceptable fonts include Arial, Calibri, Georgia, Helvetica, Lucida Sans/Grande, Tahoma, Times New Roman, and Verdana. The Office of Thesis and Dissertation Format Review in the Library will make the final decision on the acceptability of the font used. Once selected, the type font must be consistent throughout the document. Exceptions for type and size may be made for:
  - Text inside tables and figures (not the titles) as well as notes for tables and figures may have any size text.
  - Superscripts and subscripts may use smaller text.
  - Equations may be no smaller than 8 point font and no larger than 12 point font.
  - Footnotes and endnotes may be no smaller than 8 point font.
- Symbols used in paragraphs must be actual font characters (when possible), not images inserted in the line.
- Paragraphs may have text that is **bold**, *italicized*, underlined, or some combination of the previous. Any such text must be easily distinguishable from headings using similar formatting and must be consistently applied.

### 6.1.3 Line Spacing

Line-spacing terms used in this document are defined as follows:

This is what is meant by no blank lines:

There are no blank lines below this line. There are no blank lines above this line.
--

This is what is meant by one blank line (commonly known as double-spacing):

There is one blank line below this line.

There is one blank line above this line.

This is what is meant by two blank lines:

There are two blank lines below this line.

There are two blank lines above this line.

This is what is meant by three blank lines:

There are three blank lines below this line.

There are three blank lines above this line.

#### **6.1.4 Paragraph Requirements**

All paragraphs in the document should have the following qualities:

- The left and indents of paragraphs must be 0", i.e. the paragraph must align with the page margins. Lists and block quotes are exempt from this.
- The first lines of all paragraphs must be indented consistently; the indent must be either 0.25" or 0.5".
- All paragraphs must be either left-aligned or fully justified, consistently. If a paragraph is fully justified, use line breaks to avoid awkward spaces in lines.

This is an example of a full justified paragraph. Do not leave a line in any justified paragraph like this



- Paragraphs must be double-spaced (having only 1 blank line separating lines of text) and be separated from other paragraphs by 1 blank line. Excess space above or below a paragraph is not allowed unless otherwise stated in the *Standards*.
- Do not leave only one line of a paragraph at the top or bottom of a page (unless the paragraph only has one line). In Word, this can be avoided by turning on the “Widow/Orphan Control” setting.
- Symbols in paragraphs must be actual font characters (when possible), not images inserted in the line.
- Scientific names and other discipline-specific terms may be formatted as required by the department. For example, scientific names may be italicized.

### **6.1.5 Pagination**

- Every page must have a page number except the title page, copyright page, approval page, and abstract pages.
- Small Roman numerals are used for the preliminary pages, which should be arranged in the following order: dedication; acknowledgements; table of contents; and the lists of tables, figures, plates, symbols, abbreviations, and/or nomenclature. Although the title page is assigned Roman numeral i, that number does not appear on the page. Page numbers for other preliminary pages are centered, leaving 1 inch of white space from the page number to the bottom of the page. The copyright, approval, and abstract pages are neither counted nor numbered.
- Arabic numerals are used for paginating the remainder of the document, including the text and reference material. Pages are numbered consecutively beginning with

1 and continuing to the end of the document. No other numbering scheme is acceptable; the standard scheme may not be interrupted with insertions numbered 10a, 10b, 10c, etc.

All page numbers are placed at the bottom center position allowing 1 inch of white space from the numeral to the page bottom.

#### **6.1.6 Footnotes, Endnotes, and Bibliographical Material**

Footnotes and endnotes should be formatted to departmental standards and should be no smaller than 8 point font. Candidates should confer with their advisors regarding citation styles acceptable to their disciplines and use the designated style manuals. Formatting for individual lines of the bibliographical material is also determined by the author's departmental standards.

- Excess Blank Space

In general, avoid any blank space not specifically required for the Standards. The following exceptions apply:

- Moving a table or figure to the beginning of a new page to avoid splitting is allowed.
- If excess space is caused by preventing a heading from sitting at the bottom of a page, it is allowed.
- If only three or fewer lines of a paragraph fit below a table or figure, it is allowed if the author begins that paragraph on a new page.
- Blank pages required by the department are allowed if a notification is added: “[This page left blank intentionally]”

## 6.2 Preliminary Pages

The preliminary pages must appear in the following order: title page; copyright page; abstract; (optional) dedication; (optional) acknowledgements; table of contents; list of tables; list of figures; and list of symbols, abbreviations, nomenclature, or other such lists. Each element of the document is given in the order in which it should appear.

### 6.2.1 Title Page

A title page is required for all thesis and dissertation submissions. For consistency, the title page is designed from the “bottom up”, where the last line of text of the title page is on the last possible line of the page, exactly 1 inch from the bottom of the page. This is done to provide the maximum possible space for the possibility of long titles. The following list the requirements for the title page, starting from the bottom of the page and working up:

- No page number should appear on this page.
- All text on this page must be centered horizontally.
- Include Month and Year of Graduation (*not* defense; see academic calendar) with no commas (for example, “August 2011”) directly above the bottom margin.
- The location must be written as “Mississippi State, Mississippi”, leaving only one blank line between the location and the graduation date below.
- The degree statement must be single-spaced, accurate as of the graduate date, and worded exactly as follows (replace items in brackets):

A [Thesis Dissertation] Submitted to the Faculty of Mississippi State University in Partial Fulfillment of the Requirements for the Degree of [Degree–Ask Department] in [Program or Concentration–Ask Department] in the [Department/College Awarding Degree–Ask Department]
---

- Leave two or three blank lines between the degree statement and the location below.
- The committee members' and dean's name will be listed in the following order: Major Professor (or similar head of committee), Committee Members, Graduate Coordinator, and Dean. Do not use honorifics (like "Dr.") or degree designations (like "Ph.D."). The roles of Major Professor, Graduate Coordinator, and Dean will be placed in parentheses next to the professor's name. The College will also be placed next to the Dean's role. If a professor serves multiple roles on the committee (ex. Director of Thesis and Graduate Coordinator), the name only needs to be listed once and the roles will be separated by a comma.
- Leave one blank line between "Approved by:" and the list of committee members.
- The author's name must match that in MSU's academic records.
- Leave 3 spaces between the author's name and "Approved by" below.
- Leave one blank line between the word "By" (capitalized) and the author's name below.
- Leave 1 inch (five blank lines is close enough) between the title and the word "By" below.
- If the title is more than one line, it must be double-spaced and each line of the title shorter than the line above it.
- The title must not be in bold font. Capitalize only the first letter of the first word in the title and words normally capitalized in English (proper nouns, acronyms, etc.).

- The title must not have equations or symbols (type out symbol names and equations). Exceptions may be allowed at the discretion of the Office of TD Review.

See example on the following page:

The use of neural networks in the combining of time series forecasts with differential penalty  
costs

By

Morgan Beverly Wilder

Approved by:

Peter F. Strauss (Major Professor)  
Jerome Goddard  
Haimeng Zhang  
Elton Philip Amburn  
Kenneth D. Roskelly (Graduate Coordinator)  
Steward L. Kramer (Dean, College of Business)

A Dissertation  
Submitted to the Faculty of  
Mississippi State University  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy  
in Business Administration (Finance)  
in the Department of Finance and Economics

Mississippi State, Mississippi

December 1998

## 6.2.2 Copyright Page (Optional)

For documents to be copyrighted, notice of copyright is centered in the following form on the sheet immediately after the title page. The actual filing for copyright is the responsibility of the author. The publisher, UMI, will offer to file for copyright for a convenience fee, but the author is free to file independently. For more information about copyright, please see:

<http://www.copyright.gov/>

Format the copyright page as follows:

- No page number should appear on this page.
- All text on this page is centered horizontally and vertically
- The text must be double-spaced and must include the following
  - Copyright notice, e.g., “Copyright by” or “©”
  - Author’s name, matching that on the title page.
  - Year of graduation

See example on the following page:

Copyright by  
Morgan Beverly Wilder  
1998



### 6.2.3 Abstract

Abstracts are a brief summary of the document designed to quickly inform the reader about the general contents of the work. Due to standardization and cataloging requirements, certain restrictions are placed on the abstract body:

- Special characters (those not found on a standard keyboard) are not allowed in the abstract. This includes, but is not limited to:  $\geq$ ,  $\leq$ , Greek symbols, non-western characters, and complicated equations. Any such symbol that is needed should be written out. (Example:  $\alpha$  should be written alpha). Exceptions may be allowed at the discretion of the Office of TD Review. This limitation is imposed by both the needs for Cataloging and HTML consistency.
- Tables, Charts, Images, Bullets, and any other non-text entry are not allowed in abstracts. This limitation is imposed by both the needs for Cataloging and HTML consistency.
- The word count for the body of Thesis abstracts to 150 words.
- The word count for the body of Dissertation abstracts to 350 words.

Because thesis and dissertation abstracts are published in *ProQuest Dissertations & Theses (PQDT)* and in Scholar's Junction, sensitive material should not be part of an abstract for a restricted work.

The abstract is not counted as a page within the document and is not numbered. Finally, before each submission for review, verify that the "Pages of Study:" has the correct page number from the last page of the document.

Abstracts should be formatted as follows:

- There are no page numbers on these pages.

- Starting at the top of the page, the following entries must all be included. Each entry is single-spaced with a blank line following. If the entry is more than one line long (this is likely to happen only with the title), the second and following lines of the entry must be aligned with the first word after the entry colon. For example:

Title of Study: The use of neural networks in the combining of time series forecasts with differential penalty costs

- “Name:” followed by the author’s name as found on the title page.
- “Date of Degree:” followed by the date of graduation formatted as “Month Day, Year”. For example, “August 9, 2011”
- “Institution: Mississippi State University”
- “Major Field:” followed by the program/concentration as found on the title page.
- “Major Professor:” followed by the major professor’s name. If there are co-major professors, then the second professor’s name follows immediately after the first with a comma separating. Do not add honorifics or titles.
- (If the dissertation director is not the major professor) “Dissertation Director:” followed by the dissertation director’s name. If there are co-directors, then the second director’s name follows immediately after the first with a comma separating.
- “Title of Study:” followed by the title as worded on the title page.
- “Pages of Study:” followed by the page number of the last numbered page of the document. This is counting the appendices.
- “Candidate for the Degree of ” followed by the degree as found in the title page.

- The “Candidate for...” entry is followed by 2 or 3 blank lines, then the abstract body. The abstract body must not have equations, symbols (type out symbol names and equations), bullets, figures, and tables. Exceptions may be allowed at the discretion of the Office of TD Review.
- The abstract body is a series of one or more double-spaced paragraphs.
- The maximum size of a thesis’s abstract body is 150 words.
- The maximum size of a dissertation’s abstract body is 350 words.
- If the discipline requires key words, 2 or 3 blank lines are left between the abstract body and the key words.
- The key words are single-spaced and indented like an abstract entry. They are written “Key words:” followed by a comma-separated list of key words.
- The page after the last page of the abstract is page “ii”. The pages after that are numbered sequentially with lower-case Roman numerals until the page just before the first page of Chapter I (see 6.3.1 First Page of Each Chapter)

See example on the following page:

Name: Morgan Beverly Wilder

Date of Degree: December 9, 1998

Institution: Mississippi State University

Major Field: Business Administration (Finance)

Major Professor: Peter F. Strauss

Title of Study: The use of neural networks in the combining of time series forecasts with differential penalty costs

Pages in Study: 187

Candidate for Degree of Doctor of Philosophy

The need for accurate forecasting and its potential benefits are well established in the literature. Virtually all individuals and organizations have at one time or another made decisions based on forecasts of future events. This widespread need for accurate predictions has resulted in considerable growth in the science of forecasting. To a large degree, practitioners are heavily dependent on academicians for generating new and improved forecasting techniques.

In response to an increasingly dynamic environment, more diverse and complex forecasting methods have been proposed to more accurately predict future events. These methods, which focus on the different characteristics of historical data, have ranged in complexity from simplistic to very sophisticated mathematical computations requiring a high level of expertise. By combining individual techniques in order to improve on the forecasting accuracy, researchers have taken advantage of the various strengths of these techniques. A number of combining methods have proven to yield better forecasts than individual methods, with the complexity of the various combining methods ranging from a simple average to quite complex weighting schemes.

The focus of this study is to examine the usefulness of neural networks in composite forecasting. Emphasis is placed on the effectiveness of two neural networks (*i.e.*, a back propagation neural network and a modular neural network) relative to 3 traditional composite models (*i.e.*, a simple average, a constrained mathematical programming model, and an unconstrained mathematical programming model) in the presence of four penalty cost functions for forecasting errors.

Specifically, the overall objective of this study is to compare the short-term predictive ability of each of the five composite forecasting techniques on various firstorder autoregressive models, taking into account penalty cost functions representing four different situations. The results of this research suggest that in the vast majority of scenarios examined in this study, the neural network model clearly outperformed the other composite models.

Key words: neural networks, forecasting, autoregression

#### 6.2.4 Dedication (Optional)

As an optional page, the author may choose to add a Dedication page as a means to recognize individual people, groups, and/or organizations that supported/inspired the author. If a dedication is used, it immediately follows the abstract and is the first numbered page (numbered with a lowercase Roman numeral “ii”)

Format requirements for a Dedication page are as follows:

- There must be 2” of blank space between the top of the first page of the Dedication and the top of “DEDICATION”.
- “DEDICATION” must be centered, in all caps, and not bold.
- Keep 2 or 3 blank lines between “DEDICATION” and the first line of the Dedication text.
- If the Dedication has not been omitted, the first page of the Dedication is page “ii” (lower-case Roman numeral)

See example on the following page:

## DEDICATION

I would like to dedicate this research to my parents, Frederick and Hanna Wilder, and my brother Jason.

### 6.2.5 Acknowledgements (Optional)

As an optional page, the author may choose to add an Acknowledgements page to recognize any special contributors that helped make the work possible. If an acknowledgements is used, it immediately follows the dedication (if applicable, otherwise after the abstract) and continues page numbering (or if there is not a Dedication, then the first page of the Acknowledgements is numbered with a lowercase Roman numeral “ii”)

Format requirements for an Acknowledgements page are as follows:

- There must be 2” of blank space between the top of the first page of the Acknowledgements and the top of “ACKNOWLEDGEMENTS”.
- “ACKNOWLEDGEMENTS” must be centered, in all caps, and not bold.
- Keep 2 or 3 blank lines between “ACKNOWLEDGEMENTS” and the first line of the Acknowledgements text.
- The Acknowledgments text must be in paragraphs formatted as described in the “GENERAL” section

See example on the following page:



## ACKNOWLEDGEMENTS

The author expresses his sincere gratitude to the many people without whose selfless assistance this dissertation could not have materialized. First of all, sincere thanks are due to Dr. Peter F. Strauss, my committee chairman, for his magnanimity in expending time and effort to guide and assist me throughout the intricacies of the doctoral program and the dissertation process. Expressed appreciation is also due to the other members of my dissertation committee, namely, Dr. Bailey R. Keenan, Dr. Taylor M. O’Leary, Dr. Rong-Jen Lin, and Dr. Kelly C. Darden, for the invaluable aid and direction provided by them. Finally, the author would like to thank Dr. Herbert Hubbell of the University of North Carolina for making available the computer program for the computation of the BDS statistics used in this study

## 6.2.6 Table of Contents

A Table of Contents (TOC) serves two important roles. First, the TOC is a quick reference to all important sections of the document. Second, the TOC presents an outline of the document. **When using the Word templates provided by the library, NOTHING SHOULD BE MANUALLY TYPED OR PLACED INTO THE TABLE OF CONTENTS.** Once all headings are connected to the styles properly, the table of contents will be updated by right clicking on the table and choosing “Update.” Please see the Instructions for using the templates for more details.

See examples on the following pages:

## TABLE OF CONTENTS

DEDICATION .....	ii
ACKNOWLEDGEMENTS .....	iii
LIST OF TABLES .....	viii
LIST OF FIGURES .....	ix
NOMENCLATURE .....	xi
CHAPTER	
I. INTRODUCTION .....	1
Background .....	1
Energy and Emission Regulations Overview .....	2
Motivation and Objective .....	4
Organization of the Work .....	5
II. LITERATURE REVIEW .....	6
Diesel Spray Basis .....	6
Recent Developments in Diesel Spray Combustion .....	9
Dec's Conceptual Model .....	9
In-Depth Understanding of Dec's Model .....	14
Concluding Remarks .....	17
Recent Developments in Diesel Spray Structure .....	18
Spray Tip Penetration .....	19
The Liquid Length .....	21
The Lift-off Length .....	24
The Flame Length .....	26
Concluding Remarks .....	28
Review on Some Important Topics .....	29
Comparison Between Gas Jets and Diesel Spray Jets .....	29
Air Entrainment .....	32
Fuel Vaporization .....	33
Relationship Between Vaporization and Combustion .....	35
Lift-off Stabilization Mechanism .....	36

	End of Injection Behaviors .....	43
	Liquid and Lift-off Lengths at Unsteady Conditions.....	43
	Summary .....	45
III.	SUB MODELS DEVELOPMENT.....	48
	Introduction.....	48
	Brief Review of Phenomenological Modeling .....	50
	“Old” Phenomenological Models .....	50
	“New” Phenomenological Models.....	53
	Sub Models Development.....	57
	Diesel Spray Model.....	58
	The Spray Penetration Model .....	58
	The Liquid Length Model.....	60
	The Lift-off Length Model.....	61
	Ignition Delay Models .....	63
	Air Entrainment Model .....	65
	Combustion Model.....	69
	The Difusion Combustion Model .....	69
	The Premixed Combustion Model.....	71
IV.	ZONES DEVELOPMENT .....	74
	Model Conception.....	74
	Fuel Injection Rate Profile .....	77
	Ignition Delay Period.....	78
	First Stage Combustion.....	79
	Diffusion Combustion.....	81
	Premixed Combustion.....	83
	Mass Transfer Between Diffusion and Premixed Combustion Packets ....	84
	Quasi Steady Portion.....	86
	Solution Procedures .....	88
V.	RESULTS AND DISCUSSTION.....	91
	The Spray Model Results.....	91
	Spray Tip Penetratin .....	91
	The Liquid Length .....	95
	Matching Motoring Pressure Curve.....	100
	Ignition Delay Model Results .....	104
	Model Parameter Calibration.....	109
	Temperature Distribution.....	112

VI.	SUMMARY AND CONCLUSIONS .....	116
	Summary .....	116
	Conclusions.....	117
VII.	RECOMMENDATIONS FOR FUTURE WORK .....	119
	General Limitations .....	119
	Suggestions on the Spray Model.....	120
	Suggestions on the Combustion Mode .....	121
	REFERENCES .....	123
	APPENDIX	
A	COMPARISON BETWEEN SIEBERS' AND WAKURI'S MODELS.....	129
B	FIND B USING LEE-KESLER'S CORRESPONDING STATES.....	136
	Compressibility .....	137
	Specific Enthalpy .....	140
	Saturation Pressure.....	141
	Numerical Procedure .....	141
C	MASS AND ENERGY BALANCE EQUATIONS .....	142
	Overall Mass and Energy Balance Equations.....	143
	Ignition Delay Period.....	144
	First Stage Combustion.....	144
	Second Stage Combustion .....	150
D	COMBUSTION EQUILIBRIUM CALCULATIONS .....	153
	Motivations .....	154
	Determine the Products Composition .....	154
	Determine the Adiabatic Flame Temperature.....	157
	Results and Discussions .....	158

## TABLE OF CONTENTS

DEDICATION .....	ii
ACKNOWLEDGEMENTS .....	iii
LIST OF TABLES .....	viii
LIST OF FIGURES .....	ix
NOMENCLATURE .....	xi
CHAPTER	
I.    INTRODUCTION .....	1
1.1    Background .....	1
1.2    Energy and Emission Regulations Overview .....	2
1.3    Motivation and Objective .....	4
1.4    Organization of the Work .....	5
II.   LITERATURE REVIEW .....	6
2.1    Diesel Spray Basis .....	6
2.2    Recent Developments in Diesel Spray Combustion .....	9
2.2.1    Dec’s Conceptual Model .....	9
2.2.2    In-Depth Understanding of Dec’s Model .....	14
2.2.3    Concluding Remarks .....	17
2.3    Recent Developments in Diesel Spray Structure .....	18
2.3.1    Spray Tip Penetration .....	19
2.3.2    The Liquid Length .....	21
2.3.3    The Lift-off Length .....	24
2.3.4    The Flame Length .....	26
2.3.5    Concluding Remarks .....	28
2.4    Review on Some Important Topics .....	29
2.4.1    Comparison Between Gas Jets and Diesel Spray Jets .....	29
2.4.2    Air Entrainment .....	32
2.4.3    Fuel Vaporization .....	33
2.4.4    Relationship Between Vaporization and Combustion .....	35
2.4.5    Lift-off Stabilization Mechanism .....	36
2.4.6    End of Injection Behaviors .....	43

2.4.7	Liquid and Lift-off Lengths at Unsteady Conditions.....	43
2.5	Summary .....	45
III.	SUB MODELS DEVELOPMENT .....	48
3.1	Introduction.....	48
3.2	Brief Review of Phenomenological Modeling .....	50
3.2.1	“Old” Phenomenological Models .....	50
3.2.2	“New” Phenomenological Models.....	53
3.3	Sub Models Development.....	57
3.3.1	Diesel Spray Model.....	58
3.3.1.1	The Spray Penetration Model .....	58
3.3.1.2	The Liquid Length Model .....	60
3.3.1.3	The Lift-off Length Model.....	61
3.3.2	Ignition Delay Models .....	63
3.3.3	Air Entrainment Model .....	65
3.3.4	Combustion Model.....	69
3.3.4.1	The Difusion Combustion Model .....	69
3.3.4.2	The Premixed Combustion Model .....	71
IV.	ZONES DEVELOPMENT .....	74
4.1	Model Conception.....	74
4.2	Fuel Injection Rate Profile .....	77
4.3	Ignition Delay Period.....	78
4.4	First Stage Combustion.....	79
4.4.1	Diffusion Combustion.....	81
4.4.2	Premixed Combustion.....	83
4.4.3	Mass Transfer Between Diffusion and Premixed Combustion Packets .....	84
4.5	Quasi Steady Portion.....	86
4.6	Solution Procedures .....	88
V.	RESULTS AND DISCUSSTION.....	91
5.1	The Spray Model Results.....	91
5.1.1	Spray Tip Penetratin .....	91
5.1.2	The Liquid Length .....	95
5.2	Matching Motoring Pressure Curve.....	100
5.3	Ignition Delay Model Results .....	104
5.4	Model Parameter Calibration.....	109
5.5	Temperature Distribution.....	112
VI.	SUMMARY AND CONCLUSIONS .....	116
6.1	Summary.....	116
6.2	Conclusions.....	117

VII.	RECOMMENDATIONS FOR FUTURE WORK .....	119
	7.1 General Limitations .....	119
	7.2 Suggestions on the Spray Model.....	120
	7.3 Suggestions on the Combustion Mode .....	121
	REFERENCES .....	123
APPENDIX		
A	COMPARISON BETWEEN SIEBERS' AND WAKURI'S MODELS.....	129
B	FIND B USING LEE-KESLER'S CORRESPONDING STATES.....	136
	B.1 Compressibility .....	137
	B.2 Specific Enthalpy .....	140
	B.3 Saturation Pressure.....	141
	B.4 Numerical Procedure .....	141
C	MASS AND ENERGY BALANCE EQUATIONS .....	142
	C.1 Overall Mass and Energy Balance Equations.....	143
	C.2 Ignition Delay Period.....	144
	C.3 First Stage Combustion.....	144
	C.4 Second Stage Combustion .....	150
D	COMBUSTION EQUILIBRIUM CALCULATIONS .....	153
	D.1 Motivations .....	154
	D.2 Determine the Products Composition .....	154
	D.3 Determine the Adiabatic Flame Temperature.....	157
	D.4 Results and Discussions.....	158



### 6.2.7 List of Tables

A List of Tables is the quick reference list for all titled tables in a document (including those in the Appendices). **When using the Word templates provided by the library, NOTHING SHOULD BE MANUALLY TYPED OR PLACED INTO THE LIST OF TABLES.** Once all headings are connected to the styles properly, the List of Tables will be updated by right clicking on the table and choosing “Update.” Please see the Instructions for using the templates for more details.

See examples on the following pages:

LIST OF TABLES

Table 1	Different dependencies of spray angle, liquid, and lift-off lengths .....	46
Table 2	Coefficients used for different temperature ranges from Hernandez et al. (2010).....	65
Table 3	Parameters used for n-heptane, obtained from Westbrook and Dryer (1981).....	73
Table 4	Zone properties during ID period .....	79
Table 5	Zone properties during 1st stage combustion period .....	81
Table 6	Zone properties during quasi steady period .....	88
Table 7	Comparisons between Wakuri’s and Siebers’ Analyses.....	92
Table 8	Model Parameters for the Motoring Case.....	101
Table 9	Model Parameters used in the ignition delay model.....	104
Table 10	Validations of ignition delay models against experiments .....	105
Table 11	Model parameters used to determine how much of the mass in preparing zone needs to be retained .....	111
Table 12	Model parameters used for the mass transfer from diffusion packets .....	112
Table 13	Packet index and timings at which the diffusion flame packets are formed.....	112
Table 14	Comparison between Wakuri’s and Siebers’ Analyses .....	135
Table 15	Constants used in Equations (B.3) and (B.4).....	139

## LIST OF TABLES

Table 2.1	Different dependencies of spray angle, liquid, and lift-off lengths .....	46
Table 3.1	Coefficients used for different temperature ranges from Hernandez et al. (2010).....	65
Table 3.2	Parameters used for n-heptane, obtained from Westbrook and Dryer (1981).....	73
Table 4.1	Zone properties during ID period .....	79
Table 4.2	Zone properties during 1st stage combustion period .....	81
Table 4.3	Zone properties during quasi steady period .....	88
Table 5.1	Comparisons between Wakuri's and Siebers' Analyses.....	92
Table 5.2	Model Parameters for the Motoring Case.....	101
Table 5.3	Model Parameters used in the ignition delay model.....	104
Table 5.4	Validations of ignition delay models against experiments .....	105
Table 5.5	Model parameters used to determine how much of the mass in preparing zone needs to be retained .....	111
Table 5.6	Model parameters used for the mass transfer from diffusion packets .....	112
Table 5.7	Packet index and timings at which the diffusion flame packets are formed.....	112
Table A.1	Comparison between Wakuri's and Siebers' Analyses .....	135
Table B.1	Constants used in Equations (B.3) and (B.4).....	139

LIST OF TABLES

Table 2.1	Different dependencies of spray angle, liquid, and lift-off lengths .....	46
Table 3.1	Coefficients used for different temperature ranges from Hernandez et al. (2010).....	65
Table 3.2	Parameters used for n-heptane, obtained from Westbrook and Dryer (1981) .	73
Table 4.1	Zone properties during ID period .....	79
Table 4.2	Zone properties during 1st stage combustion period.....	81
Table 4.3	Zone properties during quasi steady period.....	88
Table 5.1	Comparisons between Wakuri’s and Siebers’ Analyses.....	92
Table 5.2	Model Parameters for the Motoring Case.....	101
Table 5.3	Model Parameters used in the ignition delay model.....	104
Table 5.4	Validations of ignition delay models against experiments .....	105
Table 5.5	Model parameters used to determine how much of the mass in preparing zone needs to be retained .....	111
Table 5.6	Model parameters used for the mass transfer from diffusion packets .....	112
Table 5.7	Packet index and timings at which the diffusion flame packets are formed.....	112
Table A.1	Comparison between Wakuri’s and Siebers’ Analyses .....	135
Table B.1	Constants used in Equations (B.3) and (B.4).....	139

## 6.2.8 List of Figures

A List of Figures is the quick reference list for all titled figures in a document (including those in the Appendices). **When using the Word templates provided by the library, NOTHING SHOULD BE MANUALLY TYPED OR PLACED INTO THE LIST OF FIGURES.** Once all headings are connected to the styles properly, the List of Figures will be updated by right clicking on the table and choosing “Update.” Please see the Instructions for using the templates for more details.

See examples on the following pages:

## LIST OF FIGURES

Figure 1	Energy consumption by fuel from 1980 to 2035. ....	3
Figure 2	Primary energy flow by source and sector, 2009. ....	3
Figure 3	Heavy duty diesel engine emissions standards .....	4
Figure 4	A typical full cone diesel spray structure .....	7
Figure 5	A typical heat release rate curve for diesel combustion .....	11
Figure 6.	The conceptual model of DI diesel combustion during the quasi steady period . ....	14
Figure 7	Comparison between the liquid and lift-off lengths .....	36
Figure 8	Five zone model proposed by Asay et al. ....	54
Figure 9	Six zone model proposed by Maiboom et al. ....	56
Figure 10	Evolution of various zones in different combustion stages .....	76
Figure 11	Proposed fuel injection rate history for simulations .....	77
Figure 12	Zone descriptions during the ID period .....	78
Figure 13	Zone descriptions during the 1st stage combustion period.....	80
Figure 14	Hypothetical mass transfer process between the diffusion and premixed combustion packets. ....	85

## LIST OF FIGURES

Figure 1.1	Energy consumption by fuel from 1980 to 2035. ....	3
Figure 1.2	Primary energy flow by source and sector, 2009. ....	3
Figure 1.3	Heavy duty diesel engine emissions standards .....	4
Figure 2.1	A typical full cone diesel spray structure .....	7
Figure 2.2	A typical heat release rate curve for diesel combustion .....	11
Figure 2.3	The conceptual model of DI diesel combustion during the quasi steady period . ....	14
Figure 2.4	Comparison between the liquid and lift-off lengths .....	36
Figure 3.1	Five zone model proposed by Asay et al. ....	54
Figure 3.2	Six zone model proposed by Maiboom et al. ....	56
Figure 4.1	Evolution of various zones in different combustion stages .....	76
Figure 4.2	Proposed fuel injection rate history for simulations .....	77
Figure 4.3	Zone descriptions during the ID period .....	78
Figure 4.4	Zone descriptions during the 1st stage combustion period.....	80
Figure 4.5	Hypothetical mass transfer process between the diffusion and premixed combustion packets. ....	85

LIST OF FIGURES

Figure 1.1 Energy consumption by fuel from 1980 to 2035.....3

Figure 1.2 Primary energy flow by source and sector, 2009. ....3

Figure 1.3 Heavy duty diesel engine emissions standards .....4

Figure 2.1 A typical full cone diesel spray structure .....7

Figure 2.2 A typical heat release rate curve for diesel combustion .....11

Figure 2.3 The conceptual model of DI diesel combustion during the quasi steady  
period . ....14

Figure 2.4 Comparison between the liquid and lift-off lengths .....36

Figure 3.1 Five zone model proposed by Asay et al. ....54

Figure 3.2 Six zone model proposed by Maiboom et al. ....56

Figure 4.1 Evolution of various zones in different combustion stages.....76

Figure 4.2 Proposed fuel injection rate history for simulations.....77

Figure 4.3 Zone descriptions during the ID period.....78

Figure 4.4 Zone descriptions during the 1st stage combustion period .....80

Figure 4.5 Hypothetical mass transfer process between the diffusion and premixed  
combustion packets. ....85



### **6.2.9 List of Symbols, Abbreviations, Special Nomenclature, and Other Preliminary Pages**

Some disciplines will require additional preliminary content that is not explicitly covered in the Standards. The following are some general guidelines for formatting such pages:

- There must be 2” of blank space between the top of the first page of the preliminary section and its title.
- The title must be centered, in all caps, and not bold.
- Keep 2 or 3 blank lines between the title and the rest of the preliminary section.
- Keep the vertical alignment of entries within this section consistent.
- If the entries consist of item numbers followed by items titles, follow the same rules as the List of Tables and List of Figures.

See example on following pages:

## NOMENCLATURE

IC	<i>Internal Combustion</i>
DI	<i>Direct Injection</i>
SI	<i>Spark-Ignited</i>
IVC	<i>Intake Valve Closure</i>
SOI	<i>Start of Injection</i>
EOI	<i>End of Injection</i>
EGR	<i>Exhaust Gas Recirculation</i>
LHF	<i>Local Homogeneous Flow</i>
BMEP	<i>Brake Mean Effective Pressure</i>
CO <sub>2</sub>	<i>Carbon Dioxide</i>
H <sub>2</sub> O	<i>Water</i>
N <sub>2</sub>	<i>Nitrogen</i>
O <sub>2</sub>	<i>Oxygen</i>
V	<i>Volume</i>
T	<i>Temperature</i>
P	<i>Pressure</i>
CH <sub>4</sub>	<i>Methane</i>
C <sub>n</sub> H <sub>m</sub> O <sub>l</sub> N <sub>k</sub>	<i>Generic Fuel</i>

H	<i>Monatomic Hydrogen</i>
O	<i>Monatomic Oxygen</i>
N	<i>Monatomic Nitrogen</i>
H <sub>2</sub>	<i>Hydrogen</i>
OH	<i>Hydroxyl</i>
CO	<i>Carbon Monoxide</i>
NO	<i>Nitrogen Oxide</i>
$x_i$	<i>Mole Fractions of Species</i>
$R_u$	<i>Universal Gas Constant</i>
h	<i>Specific Enthalpy</i>
NO <sub>x</sub>	<i>Oxides of Nitrogen</i>
m	<i>Mass</i>
$f_s$	<i>Actual Air to Fuel Ratio</i>
MW	<i>Molecular Weight</i>
X	<i>Molar Fraction</i>
Y	<i>Mass Fraction</i>
Z	<i>Compressibility</i>
<u>Greek</u>	
$\alpha$	<i>Model Constants</i>
$\beta$	<i>Model Constants</i>
$\gamma$	<i>Model Constants</i>
$\theta$	<i>Full Cone Angle of Spray or Crank Angle</i>
$\rho$	<i>Density</i>

### **6.3 Main Body**

The main body of the thesis/dissertation contains the written description of the full research done by the author. The work will be split into chapters that conform to an appropriate organization as set by the author's discipline/department. Chapters may be further divided through the use of headings. For the purposes of these Standards, the 1<sup>st</sup> level of division within the chapter is referred to as the 1<sup>st</sup> level headings. 1<sup>st</sup> level headings may be further divided with 2<sup>nd</sup> level headings, which must be easily distinguishable from 1<sup>st</sup> level headings. 2<sup>nd</sup> level headings may be further divided with 3<sup>rd</sup> level headings, and so forth. 4<sup>th</sup> level headings are uncommon and 5<sup>th</sup> level headings are very rare for most documents. Serious consideration for the layout of the document should be taken before utilizing headings beyond the 5<sup>th</sup> level.

Inclusion of content not explicitly allowed or prohibited by these Standards is permissible so long as such items are consistently formatted throughout the entire document and such content has a professional appearance.

#### **6.3.1 First Page of Each Chapter**

There are specific format requirements for the first page of each chapter that are meant to distinguish such pages visually. These requirements are:

- There must be 2" of blank space between the top of the first page of the chapter and the top of the word "CHAPTER" and the chapter number.
- The word "CHAPTER" is followed by one space and the chapter number. The chapter number may be a Roman numeral (preferred) or an Arabic numeral, but must be the same style for all chapters.
- The word "CHAPTER" and the chapter number must be centered, in all caps, and not bold.

- Leave one blank line between the word “CHAPTER” and the chapter title.
- The chapter title must be centered, in all caps, and not bold. If the title is more than one line, it must be double-spaced and each line of the title shorter than the line above it.
- Leave two or three blank lines below the chapter title.
- The first page of chapter I must be numbered “1”.

See example on next page.

## CHAPTER I

### INTRODUCTION

Accurate predictions of the future can yield significant advantages and outstanding opportunities. However, these benefits will not be realized unless one anticipates and evaluates possible future events and makes appropriate strategic decisions today. Because of this need to generate information today that reflects expected outcomes in the future, forecasting has developed into an extremely important and useful activity which, in recent years, has taken on an additional dimension of complexity. Furthermore, since virtually all individuals and organizations have at one time or another made a decision based on a forecast of future events, forecasting has diverse strategic uses. Business executives, government policy-makers, and individuals all face an uncertain future, which, if ignored or ineffectively evaluated, will lead to inevitable failures. From this widespread need for accurate prediction, the science of forecasting has grown considerably, particularly in the past thirty years. Numerous articles are published each year on various aspects of forecasting. These studies appear in journals such as the following: *Journal of Forecasting*, *International Journal of Forecasting*, *Management Science*, *Operational Research Quarterly*, *Decision Sciences*, and *Interfaces*, among others. To a large degree, practitioners are heavily dependent on academicians for generating new and improved forecasting techniques

## 6.3.2 Headings

### 6.3.2.1 Templates A, B, C, and C with Schemes

Headings are used to divide chapters and higher order headings into logical subparts. Heading titles should be brief, concise descriptors for the section that they are labeling. Multiple levels of headings may be used to further differentiate key points directly relating to their preceding higher order heading. That is, if the content under a 1<sup>st</sup> level heading is split among multiple 2<sup>nd</sup> level headings, those subordinate headings should directly relate to the original 1<sup>st</sup> level heading for that section. Headings must progress in a stepwise fashion so as to avoid a jump from a 1<sup>st</sup> level heading to a 3<sup>rd</sup> level heading without first labeling a 2<sup>nd</sup> level heading to encompass the collection of 3<sup>rd</sup> level headings. It may help to think of headings as points and sub-points of an outline.

Heading levels are distinguished from one another by either numbering or unique formatting (not a combination of both, nor are they interchangeable). The method used to distinguish each level of heading must be consistent throughout the entire document, including any that may appear in an appendix. Important: if numbered headings are used, then all numbered items (tables, figures, equations, etc) must also be numbered by chapter.

The formatting rules for headings are as follows:

- There must be one blank line between a heading and the paragraph below.
- All headings must have 2 or 3 blank lines above them. The only exception: If a heading is followed by another heading, you may have one blank line between them. If you take this exception, be consistent.
- Do not place punctuation at the end of a heading.

- Do not leave a heading at the bottom of a page; such headings should be moved to the top of the next page. In Word, this is fixed by turning on the “Keep with next” option in the paragraph settings for each heading.
- If sections are numbered, headings are bold and block aligned. Section numbers must align with the left margin. Multiple line headings must be single- or double-spaced. Numbers must be Arabic and start with the chapter number followed by a decimal and then the current heading number. For lower level headings include the previous heading number and add a decimal and start the new level numbering.
- If sections are not numbered:
  - Each level of heading has its own unique, consistent formatting. For example, all first-level headings are formatted the same. All second-level headings are formatted the same, and this formatting must be different than that of the first-level headings, and so on.
  - Headings are left- or center-aligned (no indents) and are formatted with any combination of the following: bold, italic, underlined. Do not use normal text for a heading. Do not use all caps or small caps for a heading.
  - If you use italicized terms (like scientific names) in your headings, do not use italics for any level of heading formatting. The same goes for bold terms and bold headings. Exceptions may be allowed at the discretion of the Office of TD Review.
  - Multiple line headings must be single or double-spaced. If such headings are centered, they each subsequent line must be short than the previous line.

See examples on the following pages.



comparison between low-sun seasons showing interannual fluctuations and trends in precipitation (Figure 8).

### **Dendrochronology**

The use of dendrochronological techniques provides a way to assess the impact of El Niño on vegetation and also provides a comparison between the dendro and instrumental records. Tree cores were obtained using an increment borer from several different locations on the Alabama Coast.

#### **Field Collection**

At locations in Mobile and Baldwin Counties, cores were collected from 28 large trees. Using an increment borer, cores were taken from each tree at 180 degrees apart to better gauge variation in growth across the entire trunk. This provided a total of 56 cores. Upon removal, cores were placed in labeled plastic straws, and the location of each tree was noted using a GPS unit. Collection of tree cores occurred on October 26th, November 21st, and December 23rd 2002.

#### **Lab Analysis**

Cores were extracted and brought to the Dendroclimatology lab at MSU (A small table in room 213). Each core was mounted and glued onto narrow wooden core mounts. The cores were then sanded using a belt sander with a grade of 120 to make the rings more clearly visible and to remove debris such as mold. After sanding, the growth ring widths of each year for each core were measured to the nearest 0.001 mm using a Velmex measuring system. The Velmex system is an electronically controlled microscope stage

that moves precisely between individual growth rings within a field of view. Velmex automatically keeps track of the distance that the stage has moved, which is used to calculate ring widths and number of rings.

## **Data Analysis**

### ***Standardized Ring Index***

The study hinged on the creation of a standardized ring index for each year for all the trees. Using the computer program ARSTAN (Cook and Holmes, 1985) is standard procedure in dendrochronology to produce a standardized ring index. ARSTAN standardized the ring widths while crossdating the years 2 years above and below the sampled year. For example, if the year 1990 was being analyzed from one tree, the program tests to see if years from the other trees' 1988, 1989, 1991, and 1992 values correspond better to the 1990 value. If they match better, the program sequences the years to match the correct rings together and eliminate the biases of possible false rings. Trees frequently have false rings that do not completely encircle the diameter of the cross section. In addition to this, the trees sometimes grow faster on one side versus the other side. Also, the width of growth rings naturally lessens as the tree ages so any comparison of ring widths cannot be substantiated without standardization. ARSTAN removed the natural variations in ring width with age by overlaying cubic splines onto the raw data (Cook and Holmes, 1985).

comparison between low-sun seasons showing interannual fluctuations and trends in precipitation (Figure 8).

## **1.1 Dendrochronology**

The use of dendrochronological techniques provides a way to assess the impact of El Niño on vegetation and also provides a comparison between the dendro and instrumental records. Tree cores were obtained using an increment borer from several different locations on the Alabama Coast.

### **1.1.1 Field Collection**

At locations in Mobile and Baldwin Counties, cores were collected from 28 large trees. Using an increment borer, cores were taken from each tree at 180 degrees apart to better gauge variation in growth across the entire trunk. This provided a total of 56 cores. Upon removal, cores were placed in labeled plastic straws, and the location of each tree was noted using a GPS unit. Collection of tree cores occurred on October 26th, November 21st, and December 23rd 2002.

### **1.1.2 Lab Analysis**

Cores were extracted and brought to the Dendroclimatology lab at MSU (A small table in room 213). Each core was mounted and glued onto narrow wooden core mounts. The cores were then sanded using a belt sander with a grade of 120 to make the rings more clearly visible and to remove debris such as mold. After sanding, the growth ring widths of each year for each core were measured to the nearest 0.001 mm using a Velmex measuring system. The Velmex system is an electronically controlled microscope stage

that moves precisely between individual growth rings within a field of view. Velmex automatically keeps track of the distance that the stage has moved, which is used to calculate ring widths and number of rings.

### **1.1.3 Data Analysis**

#### **1.1.3.1 Standardized Ring Index**

The study hinged on the creation of a standardized ring index for each year for all the trees. Using the computer program ARSTAN (Cook and Holmes, 1985) is standard procedure in dendrochronology to produce a standardized ring index. ARSTAN standardized the ring widths while crossdating the years 2 years above and below the sampled year. For example, if the year 1990 was being analyzed from one tree, the program tests to see if years from the other trees' 1988, 1989, 1991, and 1992 values correspond better to the 1990 value. If they match better, the program sequences the years to match the correct rings together and eliminate the biases of possible false rings. Trees frequently have false rings that do not completely encircle the diameter of the cross section. In addition to this, the trees sometimes grow faster on one side versus the other side. Also, the width of growth rings naturally lessens as the tree ages so any comparison of ring widths cannot be substantiated without standardization. ARSTAN removed the natural variations in ring width with age by overlaying cubic splines onto the raw data (Cook and Holmes, 1985).

### **6.3.2.2 APA Template**

When you are ready to have a heading (for 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> level only), simply type the title for the heading and then apply the appropriate heading level style to it. This will automatically space your headings appropriately, so you will not need to add any blank lines manually.

For 4<sup>th</sup>, and 5<sup>th</sup> level headings, type the in-paragraph heading and then type the rest of the paragraph. Make certain to start a new line after the paragraph. Next, click right before the first word in the paragraph to change the paragraph's style to "Heading in Paragraph" so that the spacing is accurate. Finally, highlight the entire subheading at the beginning of the paragraph and select the appropriate level heading Style. This will format your subheading accordingly and allow it to show up in the Table of Contents, when updated. Examples can be found on the following pages.

that moves precisely between individual growth rings within a field of view. Velmex automatically keeps track of the distance that the stage has moved, which is used to calculate ring widths and number of rings.

### ***Data Analysis***

**Standardized Ring Index.** The study hinged on the creation of a standardized ring index for each year for all the trees. Using the computer program ARSTAN (Cook and Holmes, 1985) is standard procedure in dendrochronology to produce a standardized ring index. ARSTAN standardized the ring widths while crossdating the years 2 years above and below the sampled year. For example, if the year 1990 was being analyzed from one tree, the program tests to see if years from the other trees' 1988, 1989, 1991, and 1992 values correspond better to the 1990 value. If they match better, the program sequences the years to match the correct rings together and eliminate the biases of possible false rings. Trees frequently have false rings that do not completely encircle the diameter of the cross section. In addition to this, the trees sometimes grow faster on one side versus the other side. Also, the width of growth rings naturally lessens as the tree ages so any comparison of ring widths cannot be substantiated without standardization. ARSTAN removed the natural variations in ring width with age by overlaying cubic splines onto the raw data (Cook and Holmes, 1985).

### 6.3.3 Lists

Lists must be formatted consistently within the entire document. Bulleted, numbered, and multi-level lists are all allowed and should be used appropriately to distinguish or enumerate points that support the text. Each entry in a list must be separated by one blank line, while individual multiple line entries may either be single or double spaced. Lists should be block aligned so that the bullet or number is the left most text for an entry. Examples:

- 1) This is the first entry of the numbered list
- 2) This is a second entry of a numbered list that consists of text that causes the entry to extend past one line and is thusly block-aligned.
  - a) This is a possible entry for a multi level list
  - b) Such multi level lists may be distinguished in any manner appropriate for the author's field of study, so long as all such multilevel lists in the document are consistently formatted

Another example for a bullet list that multiple line entries are single spaced:

- This is the first entry in the bullet list
- This is a second entry in the bullet list that consists of text that causes the entry to extend past one line and is thusly block-aligned.

### 6.3.4 Block Quotes

Block quotes are used to distinguish long instances of quoted text from the author's original text. Such long quotes must be separated from surrounding text by one blank line. Block quotes may be either single spaced or double spaced. All block quotes must have equal indentations on both the left and right. If the left indents are set to 0.5 inches, then the right

indents for the block quote must also be set for 0.5 inches. Indentations used for block quotes must be consistent throughout the entire document. Finally, Block quotes may be either left or fully justified.

Example double-spaced block quote that is left justified:

This block quote is left justified and double-spaced with 0.5 inch indents on the left and right side. The next example will be for a fully justified and single-spaced block quote with 0.5 inch indents on the left and right side.

Example of single-spaced block quote that is fully justified:

This block quote is fully justified and single-spaced with 0.5 inch indents on the left and right side. The previous example was for a left justified and double-spaced block quote with 0.5 inch indents on the left and right side.

### **6.3.5 Tables**

#### **6.3.5.1 Templates A, B, C, & C with Schemes**

Tables may be placed in either three locations within a document, after the sentence in which they are first referenced without splitting paragraphs, at the end of the chapter in which they are referenced, or in an Appendix titled “Tables”. If the latter two options are chosen, then figures should also appear after the tables at the end of the chapter and “Tables” appendix.

Table titles always appear above the table. Table titles should be short, concise, and unique descriptors for a table. Detailed descriptions that describe the contents of the table should be reserved for either notes beneath the table or part of a paragraph referencing the table.



Table numbering must be consistent within the entire document and either numbered sequentially or by chapter. Note: If headings are numbered by chapter then tables must also be numbered by chapter.

The formatting rules for tables are as follows:

- The table title must have 2 or 3 blank lines above it.
- Do not place table titles in a row of the table.
- Choose one of the two styles of table title:
  - Centered style: The word “Table”, one space, and the table number, centered. Below that, one blank line, then the table title, single-spaced, centered, with every line smaller than the line above. Below that, one blank line, then the table itself, centered.
  - Block style: The word “Table”, one space, then the table number, aligned with the left margin. The space separating the number from the title should be enough to distinguish the two, but not exceeding 0.5”. Then, the table title, single-spaced and block aligned. Below that, a blank line, then the table, left-aligned or centered (be consistent for all tables).
- The table itself is formatted according to the author’s need. Any size font, any style text is allowed, as long as the table is legible and meets departmental standards.
- The table gridlines may not extend into the margins. Word tends to get this wrong automatically. Setting the cell margins to 0” will fix this.
- Table must be in line with text (no text wrapping).
- Notes go below the table (not inside it). There may be zero or one blank line separating table from notes.

- Keep two or three blank lines below the table (or the notes, if present).
- If a table is more than one page in size (note: if a table can be placed on one page, it must be. Do not break small tables over two pages), then the table title is placed above the first page. Above the following pages of the table, place the word “Table”, a space, the table number, a space, then “(continued)”, followed by one blank line, then the piece of table for that page. Notes for a table appear below the last part of the table.

See examples on the following pages.

Table 3

Risk/Return Characteristics of Country Stock Market Indices and Selected Portfolios:  
January 1990 - December 1994

Country Index and Type of Portfolio:	*Mean Return $\bar{x}$	Standard Deviation $\sigma$	Coeff. of Var.: $\sigma/\bar{x}$	Proportions in Portfolio:			
				Equally Equally Weighted	Overall Optimum Weighted	Equally Weighted	Optim. Portfolio
Australia	.1007	2.3246	23.08	.06			
Belgium	.0627	2.2018	35.14	.06			
Canada	-.0386	1.7540	-45.49	.06			
Denmark	.0688	2.7323	39.73	.06			
France	.0704	2.5251	35.85	.06			
Germany	.0871	2.5892	29.72	.06			
Hong Kong	.4410	3.4983	7.93	.06	.35	.20	.43
Italy	-.0204	3.7920	-185.67	.06			
Japan	-.0019	3.6002	-187.59	.06			
Netherlands	.1775	1.8625	10.49	.06	.20	.20	.27
Norway	.0868	3.3162	38.19	.06			
Singapore/Malaysia	.2810	2.7200	9.68	.06	.11	.20	
Spain	-.0033	3.3540	-100.73	.06			
Sweden	.1143	3.4814	30.47	.06			
Switzerland	.2518	2.3952	9.51	.06	.21	.20	.30
U. K.	.1213	2.3962	19.76	.06			
U. S.	.1274	1.7087	13.41	.06	.14	.20	
<b>Portfolio #1</b>	.1103	‡1.7926	<b>16.26</b>	1.00			
<b>Portfolio #2</b>	.2887	1.9986	<b>6.92</b>		1.00		
<b>Portfolio #3</b>	.2549	1.8068	<b>7.09</b>			1.00	
<b>Portfolio #4</b>	.3125	2.1938	<b>7.02</b>				1.00
<b>Portfolio #5</b>	.2898	2.0521	<b>7.08</b>				1.00

\* Represents the mean weekly percentage rate of return.

‡ To the extent that returns on individual country indices are less than perfectly positively correlated with the returns on the portfolio, the standard deviation of a portfolio is less than the weighted average of the individual standard deviations of country indices in a portfolio.

NOTE: **Portfolio #1** consists of each one of the 17 country indices, all equally weighted in the portfolio.

**Portfolio #2** represents the overall optimum portfolio, defined as the one which minimizes the absolute value of the coefficient of variation for the portfolio.

**Portfolio #3** consists of the five country indices which make up the optimum portfolio, in this case, however, each index received equal weight in the portfolio.

**Portfolio #4** is an optimum portfolio based on the optimum three country indices.

**Portfolio #5** consists of the above 3-country index, but equally weighted.

### Process Employed to Optimize the Individual Forecasting Models

FORTTRAN programs (Appendix B.1-B.4) are used to optimize the four individual forecasting models (*i.e.*, MAVG, SES, Holt's, and Winter's). In this study a model is considered optimal when its parameters yield a minimum mean square error (MSE) for the training data. The resulting parameters of the forecasting models are summarized in Table 4.1.

Table 4.1

Parameters for optimal individual forecasting models for simulated data

Composite Models:	Individual Forecasting Parameters	Case #1	Case #2	Case #3	Case #4
		Positive correl. Low variance	Positive correl. High variance	Negative correl. Low variance	Negative correl. High variance
MAVG	n=	6	6	6	6
SES	$\alpha$ =	0.37	0.37	0.05	0.03
Holt's	$\alpha$ =	0.40	0.40	0.05	0.05
	$\gamma$ =	0.05	0.05	0.05	0.05
Winter's	$\alpha$ =	0.05	0.05	0.05	0.05
	$\beta$ =	0.05	0.05	0.05	0.05
	$\gamma$ =	0.40	0.40	0.05	0.05

It should be pointed out that while these four models may not be the best models to fit an AR(1) process, the purpose of this research is to compare how well various composite models perform in combining the same four individual forecasts. Therefore, as long as each of the composite models receives the same information, the specific four individual forecasting models employed should not have a significant impact on the overall comparison between the composite models.

Table 4 Testing for Differences in Rates of Return in Three Market Indices by the Day-of-the-Week and Business Cycles: Results of ANOVA and Kruskal-Wallis

Ho: Ri(Monday) = Ri(Tuesday) = Ri(Wednesday) = Ri(Thursday) = Ri(Friday)					
Index:	ANOVA:		No. of Observ.	Kruskal-Wallis:	
	F-value:	*P-value:		F-value:	*P-value:
<b>Junk Bonds (overall)</b>	4.08	.0027	1,886	67.56	.0000
Expansion:	3.44	.0082	1,719	57.17	.0000
Contraction:	1.15	.3347	167	7.97	.0926
<b>Investment-Grade Bonds</b>	0.16	.9588	1,891	1.30	.8615
Expansion:	0.16	.9572	1,724	1.65	.7998
Contraction:	0.13	.9729	167	1.02	.9061
<b>CRSP Equally-Weighted</b>					
Equity (overall)	5.83	.0001	1,770	38.81	.0000
Expansion:	6.36	.0000	1,603	39.81	.0000
Contraction:	0.82	.5129	167	4.68	.3219

\*The reported F-values and associated P-values correspond to the null hypothesis of equal mean return by the day of the week

Table 5 Duncan's Test Statistics for Pairwise Comparisons in the Daily Returns in the Three Market Indices by Business Cycles

Index:	Comparison of Days With Significantly Different Returns at the .05 Level:
Junk Bonds (overall) -----	Friday > Monday, Tuesday, Wednesday, Thurs.
Expansions: -----	Friday > Monday, Tuesday, Wednesday, Thurs.
Contractions: -----	(none)
Investment-Grade Bonds (overall)	(none)
Expansions: -----	(none)
Contractions: -----	(none)
CRSP Equally-Weighted	
Equity (overall) -----	Monday < Wednesday, Thursday, Friday Tuesday < Wednesday
Expansions: -----	Monday < Tuesday, Wednesday, Thurs., Friday Tuesday < Wednesday
Contractions: -----	(none)

### 6.3.5.2 APA Template

Tables may be placed in either three locations within a document, after the sentence in which they are first referenced without splitting paragraphs, at the end of the chapter in which they are referenced, or in an Appendix titled “Tables”. If the latter two options are chosen, then figures should also appear after the tables at the end of the chapter and “Tables” appendix.

Table titles always appear above the table. Table titles should be short, concise, and unique descriptors for a table. Detailed descriptions that describe the contents of the table should be reserved for either notes beneath the table or part of a paragraph referencing the table.

Table numbering must be consistent within the entire document and numbered by chapter.

The formatting rules for tables are as follows:

- Table title is italicized and below the table number.
- Table titles are double spaced.
- The table title must have 2 or 3 blank lines above it.
- Do not place table titles in a row of the table.
- Use the title format required by the Standards
- The table itself is formatted according to the author’s need. Any size font, any style text is allowed, as long as the table is legible and meets departmental standards.
- The table gridlines may not extend into the margins. Word tends to get this wrong automatically. Setting the cell margins to 0” will fix this.
- Table must be in line with text (no text wrapping).

- Notes go below the table (not inside it). There may be zero or one blank line separating table from notes.
- Keep two or three blank lines below the table (or the notes, if present).
- If a table is more than one page in size (note: if a table can be placed on one page, it must be. Do not break small tables over two pages), then the table title is placed above the first page. Above the following pages of the table, place the word “Table”, a space, the table number, a space, then “(continued)”, followed by one blank line, then the piece of table for that page. Header information must be found on each page of the table if continued. Notes for a table appear below the last part of the table.

See examples on the following pages.

Table 3

*Risk/Return Characteristics of Country Stock Market Indices and Selected Portfolios:*

*January 1990 - December 1994*

Country Index and Type of Portfolio:	*Mean Return $\bar{x}$	Standard Deviation $\sigma$	Coeff. of Var.: $\sigma / \bar{x}$	Proportions in Portfolio:				
				Equally Equally Weighted	Overall Optimum Weighted	Equally Weighted	Optim. Portfolio	
Australia	.1007	2.3246	23.08	.06				
Belgium	.0627	2.2018	35.14	.06				
Canada	-.0386	1.7540	-45.49	.06				
Denmark	.0688	2.7323	39.73	.06				
France	.0704	2.5251	35.85	.06				
Germany	.0871	2.5892	29.72	.06				
Hong Kong	.4410	3.4983	7.93	.06	.35	.20	.43	.33
Italy	-.0204	3.7920	-185.67	.06				
Japan	-.0019	3.6002	-187.59	.06				
Netherlands	.1775	1.8625	10.49	.06	.20	.20	.27	.33
Norway	.0868	3.3162	38.19	.06				
Singapore/Malaysia	.2810	2.7200	9.68	.06	.11	.20		
Spain	-.0033	3.3540	-100.73	.06				
Sweden	.1143	3.4814	30.47	.06				
Switzerland	.2518	2.3952	9.51	.06	.21	.20	.30	.33
U. K.	.1213	2.3962	19.76	.06				
U. S.	.1274	1.7087	13.41	.06	.14	.20		
<b>Portfolio #1</b>	.1103	‡1.7926	<b>16.26</b>	1.00				
<b>Portfolio #2</b>	.2887	1.9986	<b>6.92</b>		1.00			
<b>Portfolio #3</b>	.2549	1.8068	<b>7.09</b>			1.00		
<b>Portfolio #4</b>	.3125	2.1938	<b>7.02</b>				1.00	
<b>Portfolio #5</b>	.2898	2.0521	<b>7.08</b>					1.00

\* Represents the mean weekly percentage rate of return.

‡ To the extent that returns on individual country indices are less than perfectly positively correlated with the returns on the portfolio, the standard deviation of a portfolio is less than the weighted average of the individual standard deviations of country indices in a portfolio.

NOTE: **Portfolio #1** consists of each one of the 17 country indices, all equally weighted in the portfolio.

**Portfolio #2** represents the overall optimum portfolio, defined as the one which minimizes the absolute value of the coefficient of variation for the portfolio.

**Portfolio #3** consists of the five country indices which make up the optimum portfolio, in this case, however, each index received equal weight in the portfolio.

**Portfolio #4** is an optimum portfolio based on the optimum three country indices.

**Portfolio #5** consists of the above 3-country index, but equally weighted.



### **6.3.5.3 Specifying a Table Headers**

Highlight the top row of information for the table. In Table Tools, under Design, ensure that the box for Header Row is checked.

### **6.3.5.4 Adding Alternate Text for Tables**

To add alternate text to a table, right click on the small compass arrow that is found in the top left corner of the table. Then select the option for “Table Properties”. In the window that opens, select the last tab for “Alt Text”. Type the table title into the Title box. For the description, enter 1-2 sentences that briefly describe the table and then reference the page number(s) where the table is discussed in detail.

## **6.3.6 Figures and Other Labeled Illustrations**

### **6.3.6.1 Template A, B, C, & C with Schemes**

Figures may be placed in either three locations within a document, after the sentence in which they are first referenced without splitting sentence, at the end of the chapter in which they are referenced, or in an Appendix titled “Figures”. If one of the latter options is chosen, then tables should also appear before the figures at the end of the chapter or in Appendix order.

Figures should always be in line with text (no text wrapping). Figure titles always appear below the figure. Figure titles should be short, concise, and unique descriptors for a figure. Detailed descriptions that describe the contents of the figure should be reserved for either notes beneath the figure title or part of a paragraph referencing the figure.

Figure numbering must be consistent within the entire document and either numbered sequentially or by chapter. Note: If headings are numbered by chapter then figures must also be numbered by chapter.

If a discipline requires, additional illustrations that are not considered figures but go by another label (such as schemes) may also be included with an appropriate label and must follow the format requirements for figures. Such illustrations should also have their own reference list after the List of Figures in the preliminary pages.

The formatting rules for figures are as follows:

- Figures may not be placed in the middle of a paragraph, even if the paragraph is split between two pages.
- The figure must have 2 or 3 blank lines above it.
- Do not place figure titles in the figure itself or a text box.
- Figures should be inserted as images. If the Office of TD Review sees that a figure is slow in rendering, they will require the figure be replaced with an image.
- Choose one of the two styles of figure title:
  - Centered style: Below the centered figure, one blank line, then the word “Figure”, one space, and the figure number, centered. Below that, one blank line, then the figure title, single-spaced, centered, with every line smaller than the line above.
  - Block style: Below the figure (centered or left-aligned, be consistent), one blank line, then the word “Figure”, one space, then the figure number, aligned with the left margin. The space separating the number from the title should be enough to distinguish the two, but not exceeding 0.5”. Then, the figure title, single-spaced and block aligned.
- The figure itself is formatted according to the author’s need as long as it is legible and meets departmental standards.

- If the figure has white space at the top or bottom of the image itself, it must be cropped or surrounded with a single-line border, i.e., no shadows, 3-D, etc.
- Figures may not extend into the margins.
- Figures must be inserted in line with text (no text wrapping).
- Notes go below the figure title (not inside it). There must be one blank line separating figure title from notes.
- Keep two or three blank lines below the figure title (or the notes, if present).
- If a figure is more than one page in size (note: if a figure can be placed on one page, it must be. Do not break small figures over two pages), then the figure title is placed below the figure portion on the first page. Below the figure portions on the following pages, add a blank line, then place the word “Figure”, a space, the figure number, a space, then “(continued)”. Notes for a figure appear below the last “(continued)” note.
- Multiple small figures that are related may be grouped together provided that:
  - each figure contains an identifier (“a”, “b”, “c”, or equivalent identifier) inside each image.
  - the group of figures is given only 1 collective title
  - notes for the figure detail the specifics by referencing the unique labels for each figure.

See examples on the following pages.

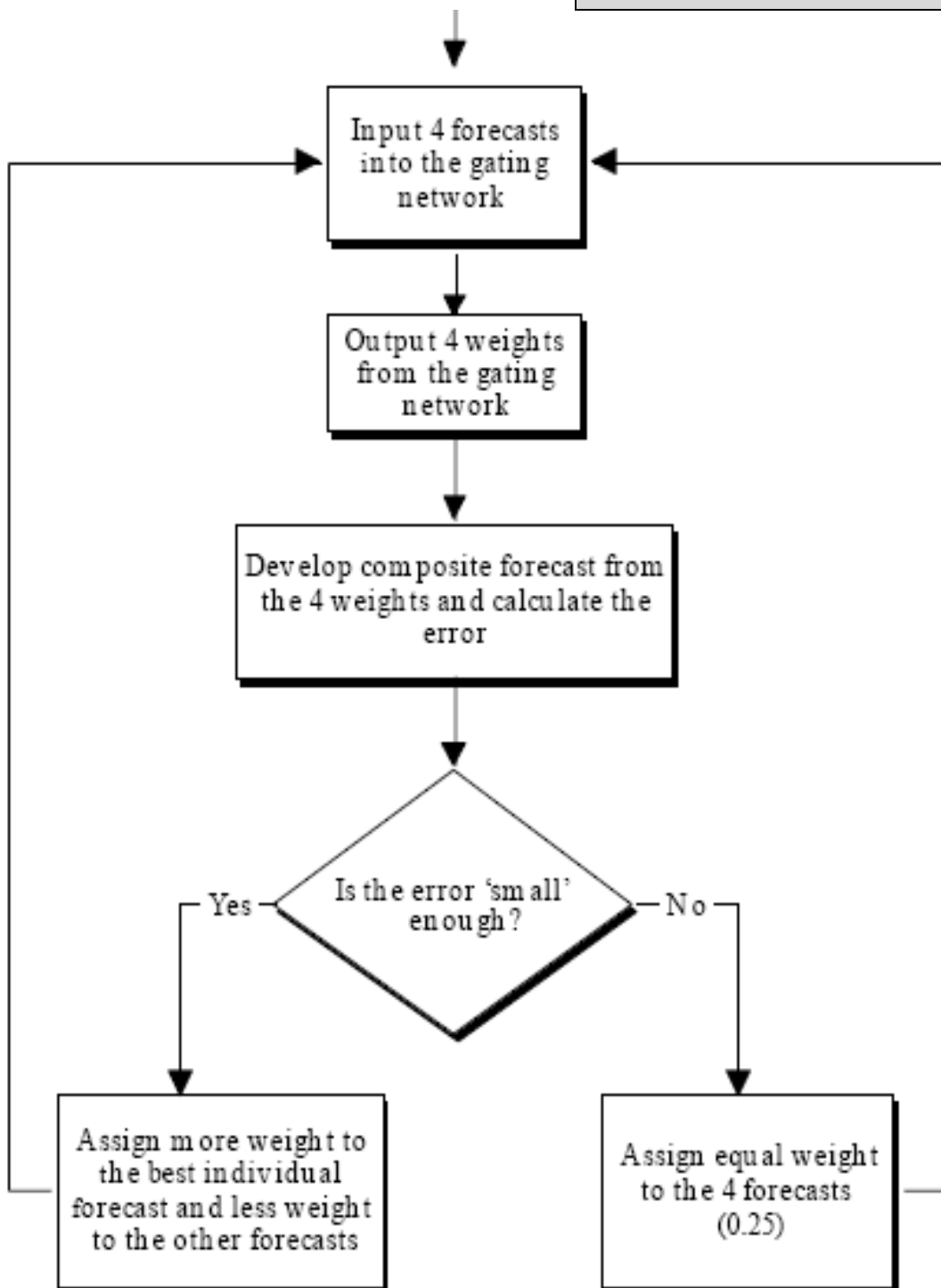


Figure 4.6

Modular Neural Network Training Procedure

The use of mathematical programming helped to identify Portfolio #2, the one with the smallest coefficient of variation. This portfolio resulted in a remarkable reduction in the coefficient of variation relative to Portfolio #1 (i.e., 6.92 versus 16.26, respectively). In addition, the risk/return characteristics of this portfolio are significantly better than those of any individual country index. It is also of interest to note that the overall optimum portfolio required only 5 of the 17 country indices.

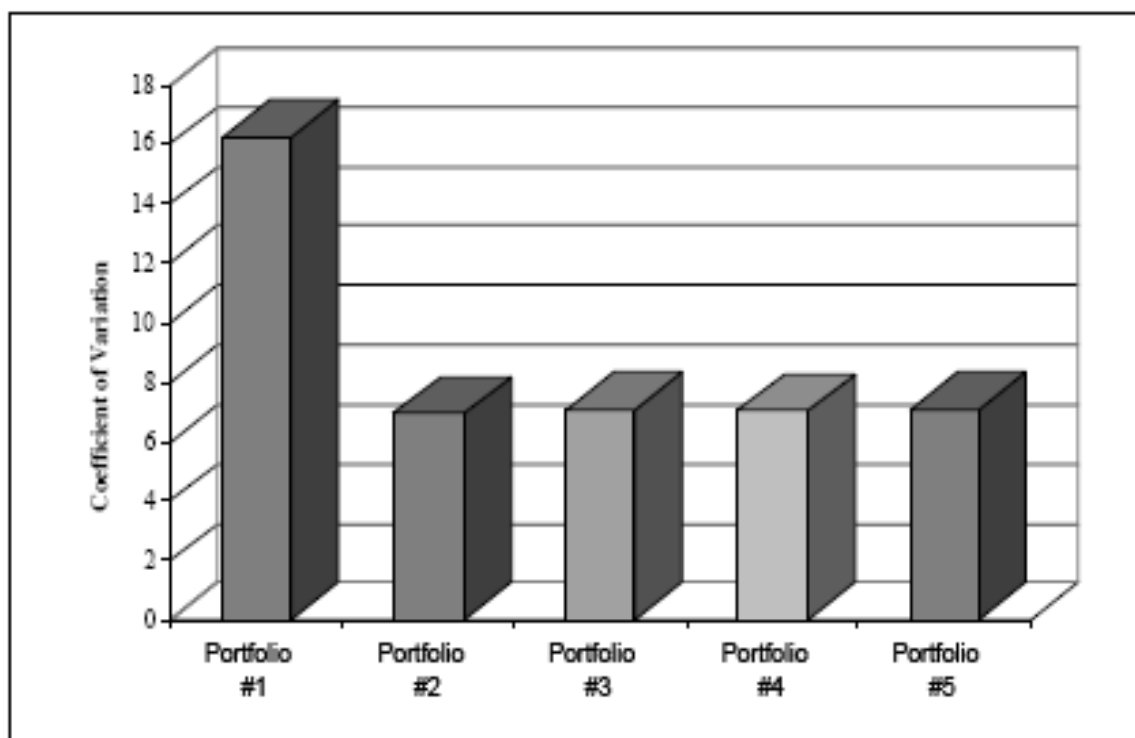


Figure 4.1 Risk/Return Characteristics of Selected International Portfolios: January 1990-December 1994

Relying on more relaxed assumptions, Portfolio #3's results are quite close to those obtained for the overall optimum portfolio (coefficient of variation of 7.09 versus 6.92, respectively). Recall that Portfolio #3 relies on the same country indices as the optimum portfolio, except they are all equally weighted. So, comparing the coefficient .

### 3.1.4 Absorption of the Skin Mimicking Material

In order to study the absorption characteristics of the tissue mimicking materials, the following measuring set-up is preformed. Two horn antennas that operate at 7-11 GHz are connected to the Agilent Technologies® E8362B PNA Network Analyzer to measure the absorption of power because of the interference or presence of a square skin mimicking gel sample. For both horn antennas, the waveguide length is 9 cm, the height is 5.8 cm, and the thickness is 8.2 cm, while the antennas' length is 4.5 cm, the height is 1.2 cm, and the thickness is 2.5 cm. The dimensions of the square sample are 26.5 cm in height, 26.5 cm in length, and 1.02 cm in thickness. The horn antennas are placed 9.5 cm apart, and the sample is placed between the horns. Figure 3.14 shows the measurement set-up with and without a skin mimicking gel sample.

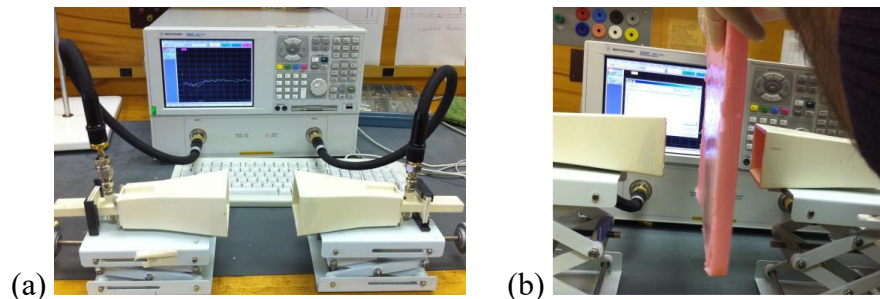


Figure 3.14 S12 and S21 Measurement Set-Up

- (a) Without Interference of a Skin Mimicking Sample
- (b) With Interference of a Skin Mimicking Sample

Figure 3.15 shows S12 and S21 from 7-11 GHz of the antennas with and without the interference of the skin mimicking sample. These measurements are performed using Agilent Technologies® E8362B PNA Network Analyzer. The difference of the S12 and S21 of the antennas with and without the sample provides the amount of energy absorbed by the material. The absorption by the skin mimicking material is shown in Figure 3.16.

### 6.3.6.2 APA Templates

Figures may be placed in either three locations within a document, after the sentence in which they are first referenced without splitting sentence, at the end of the chapter in which they are referenced, or in an Appendix titled “Figures”. If one of the latter options is chosen, then tables should also appear before the figures at the end of the chapter or in Appendix order.

Figure titles always appear below the figure. Figure titles should be short, concise, and unique descriptors for a figure. Detailed descriptions that describe the contents of the figure should be reserved for either notes beneath the figure title or part of a paragraph referencing the figure.

Figure numbering must be consistent within the entire document and either numbered sequentially and by Appendix Letter if applicable.

The formatting rules for figures are as follows:

- The word “Figure” and the number must be Bolded
- The figure title must be Italicized.
- The figure must have 2 or 3 blank lines above it.
- Do not place figure titles in the figure itself or a text box.
- Figures should be inserted as images. If the Office of TD Review sees that a figure is slow in rendering, they will require the figure be replaced with an image.
- Figures must be in the following style
  - Block style: Below the figure (centered or left-aligned, be consistent), one blank line, then the word “Figure”, one space, then the figure number, aligned with the left margin. The space separating the number from the title should be

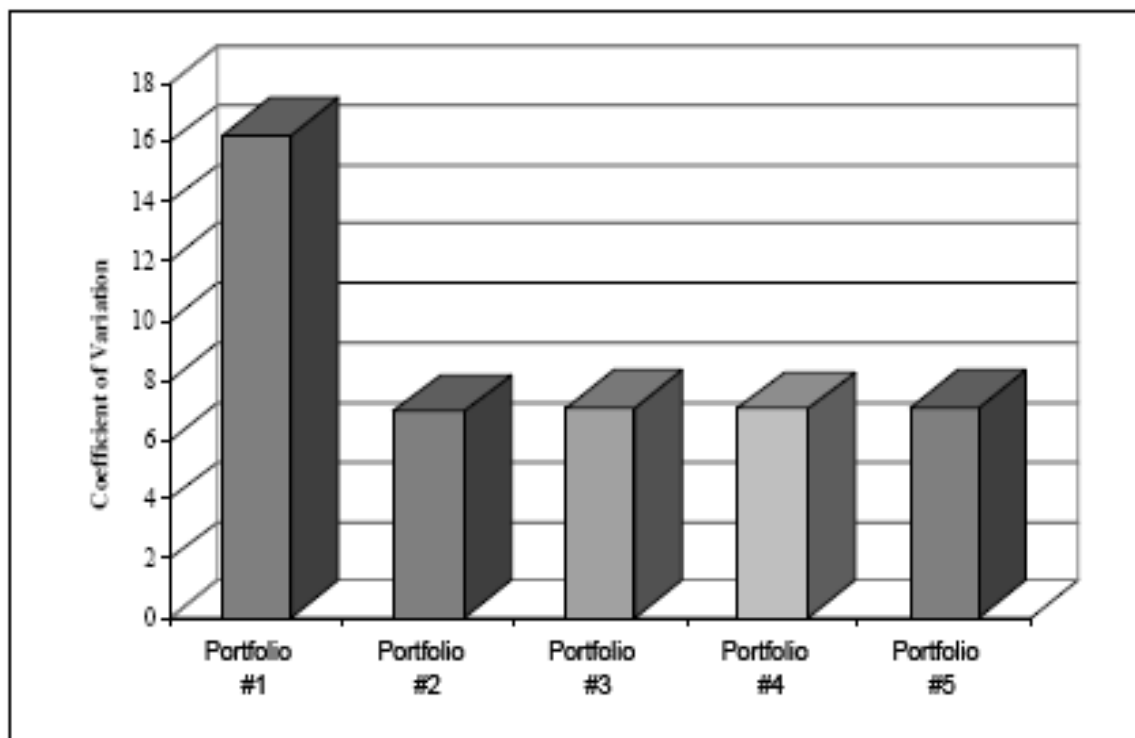
enough to distinguish the two, but not exceeding 0.5". Then, the figure title, single-spaced and block aligned.

- The figure itself is formatted according to the author's need as long as it is legible and meets departmental standards.
- If the figure has white space at the top or bottom of the image itself, it must be cropped or surrounded with a single-line border, i.e., no shadows, 3-D, etc.
- Figures may not extend into the margins.
- Figures must be inserted in line with text (no text wrapping).
- Notes go below the figure title (not inside it). There must be one blank line separating figure title from notes.
- Keep two or three blank lines below the figure title (or the notes, if present).
- If a figure is more than one page in size (note: if a figure can be placed on one page, it must be. Do not break small figures over two pages), then the figure title is placed below the figure portion on the first page. Below the figure portions on the following pages, add a blank line, then place the word "Figure", a space, the figure number, a space, then "(continued)". Notes for a figure appear below the last "(continued)" note.
- Multiple small figures that are related may be grouped together provided that:
  - each figure contains an identifier ("a", "b", "c", or equivalent identifier) inside each image.
  - the group of figures is given only 1 collective title
  - notes for the figure detail the specifics by referencing the unique labels for each figure.

See examples on the following pages.



The use of mathematical programming helped to identify Portfolio #2, the one with the smallest coefficient of variation. This portfolio resulted in a remarkable reduction in the coefficient of variation relative to Portfolio #1 (i.e., 6.92 versus 16.26, respectively). In addition, the risk/return characteristics of this portfolio are significantly better than those of any individual country index. It is also of interest to note that the overall optimum portfolio required only 5 of the 17 country indices.

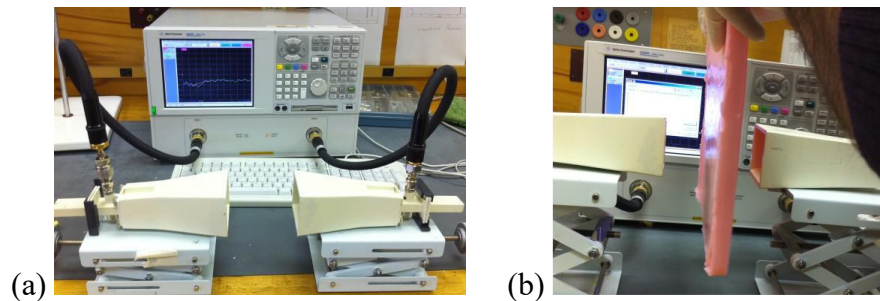


**Figure 1** *Risk/Return Characteristics of Selected International Portfolios: January 1990-December 1994*

Relying on more relaxed assumptions, Portfolio #3's results are quite close to those obtained for the overall optimum portfolio (coefficient of variation of 7.09 versus 6.92, respectively). Recall that Portfolio #3 relies on the same country indices as the optimum portfolio, except they are all equally weighted. So, comparing the coefficient .

### 3.1.4 Absorption of the Skin Mimicking Material

In order to study the absorption characteristics of the tissue mimicking materials, the following measuring set-up is preformed. Two horn antennas that operate at 7-11 GHz are connected to the Agilent Technologies® E8362B PNA Network Analyzer to measure the absorption of power because of the interference or presence of a square skin mimicking gel sample. For both horn antennas, the waveguide length is 9 cm, the height is 5.8 cm, and the thickness is 8.2 cm, while the antennas' length is 4.5 cm, the height is 1.2 cm, and the thickness is 2.5 cm. The dimensions of the square sample are 26.5 cm in height, 26.5 cm in length, and 1.02 cm in thickness. The horn antennas are placed 9.5 cm apart, and the sample is placed between the horns. Figure 3.14 shows the measurement set-up with and without a skin mimicking gel sample.



**Figure A.14** *S12 and S21 Measurement Set-Up*

- (a) Without Interference of a Skin Mimicking Sample
- (b) With Interference of a Skin Mimicking Sample

Figure A.14 shows S12 and S21 from 7-11 GHz of the antennas with and without the interference of the skin mimicking sample. These measurements are performed using Agilent Technologies® E8362B PNA Network Analyzer. The difference of the S12 and S21 of the antennas with and without the sample provides the amount of energy absorbed by the material. The absorption by the skin mimicking material is shown in Figure 3.16.

### **6.3.6.3 Adding Alternate Text for Figures**

To add alternate text to a figure (or scheme), right click on the image and select “Edit Alt Text”. In the window that opens, enter 1-2 sentences that briefly describe the image (cannot be identical to the figure title) and then reference the page number(s) where the figure is discussed in detail.

### **6.3.7 Landscape Pages**

Some tables and figures may be too wide to fit on a standard portrait page (width: 8.5” height: 11”) and are best displayed on a landscaped page (width: 11” height: 8.5”). To format a landscape page in Word, go to Layout, Orientation and chose Landscape. **NOTE:** You must add a “Next Page” break to the page before the landscape page and another “Next Page” break after the information on the last landscape page before you change the page orientation.

### **6.3.8 Equations**

Equations may be used as part of a paragraph or separate, as appropriate. Equations that are separated from paragraphs must be numbered, using the same numbering scheme for tables and figures. For numbering purposes, only each unique equation should be numbered. A series of derivations or directly related equations should only have one number, however, such series should be vertically aligned by their major operators (e.g. equivalency signs) when possible. Due to the limitations on cataloging and html, equations are not allowed as part of a document’s title or in the abstract. It is also inadvisable to use equations in chapter, heading, table, or figure titles.

Numbering for equations must be right aligned to the right margin. The equations, themselves, must be formatted in a consistent manner. Centering equations is one method.

Using a consistent left-alignment is another. For purposes of consistency, align equations series by the longest line within the series.

The formatting rules for equations are as follows:

- All equations outside of a paragraph must be numbered in the same method as the tables and figures.
- Equation numbers must be aligned with the right margin.
- Consistent spacing must be kept above and below equations.
- Equations must be aligned in one of two ways: Centered horizontally on the page, or consistently left-aligned with all other equations.
- If there are a series of equations for one equation number, the equation must be aligned by the equivalency sign or other major operator, e.g., less-than sign.
- The author is responsible for verifying the proper output of the equations to the PDF. It may be beneficial for the author to convert equations to images.

See examples on the following pages.

### **6.3.8.1 Adding Alternate Text for Equations**

Equations will be entered into an invisible table. Make sure you are using the “Equation number” QuickPart in order to accomplish this goal. This will provide you the area to enter your equation and number the equation for you. Once you have entered the equation, you will highlight the entire table. You will then go to “Layout” in the “Table Tools” menu. You will then click “Properties” on the far left. You will then click on the “Alt-text” tab. For the title, you will enter “Equation” and then the number of that equation. In the “Description”, you will write “This equation is discussed on (page number). If there are any questions, contact the author.”

Hence if  $\hat{f}_1 := \sup_{[0, \infty)} \hat{f}(s) = \frac{b_1^2 + 4a_1 m_0}{4m_0} \leq \mu_1$  or equivalently,  $a_1 < \mu_1$  and

$b_1 \leq 2\sqrt{m_0(\mu_1 - a_1)}$  then

$$\begin{aligned} \int_{\Omega} \psi_1 [a(x)u + b(x)u^2 - m(x)u^3 - ch(x)] dx - \int_{\Omega} [\mu_1 \psi_1 u] dx &\leq \\ \int_{\Omega} [\psi_1 u \hat{f}(u) - \mu_1 \psi_1 u] dx - c \int_{\Omega} [h(x) \psi_1] dx &\leq \\ \int_{\Omega} \psi_1 u [\hat{f}_1 - \mu_1] dx &\leq 0 \end{aligned} \quad (4.4)$$

Also, if  $\|u\|_{\infty} < \delta$  then we have,

$$\int_{\Omega} \psi_1 [g(u) - u] dx \geq \int_{\Omega} \psi_1 [\delta - \|u\|_{\infty}] dx > 0. \quad (4.5)$$

Therefore, (4.4) and (4.5) together contradict (4.2).

To prove Theorem 8(b) note that from (4.1) we have,

$$\int_{\Omega} [\psi_1 \Delta u] dx = -\mu_1 \int_{\Omega} [\psi_1 u] dx + \int_{\partial\Omega} \psi_1 [u - g(u)] dx. \quad (4.6)$$

By the maximum principle, every solution,  $u$ , of (1.22) - (1.23) (for any  $c \geq 0$ ) must be such that

$u \leq \tilde{M}$  where  $\tilde{M} := \frac{b_1 + \sqrt{b_1^2 + 4m_0 a_1}}{2m_0}$  is the positive zero of  $\hat{f}(s)$ . Thus we have,

$$\begin{aligned} c \int_{\Omega} [h(x) \psi_1(x)] dx &= \int_{\Omega} [\psi_1 (\Delta u)] dx + \int_{\Omega} \psi_1 [a(x)u + b(x)u^2 - m(x)u^3] dx \\ &\leq -\mu_1 \int_{\Omega} [\psi_1 u] dx + \int_{\partial\Omega} \psi_1 [u - g(u)] dx + \hat{f}_1 \int_{\Omega} \psi_1 u dx \\ &\leq \int_{\partial\Omega} \psi_1 [\tilde{M} - \delta] dx + \hat{f}_1 \tilde{M} \int_{\Omega} \psi_1 dx. \end{aligned} \quad (4.7)$$

But, (4.7) cannot hold for large  $c$ -values thus proving Theorem 8(b).

Hence if  $\hat{f}_1 := \sup_{[0,\infty)} \hat{f}(s) = \frac{b_1^2 + 4a_1m_0}{4m_0} \leq \mu_1$  or equivalently,  $a_1 < \mu_1$  and

$b_1 \leq 2\sqrt{m_0(\mu_1 - a_1)}$  then

$$\begin{aligned} \int_{\Omega} \psi_1 [a(x)u + b(x)u^2 - m(x)u^3 - ch(x)] dx - \int_{\Omega} [\mu_1 \psi_1 u] dx &\leq \\ \int_{\Omega} [\psi_1 u \hat{f}(u) - \mu_1 \psi_1 u] dx - c \int_{\Omega} [h(x) \psi_1] dx &\leq \\ \int_{\Omega} \psi_1 u [\hat{f}_1 - \mu_1] dx &\leq 0 \end{aligned} \quad (4.4)$$

Also, if  $\|u\|_{\infty} < \delta$  then we have,

$$\int_{\Omega} \psi_1 [g(u) - u] dx \geq \int_{\Omega} \psi_1 [\delta - \|u\|_{\infty}] dx > 0. \quad (4.5)$$

Therefore, (4.4) and (4.5) together contradict (4.2).

To prove Theorem 8(b) note that from (4.1) we have,

$$\int_{\Omega} [\psi_1 \Delta u] dx = -\mu_1 \int_{\Omega} [\psi_1 u] dx + \int_{\partial\Omega} \psi_1 [u - g(u)] dx. \quad (4.6)$$

By the maximum principle, every solution,  $u$ , of (1.22) - (1.23) (for any  $c \geq 0$ ) must be such that

$u \leq \tilde{M}$  where  $\tilde{M} := \frac{b_1 + \sqrt{b_1^2 + 4m_0a_1}}{2m_0}$  is the positive zero of  $\hat{f}(s)$ . Thus we have,

$$\begin{aligned} c \int_{\Omega} [h(x) \psi_1(x)] dx &= \int_{\Omega} [\psi_1 (\Delta u)] dx + \int_{\Omega} \psi_1 [a(x)u + b(x)u^2 - m(x)u^3] dx \\ &\leq -\mu_1 \int_{\Omega} [\psi_1 u] dx + \int_{\partial\Omega} \psi_1 [u - g(u)] dx + \hat{f}_1 \int_{\Omega} \psi_1 u dx \\ &\leq \int_{\partial\Omega} \psi_1 [\tilde{M} - \delta] dx + \hat{f}_1 \tilde{M} \int_{\Omega} \psi_1 dx. \end{aligned} \quad (4.7)$$

But, (4.7) cannot hold for large  $c$ -values thus proving Theorem 8(b).

## 6.3.9 Bibliographic Materials

### 6.3.9.1 Templates A, B, C, and C with Schemes

Bibliographic styles are set by the conventions of the author's discipline, except for the following:

- 1) each entry must be single spaced.
- 2) each entry must be separated by other entries by one blank line.

All other aspects (such as order of each entry, information provided, etc.) should conform to the expectations of the author's committee.

Bibliographic material is placed in one of two possible locations, either at the end of each chapter or the end of the document following the last chapter. If placed at the end of each chapter the heading (bibliography, works cited, references, etc.) should be formatted as a 1<sup>st</sup> level heading at the start of a new page. If placed at the end of the document, then the heading will be formatted like those in the preliminary pages.

The formatting rules for bibliographic materials are as follows:

For all bibliographic sections:

- Bibliographic entries must be single-spaced with a blank line below each entry.

All other formatting is to be according to departmental citation standards.

- Entries should not be split across a page break

For bibliographic sections placed at the end of each chapter:

- Start a new page.
- Format the section heading as a first-level subheading (do not use all caps), followed by one blank line, then the first bibliographic entry

For an overall bibliographic section at the end of the document:

- Start a new page.
- There must be 2” of blank space between the top of the first page of the section and the top of the section title.
- The section title must be centered, in all caps, and not bold.
- Keep 2 or 3 blank lines between the section and the first bibliographic entry.

See examples on the following pages.



## 2.11 References Cited

- [1] Alderson, M. J., and T. L. Zivney, "On Computing Bond Returns: The Evaluation of Low-Grade Debt," *Journal of Financial Research*, XVII, 3, Fall 1994, pp. 403-415.
- [2] Altman, Edward I., "Measuring Corporate Bond Mortality and Performance," *Journal of Finance*, 44, September 1989, pp. 909-922.
- [3] Altman, Edward I., "Current Issues: Junk Bonds — How 1989 Changed the Hierarchy of Fixed Income Security Performance," *Financial Analysts Journal*, 46, 3, May/ June 1990, pp. 9-12, 20.
- [4] Blume, Marshall E., and Donald B. Keim, "Lower-Grade Bonds: Their Risks and Returns," *Financial Analysts Journal*, 43, (July-August 1987), pp. 26-33.
- [5] Blume, Marshall, Donald B. Keim, and Sandeep A. Patel, "Returns and Volatility of Low-Grade Bonds, 1977-1989," *Journal of Finance*, 46, no. 1 (March 1991), pp. 49-74.
- [6] Chang, Eric C., J. M. Pinegar, "Return Seasonality and Tax-Loss Selling in the Market for Long-Term Government and Corporate Bonds," *Journal of Financial Economics*, 17, December 1986, pp. 391-415.
- [7] Connolly, Robert A., "A Posterior Odds Analysis of the Weekend Effect," *Journal of Econometrics*, 49, 1991, pp. 51-104.
- [8] Cooper, Rick A., and Joel M. Shulman, "The Year-End Effect in Junk Bond Prices," *Financial Analysts Journal*, September-October 1994, pp. 61-65.
- [9] Cornell, Bradford, "Liquidity and the Pricing of Low-Grade Bonds," *Financial Analysts Journal*, January-February 1992, pp. 63-67, 74.
- [10] Cornell, Bradford, and Kevin Green, "The Investment Performance of Low-grade Bond Funds," *Journal of Finance*, 46, no. 1 (March, 1991), pp. 29-48.
- [11] Cornish, Geoffrey and Ronald E. Whitten. 1993. *The Architects of Golf: A Survey of Golf Course Design from its Beginnings to the Present*. Harper Collins. Sample Page of "References Cited" p. 72 14
- [12] Doak, Tom. 1999. *The Anatomy of A Golf Course*. Short Hills: Burford Books.
- [13] Dockery, Donny. 2002. Personal Interview. May 25, 2002.

## BIBLIOGRAPHY

- Akaike, H. "A New Look at Statistical Model Identification." *IEEE Transactions on Automatic Control*, AC-19 (6), December 1974, pp. 716-723.
- Atkins, A. B. and E. A. Dyl. "Price Reversals, Bid-Ask Spreads, and Market Efficiency." *Journal of Financial and Quantitative Analysis*, 25, 4, December 1990, pp. 535-547.
- Ball, R. and S. P. Kothari. "Nonstationary Expected Returns: Implications for Tests of Market Efficiency and Serial Correlation in Returns." *Journal of Financial Economics*, 25, 1, November 1989, pp. 51-74.
- Brock, W., W. Dechert, and J. Scheinkman. "A Test for Independence Based on the Correlation Dimension." Working Paper, University of Wisconsin at Madison, University of Houston, and University of Chicago, 1987.
- Brock, W., D. Hsieh, and B. LeBaron. *Nonlinear Dynamics, Chaos, and Instability*. Cambridge, MA.: MIT Press, 1991.
- Brorsen, B. W. and S. R. Yang. "Nonlinear Dynamics and the Distribution of Daily Stock Index Returns." *Journal of Financial Research*, 17, 2, Summer 1994, pp. 187-203.
- Cochran, S. J., R. H. DeFina, and L. O. Mills. "International Evidence on the Predictability of Stock Returns." *Financial Review*, 28, 2, May 1993, pp. 159-180.
- Errunza, V., K. Hogan, Jr., O. Kini, and P. Padmanabhan. "Conditional Heteroskedasticity and Global Stock Return Distributions." *Financial Review*, 29, 3, August 1994, pp. 293-317.
- Frank, M., R. Gensay, and T. Stegnos. "International Chaos?" *European Economic Review*, 32, 1988, pp. 1569-1584.
- Hsieh, D. "Chaos and Nonlinear Dynamics: Application to Financial Markets." *Journal of Finance*, 5, December 1991, pp. 1839-1877.
- Hsieh, D. "Implications of Nonlinear Dynamics for Financial Risk Management." *Journal of Financial and Quantitative Analysis*, 28, 1, March 1993, pp. 41-64

### **6.3.9.2 APA Template**

The References page is pre-formatted. Change the title from “References” if desired. The APA style requires references to be double spaced. Replace the default text with your actual references. If you are required to place references at the end of each chapter, then remove this section (deleting all text and the “Section Break (Next Page)”). Start your reference sections on new pages at the end of each chapter and use the “1<sup>st</sup> level subheading” style for your reference heading. The references still need to be double spaced. The style "Reference entry" is available to assist in formatting reference entries. It will also keep your references from splitting across pages. Examples can be seen on the following pages.

## REFERENCES

- Akaike, H. "A New Look at Statistical Model Identification." *IEEE Transactions on Automatic Control*, AC-19 (6), December 1974, pp. 716-723.
- Atkins, A. B. and E. A. Dyl. "Price Reversals, Bid-Ask Spreads, and Market Efficiency." *Journal of Financial and Quantitative Analysis*, 25, 4, December 1990, pp. 535-547.
- Ball, R. and S. P. Kothari. "Nonstationary Expected Returns: Implications for Tests of Market Efficiency and Serial Correlation in Returns." *Journal of Financial Economics*, 25, 1, November 1989, pp. 51-74.
- Brock, W., W. Dechert, and J. Scheinkman. "A Test for Independence Based on the Correlation Dimension." Working Paper, University of Wisconsin at Madison, University of Houston, and University of Chicago, 1987.
- Brock, W., D. Hsieh, and B. LeBaron. *Nonlinear Dynamics, Chaos, and Instability*. Cambridge, MA.: MIT Press, 1991.
- Brorsen, B. W. and S. R. Yang. "Nonlinear Dynamics and the Distribution of Daily Stock Index Returns." *Journal of Financial Research*, 17, 2, Summer 1994, pp. 187-203.
- Cochran, S. J., R. H. DeFina, and L. O. Mills. "International Evidence on the Predictability of Stock Returns." *Financial Review*, 28, 2, May 1993, pp. 159-180.
- Errunza, V., K. Hogan, Jr., O. Kini, and P. Padmanabhan. "Conditional Heteroskedasticity and Global Stock Return Distributions." *Financial Review*, 29, 3, August 1994, pp. 293-317.

Frank, M., R. Gensay, and T. Stegnos. "International Chaos?" *European Economic Review*, 32, 1988, pp. 1569-1584.

Hsieh, D. "Chaos and Nonlinear Dynamics: Application to Financial Markets." *Journal of Finance*, 5, December 1991, pp. 1839-1877.

Hsieh, D. "Implications of Nonlinear Dynamics for Financial Risk Management." *Journal of Financial and Quantitative Analysis*, 28, 1, March 1993, pp. 41-64

## **6.4 Checking Documents for Accessibility**

Microsoft Word has a built in accessibility checker that assists in determining errors. To run an accessibility check, go to the Review tab of the ribbon and select “Check Accessibility”. A window frame will open to the right of the document that lists out all of the errors and warnings found in the document. Once an error is corrected, it will automatically be removed from the list.

## **6.5 Appendices**

Appendices are for organizing and including supplemental material. Multiple appendices should be used to distinguish between disparate materials. Such materials include, but are not limited to:

- data tables
- correspondence letters
- IRB approval letters
- example surveys used
- sample code

Each appendix must have a divider page preceding its relevant material. This divider page must have the word “APPENDIX” and the letter (“A”, “B”, etc) of the appendix and a title for the appendix. If headings are used in an appendix, then they must be listed in the Table of Contents and formatted as the headings used in the main body. Note: numbered by chapter headings, would be numbered by appendix letter (A.1, A.2, etc.). Also, titled tables and figures must also be listed in the List of Tables and List of Figures, respectively. Sequentially numbered tables/figures continue their numbering in the appendices to represent the order of their

appearance in the document. Tables/Figures that are numbered by chapter would be numbered by appendix letters.

The formatting rules for appendix pages are as follows:

- Appendices are lettered A, B, C, etc. If there is only one appendix, it is Appendix A.
- Every appendix is preceded by a divider page, which has the following text centered vertically and horizontally on the page:
  - The word “APPENDIX”, a space, then the appendix letter
  - one blank line
  - The appendix title, double-spaced, in all caps, with each line smaller than the line above.
- If the appendix is divided into sections, the section headings must match the format of the headings in the body.

See examples on the following pages.



APPENDIX A  
DATA ON HURRICANES BEGINNING IN THE ATLANTIC BASIN AND  
REACHING THE NORTH AMERICAN CONTINENT  
FROM 1928 THROUGH 193

## **6.6 Supplemental Files**

There may be instances where additional material is desired, but not viable for direct inclusion within the main document. Such items could include: large maps, multimedia files, sample programs, etc. In such cases, the author should include such materials as separate files. Each such file should have an appendix entry that either cites the file by name and/or is hyperlinked to the file (assume the file is in the same directory as the document). This appendix should also list any needed software requirements for viewing the associated supplemental file.

However, please be aware that ProQuest (UMI) will only publish one, singular, PDF file. Subsequent files (as outlined above) submitted to ProQuest will not be published.