

**A PROPOSED EMPLOYEES PROVIDENT FUND
EQUIVALENT POST - EMPLOYMENT PENSION
SCHEME**

S.P.P.R. Harischandra

(158854F)

Degree of Master of Science

Department of Mathematics

University of Moratuwa

Sri Lanka

September 2019

**A PROPOSED EMPLOYEES PROVIDENT FUND
EQUIVALENT POST - EMPLOYMENT PENSION
SCHEME**

S.P.P.R. Harischandra

(158854F)

Thesis/Dissertation submitted in partial fulfillment of the requirement for the degree

Master of Science in Financial Mathematics

Department of Mathematics

University of Moratuwa

Sri Lanka

September 2019

DECLARATION PAGE OF THE CANDIDATE & SUPEVISOR

“I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgment any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

Also, I hereby grant the University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or in part in future works (such as articles or books)”

.....

Signature

.....

Date

The above candidate has carried out research for the Master thesis/dissertation under my supervision.

.....

Signature

.....

Date

DEDICATION

I dedicate my dissertation work to my family. A special gratitude to my loving parents whose words encouraged me to be who I am today. I also dedicate my work to my wife who was there for me throughout the entire Master's Program and also friends who have supported me throughout this process by giving support and advices.

ACKNOWLEDGEMENTS

I would like to thank my thesis advisor Mr. Rohana Dissanayake of University of Moratuwa, for his comprehensive guidance on this thesis. He has been very patient, generous and encouraging me. I truly appreciate his dedication of time and efforts, without which this thesis could not be accomplished smoothly.

Further, my special gratitude goes to Mr. T.M.J.A. Cooray who is my course co-coordinator of the program. He was the person who encouraged me in completing this task for the entire period.

ABSTRACT

The labor force in Sri Lanka can be mainly divided into two sub sectors as government sector and private sector. Government sector employees are benefited with a monthly pension income while private sector employees are received a lump-sum retirement benefit which is known as Employees Provident Fund (EPF) payment. However most of the employees like to have a monthly retirement benefit than a lump-sum benefit, thus majority of the private sector employees demand for a pension scheme which is similar to the government sector instead of EPF.

In Sri Lanka five main employment-based pension schemes can be found. The Public Service Pension Scheme (PSPS) is a non-contributory pension scheme which is governed by the Pension department of Sri Lanka. Employees Provident Fund (EPF), Farmers' Pension and Social Security Benefit Scheme (FMPS), Fishermen's Pension and Social Security Benefit Scheme (FSHPS), The Self-employed Persons Pension Scheme (SPPS) are the other main pension schemes and these four schemes are being contributed by the employees and/or employers. Previous studies proved that 18 per cent of the working age population is covered by these schemes, while the effective coverage is estimated to be only 13 per cent.

These statistical measurements depict an upcoming crisis in Sri Lankan workforce within next few decades. This thesis was carried out to address the issue using an actuarial model and design a sustainable pension scheme which can fulfill the requirements in post-employment period of private sector labor force in Sri Lanka. This study has introduced a contributory pension scheme for the private sector labor force in Sri Lanka. The contribution is equivalent to the existing total EPF contribution of employee and employer which is 20 percent of the salary (8% by employee and 12% by employer). The Employees, those who have longer service period or higher salary scales are the most benefited party from the EPF equivalent post-employment pension scheme. The lowest monthly benefit value at the benefit period of an employee is greater than his or her monthly contribution at the contribution period. Annuities and life tables are the basic tools which are used to develop the scheme.

According to the proposed scheme by this study, an employee who can contribute Rs. 17000.00 per month for a period of 21 years will be benefited with a monthly income of Rs. 59640.80 starting from his age of 55 to, until his death or age of 105. It is proved that the EPF equivalent pension scheme is more effective than the government pension scheme which is introduced for the Tri forces staff members in 2019 September, for 64 % of the employees in the considering sample. Employees' monthly benefit of the considering sample is varied between Rs. 3607.81 and Rs.63797.41 depending on the contributing amount and the contributing period. Thus, it is actuarial scientifically proved that EPF equivalent pension scheme for the private sector labour force in Sri Lanka is a realistic project.

Key words: Post- employment benefit, Actuarial, Annuities, Pension scheme

CONTENTS

Declaration of the candidate & supervisor	i
Dedication	ii
Acknowledgement	iii
Abstract	iv
Table of contents	v
List of Figures	viii
List of Tables	ix
List of Abbreviations	x
List of Appendices	xi
Chapter 1-Introduction	
1.1. Introduction	1
1.2. Pension Schemes and Insurance Industry	1
1.3. Life Insurance	2
1.4. Current post-employment Benefit schemes of Sri Lanka	3
1.5. International post-employment benefit schemes	5
1.6. Objectives of the post-employment benefit schemes	5
1.7. Significant of the study	6
1.8. Key stakeholder	6
1.9. Outline of the thesis	7
Chapter 2-Literature Review	
2.1 .Introduction	8
2.2 .Definition and approaches	8
2.3.Does aging affect the economy	9
2.4.Types of pension	9

2.5.Trust in pension	10
2.6.Comparison between defined benefit and defined contribution	11
2.7.Pension plans in other countries	12
 Chapter 3-Methodology	
3.1. Introduction	17
3.2.Annuities	17
3.2.1. Types of annuities	18
3.2.2. Annuities certain	19
3.3. Contributory stage	20
3.4 .Annuity payment for n Years	20
3.5. Compound interest and discount factor	21
3.6. Life tables	23
3.7. Curtate Future –Life time	24
3.8.Benefit payment stage	25
3.9.Life annuities with monthly payments	26
3.10.Monthly retirement benefit	27
 Chapter 4-Analysis	
4.1.Introduction	28
4.2.Data collection	28
4.3.Contributory stage	29
4.4.Benefit payment stage	32
4.4.1.Discount value	32
4.4.2.Expected number of years lived beyond age x (T_x)	32
4.4.3.Net single premium for whole life insurance model	33
4.4.4.Interest rate for monthly benefit payment	35
4.4.5.Nominal rate of discount payable monthly	36
4.4.6.Relationship between net single premium & monthly annuities	36
4.4.7.Actuarial present value of the monthly benefit	37
4.5.Monthly retirement benefit	37

4.6. Comparison of EPF Equivalent post-employment Pension Scheme with a government pension scheme.	39
Chapter 5-Conclusions and Recommendations	
5.1. Conclusion	44
5.2. Recommendation	44
5.3. Future analysis	45
List of Reference	46
Appendix A: Primary data-Age vs. salary scales	49
Appendix B: Contributory Benefit Table	53
Appendix C: Proposed Benefit Payments	59
Appendix D: Proposed EPF Equivalent Post Employment Pension Scheme Vs. Tri forces Non-Contribution Pension Scheme introduced by the Government	61
Appendix E : English Life Table No 15.1990-9	65
Appendix F: The pension circular no 01/2019 amendment III	67
(Pension Department of Sri Lanka, 2019, Annexure 01, Table 01)	

LIST OF FIGURES

	Page
Figure 3.1 Annuities certain	19
Figure 4.1 Benefit pension fund build up from 20% of monthly salary	29
Figure 4.2 Benefit payment stage	32
Figure 4.3 Employee's Monthly Benefit vs. Employee's Monthly Contribution	42
Figure 4.4 Government Pension Monthly Benefit vs. EPF Equivalent Pension Scheme Monthly Benefit	43

LIST OF TABLES

	Page
Table 2.1 – Interesting Parties and Their Interests	10
Table 2.2 –Trust Measuring Methods	11
Table 4.1-Age vs. Salary scales	28
Table 4.2 – Contributory benefit table	30
Table 4.3 – Net single premium for whole life insurance	33
Table 4.4- Proposed benefit payments	37
Table 4.5- Proposed EPF Equivalent Post Employment Pension Scheme vs. Tri forces Non-Contribution Pension Scheme introduced by the Government	40

LIST OF ABBREVIATIONS

Abbreviation	Description
DB	Defined Benefit
DC	Defined Contribution
EPF	Employees Provident Fund
GDP	Gross Domestic Product
RPI	Retail Prices Index
CPI	Consumer Prices Index
S&P 500	Standard & Poor's 500 indexes
ETF	Employees Trust Fund
FMP	Farmers Pension and Social Security Benefit Scheme
FSHPS	Fishermen's Pension and Social Security Benefit Scheme
SPPS	Self- employed Persons Pension Scheme

LIST OF APPENDICES

	Page
Appendix A: Primary data-Age vs. salary scales	49
Appendix B: Contributory Benefit Table	53
Appendix C: Proposed Benefit Payments	59
Appendix D: Proposed EPF Equivalent Post Employment Pension Scheme vs. Tri-forces Non-Contribution Pension Scheme introduced by the Government.	61
Appendix E: English life table No 15.1990-9	65
Appendix F: The pension circular no 01/2019 amendment III (Pension department of Sri Lanka, 2019, Annexure 01, Table 01)	67