Proposed Model of Old-Age System of Sustainable Income Security (OASIS) to the Norganized Labor in India : An Empirical Study

Un-Published Research Article by A. Manjuvani, PhD Research Scholar (Regd. No. 03/PhD/2012)Diploma (French), B.Sc., M.A., L.L.B., LL.M., M. Phil., Ph. D (Scholar), in the Guidance of Professor Amita Danda, PhD, National Academy of Legal Sciences (NALSAR University of Law) Justice City, Shamirpet, Hyderabad, India 500 078.

ABSTRACT

Previous studies tell us that only seven per cent of the total workforce in India is financially secure with a defined or contributory pension (CPS). And, with a low-income economy like India , providing a pension layer of non-contributory nature to the ninety-three per cent of the remaining workforce is a big challenge, although an initiation has been made in this direction in the form of the National Old-Age Pension Scheme (NOAPS) which is at least, catering to some small segments of the society . Therefore, the challenge for the Government of India (GoI) is to locate and integrate social-security schemes in such a manner as to self-provide the income-security for millions of the workforce who will not be in a position in the foreseeable future to secure their old-age through pension or by any other means. The idea is to enroll all the unorganized workers into the CPS model mandatorily in the lines of the National Employment Savings Trust (NEST) of England to include all the informal sector workers under one comprehensive old-age income security scheme. This SocialSecurity Policy Paper of Legal Sciences is a thorough Hypothesis-based Testing and Analysis on the topic that includes innovation of techniques in the contemporary socio-legal research to conceptualize a viable option of CPS to the massive unorganized workers in India. In doing so, I have relied on the standard research observation report of the ADB Project Team of the UK in India. The premise of my research paper is that the MGNREGS in India is providing work to the rural wageseekers throughout the year and especially during the off-season too. The jobcardholders of the MGNREGS are themselves quite sure about their capacity to make contributions through their MGNREGS wage-earnings; so the argument presented by the ADB consultants way back in 2004 for excluding them from Contributory Pension Equations for want of contributory capacity falls short. The objection was allowed at that time and the unorganized labor were not included in the pension calculations by the ADB research team in India in 2004. However, their observation that India in due course of time will reach a position to provide them with one is commendable. Upon the recommandation of their report only, the Government of India intruduced a Contributory Pension Scheme to all the workers of the organized secror. That unfinished job can now be reviewed and overruled in the present scenario, by suitably reading the 'right to work ' with the 'right to life' so that it can be coupled with the 'right to pension'. The interpretation of the kind must help envisage a special right to these marginalised sections in the form of a 'work-place pension' policy. The NEST scheme of the UK is a pioneer in this regard, in providing such pensions to the informal labour which can also form a model replica for the Indian sub-continent. This research paper is a humble attempt to find some answers in seeking "pensions to all" in a country like India with a large unorganized sector. thereby finding an OASIS (Old-Age System of Sustainable Income Security) which may help the poorest of the poor to tide over the vigours of the old age.

Meanings in this paper, unless the context otherwise requires:

1. "Human Subject", according to the federal regulations 45 CFR 46.102 (Protection of Human Subjects 2009), a human subject is a "living individual about whom an investigator (whether professional or student) conducting research obtains (1) Data through intervention or interaction with the individual, or (2) Identifiable private information.
2. " Contribution" means an amount of money payable to the scheme by the principal employer in respect of an employee and also includes any amount payable by or on behalf of the employees as per the provisions of the scheme.

3. " Employer" means in relation to any commercial establishment, the authority which has the ultimate control over the affairs of the establishment, like owner or occupier or where the said affairs are entrusted to a manager, manager directed, or managing agent, such manager, managing director, or agent.
4. " Factory" means any premises including precincts thereof in any part of which a manufacturing process is being carried on or is ordinarily so carried, with or without the aid of power.
5. " Identity card" means a card, document or certificate issued to an unorganized sector worker by the District Administration of a State or an'y competent authority to that effect.
6. The "unorganized labor" includes all informal workers in all kinds of employment.

INTRODUCTION

In 2004, upon the recommendation of the Asian Development Bank (ADB) project under the aegis of the GoI, a contributory pension scheme has been introduced to the organized sector of the workforce in India. The project team was of the opinion that India in due course of time will be able to include the unorganized labor into her pension equations, if properly conceived and implemented. Keeping this observation in mind, I started with the research to evolve a viable model of old-age income-security to the teeming millions of the unorganized labo in India.

Qualitative analysis

I had proposed the following hypothesis to arrive at a generalization on the old-age income security to the unorganized labor in India:

" Generally, the unorganized labor is inclined to contribute towards their old-age income security and it would seem possible that introducing and maintaining a basic layer of noncontributory social pensions represent an affordable option for ensuring inclusive growth" .

The hypothesis poses the following research questions: What should be the broad based social protection arrangement model to reduce vulnerability of the ageing unorganized labor in India? This question can be answered by way of conceptual modeling. How other countries have achieved law reforms to mitigate the constraining factors in extending the old-age pension to the unorganized labor? This necessitates a thorough legal analysis in question. Is the unorganized labor inclined to contribute towards the old-age income security? This question can only be answered by testing the survey-based hypothesis and What possible market and communication policy Interventions can be suggested? A draft bill is to recommended outlining a CPS to the unorganized labor in India. And this paper precisely attempts to find some possible answers to these questions.

Many theories have been put forward in order to explain the aim of the social security schemes. The most relevant to my research seems to be the one proposed by Vienne in 1993 known as the Human Damage Theory. According to him, the primary preventive instrument includes the provision for the availability of work opportunities to guarantee an appropriate income level, the secondary reparative instrument lies in providing healthy living conditions

and the tertiary curative instrument provides for compulsory cash transfers (CCTs) to safeguard their social participation.

I envisaged a viable option of old-age system of income security (OASIS) to the unorganized labor in India. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and (National Old-age Pension. Scheme) NOAPS which form the primary ' preventive' and ' tertiary curative' measures respectively are in place however, the secondary reparative measure of a basic contributory pension scheme for the unorganized labor is not available.

I found through the secondary resources of research that the best fit option of CPS to the unorganized labor in India is that of the pension reform of the United kingdom. My conceptual model, therefore is based upon the National Employment and Savings Trust (NEST) scheme for the informal labor which is being implemented successfully in the United Kingdom since 2013. In sharp contrast, India has evolved since 1995, a successful NOAPS of cash transfers to the people with white ration cards i.e., those living below the poverty line, and in addition to it, MGNREGS has been successfully implemented since 2005 which constitutes although, only one per cent of the Gross Domestic Product (GDP)of the national income. I safely inferred from the earlier studies on the subject that the Indian economy can stand up to three per cent of the GDP towards social assistance schemes as compared to other countries that have reached up to forty per cent of the GDP. This research therefore, proposes to link essentially, these two centrally sponsored schemes in India, in order to introduce a contributory pension scheme (CPS) for the unorganized labor. In doing so, my research hypothesizes that even in a country like India where there is a large number of unorganized labor living below the poverty line, it is possible to introduce a basic non-contributory pension layer by re-arranging the levels of social security initiatives taken by the government into a single umbrella-like system of old-age system of income security (OASIS).

Conceptual modeling : The viable option suggested in this research is to gear up employment schemes (primary preventive measures) such as MGNREGS to protect a basic minimum income to the unorganized labor and to tag it to a contributory pension scheme (as one of the secondary reparative measures) which in turn should be linked with the CCTs (tertiary curative measures)such as the NOAPS. This is necessary for maintaining a basicpension welfare fund for all the unorganized labor in a phased manner. That is, to include workers from different avocations, industries, and employment sectors so as to cover the entire unorganized workforce in India. It should be noted here, that the secondary reparative measures include in addition to CPS, housing, medical and educational facilities that are in progress under various government schemes . Thus, my model proposes to correct this serious imbalance in the social assistance policy thinking in India. In settings with highly informal labor markets like India, it is a sensible adaptation of the basic notion of linking social assistance to positive behavioral policy change as discussed above.

QUANTITATIVE RESEARCH METHOD

Exercise No.1

A) Calculation of the sample size

A <u>Preliminary test</u> for the calculation of the sample size using **Two-Sample T-Tests Assuming Equal Variance[1] was run.**A calculator was used to get the numeric results for Two-Sample T-Test Assuming Equal Variance where**,**Alternative Hypothesis: $\delta \neq 0$

Table 1

Power	Power	N1	N2	Target Actual N	δ	σ	Alpha
0.90 0	0.92949	10	10	20	2.0	1.0	0.010
0.90 0	0.92907	7	7	14	2.0	1.0	0.050
0.90 0	0.90596	32	32	64	2.0	2.0	0.010
0.90 0	0.91250	23	23	46	2.0	2.0	0.050
0.90 0	0.90182	69	69	138	2.0	3.0	0.010
0.90 0	0.90434	49	49	98	2.0	3.0	0.050
0.90 0	0.90083	121	121	242	2.0	4.0	0.010
0.90 0	0.90323	86	86	<u>172</u>	2.0	4.0	0.050
0.90 0	0.90062	188	188	376	2.0	5.0	0.010
0.90 0	0.90148	133	133	266	2.0	5.0	0.050

Definitions

Target Power is the desired power value (or values) entered in the procedure. Power is the probability ofrejecting a false null hypothesis.

Actual Power is the power obtained in this scenario. Because N1 and N2 are discrete, this value is often(slightly) larger than the target power.

N1 and N2 are the number of items sampled from each population.

N is the total sample size, N1 + N2.

δ is the difference between population means at which power and sample size calculations are made.

σ is the assumed population standard deviation for each of the two groups.

Alpha is the probability of rejecting a true null hypothesis.

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[1] PS software to calculate a power sample size downloaded from the Biostatistics software of Vanderwolt University D/ 09–07-2015 06:52:57 PM

Graph 1 Two-Sample T-Tests Assuming Equal Variance

N1 vs σ and Alpha
δ=2.0 Power=0.90 N2=N1 2-Sided T-Test
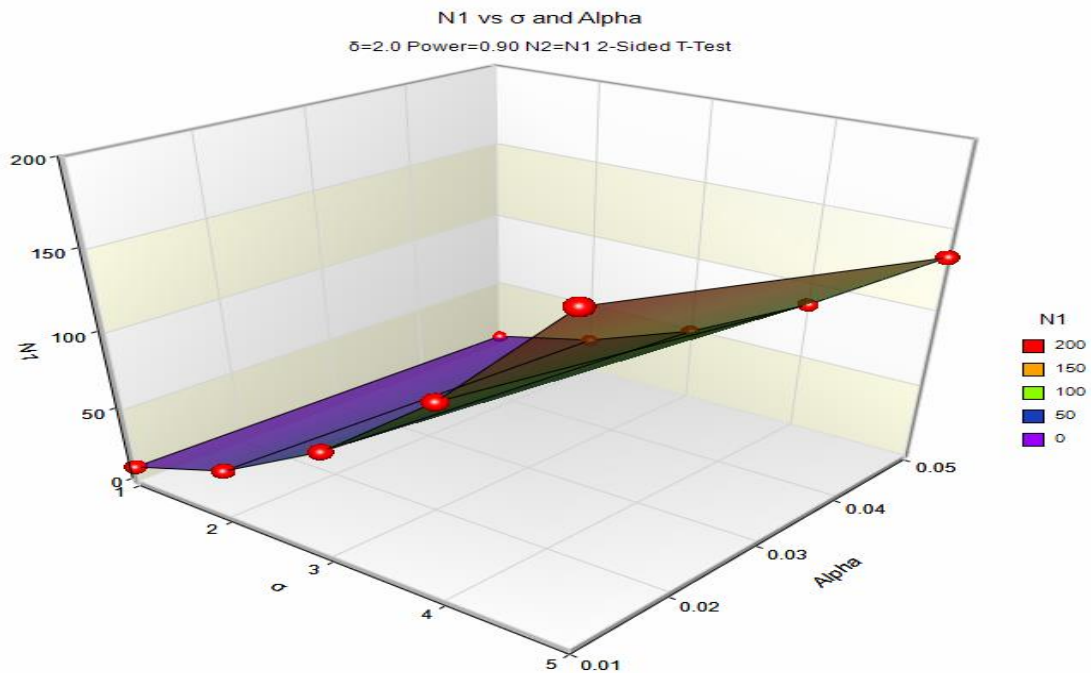
Summary Statement

A sample size of 172 consisting of two equal groups achieves 90.0062% power to reject the null hypothesis of equal means when the population mean difference is 2.0 with a standard deviation for both groups of 4.0 and with a significance level (alpha) of 0.050 using a two-sided two-sample equal-variance t-test.

Graph 2 Two-Sample T-Tests Assuming Equal Variance

N1 vs σ by Alpha
δ=2.0 Power=0.90 N2=N1 2-Sided T-Test
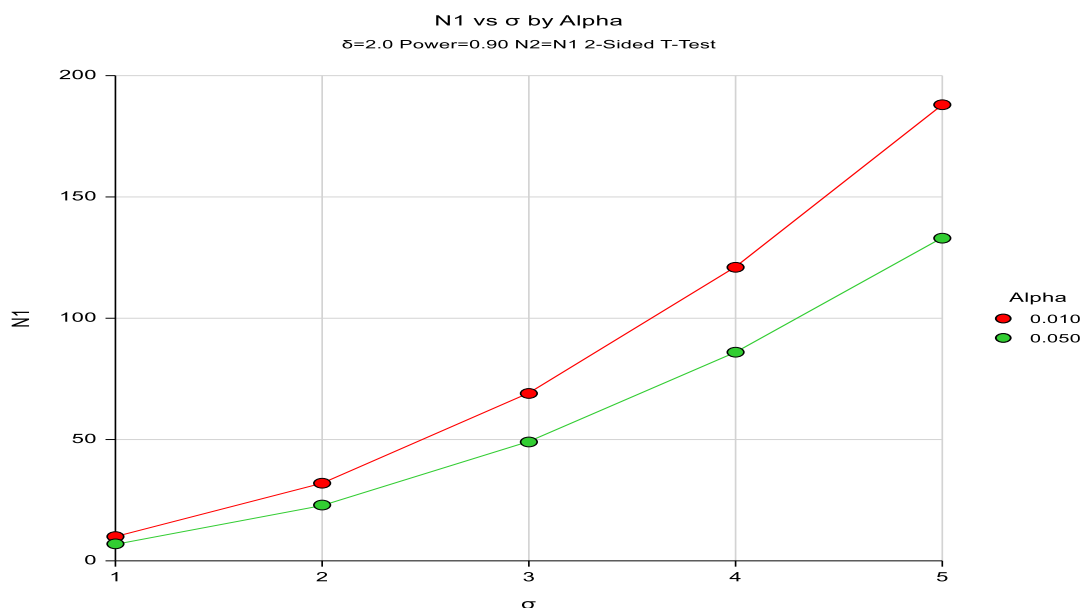
The two curves show the linear relationship between the σ in the X-axis and N (N1 + N2) in the Y-axis.

Result: The maximum sample size that can be taken is 376 (188 +188) at 0.01 statistical significance and lambda of 5. Alternatively, a sample size of 266 (133 +133) at 0.05 alpha and lambda 5 can be taken for the research.

Exercise No. 2

Manualcalculation of the actual sample required by using the following formula:

n = t² p (1-p) f/d², where

n = required sample size,

t = factor to achieve 90% level of significance (square of the z Value),

p = prevalence of the indicator being measured,

d = margin of error to be calculated, and

f = design effect.

Evaluation of Proportion (p): Since the parameters under the study are not readily available at the State level, the value of the proportion 'p' in the formula was taken as 50% (or 0.05) so as to cover all the indicators and to ensure maximum sample size within the permissible margin of error at 90% significant level. The indicators could be the economic indicators such as the proportion of savings in terms of short or long term policies of the respondents.

Estimation of Design Effect (DE): It is a known fact that there is no prescribed sampling estimate readily available at any level for any sub-sector and therefore, simple random sampling (SRS) technique could not be employed. The research work therefore, applied a cluster random sampling design which increased the standard error of the estimate. So following the procedure adopted by the ADB UK Consultants; I calculated the sample size by taking DE as '1.5'and to answer as to why I have chosen this DE; the answer would be that the National Family Health Survey (NFHS) also uses 1.5 as the design effect as to lower the number of stages enduring lesser departure from simple random sampling. The procedure was to directly select the villages in rural and urban areas and picking up of the respondents for the survey.The NFHS and subsequently the UK's ADB project team in India had evolved a DE to measure the increase of the level of standard error. The DE is defined as the ratio of the standard error of the estimate as per the study adopted and that of SRS technique, the sample size being the same. To counter the effect of the standard error, the sample size was increased that many times as given by the value of DE.

Permissible margin of error (d) for this study was assumed to be 0.075, i.e., ±7.5 percentage points.

Value of z score: The z score value corresponding to 90% significant level is 1.645

Therefore, the sample size = (1.645) * 0.5 (1 – 0.5) * 1.5/0.075= <u>180 individual respondents</u>.

Exercise No. 3

Table 2 Pilot Study (Group 1) observations of a sample of 54 respondents:

Gender	CPS
Males	77
Females	23
Total	100

The findings of the pilot sample stated that the unorganized sector workers are actually willing to participate in the Contributory Pension Scheme. 73% of males and 27% of females voted for the CPS resulting in an absolute 100% preference for the CPS; with this positive note, I started off with my study.

Exercise No. 4

Table 3 Statistics of the Pilot study sample

Parameters	Preference
Number of values	2
Minimum	23.00
25% Percentile	23.00
Median	50.00
75% Percentile	77.00
Maximum	77.00
10% Percentile	23.00
90% Percentile	77.00
Mean	50.00
Std. Deviation	38.18
Std. Error of Mean	27.00
Lower 95% CI of mean	-293.1
Upper 95% CI of mean	393.1
95% CI of median	
Actual confidence level	100.0%
Lower confidence limit	23.00
Upper confidence limit	77.00

D'Agostino& Pearson omnibus normality test
K2   N too small
P value
Passed normality test (alpha=0.05)?
P value summary

Shapiro-Wilk normality test
W   N too small
P value
Passed normality test (alpha=0.05)?
P value summary

KS normality test
KS distance   N too small
P value
Passed normality test (alpha=0.05)?
P value summary

One sample t test
Theoretical mean   50.00
Actual mean   50.00
Discrepancy   0.0
95% CI of discrepancy   -343.1 to 343.1
t, df   t=0.0 df=1
P value (two tailed)   1.0000
Significant (alpha=0.05)?   No

Wilcoxon Signed Rank Test
Theoretical median
Actual median
Discrepancy
Sum of signed ranks (W)
Sum of positive ranks
Sum of negative ranks
P value (method of Pratt, two tailed)
Exact or estimate?
Significant (alpha=0.05)?

Coefficient of variation   76.37%

Geometric mean   42.08

Lower 95% CI of geo. Mean	0.01951
Upper 95% CI of geo. Mean	90778

Skewness
Kurtosis

Sum	100.0

Exercise No. 5

Table 4Mean, Variance, and Standard deviation of the Pilot sample

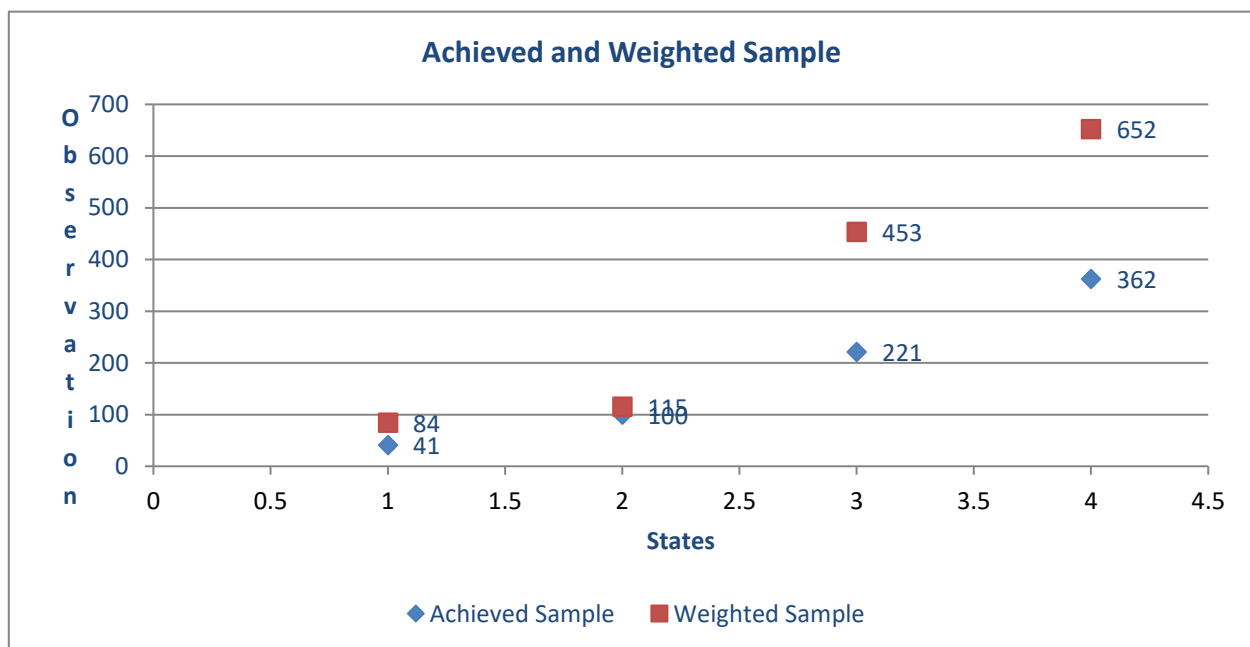| Total Number of respondents	54
Total Numbers	2
Mean (Average)	50
Standard deviation	32.52691
Variance (Standard deviation)	1058
Population Standard deviation	23
Variance (Population Standard deviation)	529

Easycalculation.com/ visited on 21.6.2015

Exercise No. 6

Achieved Sample and Reporting Details

Table 5Achieved and Allocated Sample Sizes to each State

State	Allocated sample	Achieved sample	% Deviation
Andhra Pradesh	180	221	+22.77
Odisha	180	100	-44.00
Telangana	180	41	-77.22
Total	540	362	32.96

Exercise No. 7

Table 6 Weighted Distribution of Achieved Sample

State	Allotted sample size	State Factor	Achieved Sample	Weighted Sample	Percentage over-achieved
Andhra Pradesh	180	2.05	221	221*2.05=453	+151.67%
Odisha	180	1.15	100	100*1.15=115	-36.11%
Telangana	180	2.05	41	41*2.05=84	-53.33%
Total	540	-	362	**652**	**+20.74%**

Graph 3

On X-axis,

  1 represents Telangana State,

  2 the State of Odisha, and

  3 represent Andhra Pradesh.

On Y-axis,

0-700 units represent the number of respondents.

In this research work, 362 respondents are asked to pick their favourite pension savings pattern and their weighted sample is calculated; the two observations viz., achieved and weighted samples are plotted on a

scatter-plot to see the spread of the graph. Each dot represents one observation, and the number of dots in a column represents the number of observations in that column. The distribution is not continuous on the x-axis. In other words, there is no spread of data on the x-axis. The dots represent the achieved and weighted sample of the data collected from the individual States in the present instance. The x-axis represents the States from where the samples have been collected which are displayed numerically as 1, 2, and 3 so on. If we look at the graph for State 1 on the Y-axis, the dots 84 and 41 in the columns represent the weighted and achieved sample for the State 1 i.e., Telangana.If, the State 2 is taken into consideration for analysis, the observed and weighted samples are almost similar as compared to the data collected from other States. That means, all the other given States have a State factor slightly higher than State 2 as a result the weighted samples had shown a huge difference as compared to their achieved samples.

Exercise No. 8

Table 7 Trade-Offs of selecting a power sample size

Test chosen: Sample size for comparing two proportions where, the expected proportion "success" in the control group = 0.5 and Significance level (alpha) = 0.05 (two-tailed) standard. The experimental design applied here is to compare two proportions of the gender and their preferences to the pension saving patterns and the result was to be tabulated in ratios.A statmatecalculator is used for the purpose.

	Power				
N	99%	95%	90%	80%	50%
3	Impossible	Impossible	Impossible	Impossible	Impossible
4	Impossible	Impossible	Impossible	Impossible	1.98
5	Impossible	Impossible	Impossible	Impossible	1.95
6	Impossible	Impossible	Impossible	Impossible	1.91
7	Impossible	Impossible	Impossible	2.00	1.87
8	Impossible	Impossible	Impossible	1.99	1.83
9	Impossible	Impossible	2.00	1.97	1.80
10	Impossible	Impossible	1.99	1.95	1.77
12	Impossible	2.00	1.97	1.91	1.72
14	Impossible	1.98	1.94	1.87	1.67
16	2.00	1.96	1.91	1.84	1.64
18	1.99	1.93	1.88	1.80	1.61
20	1.98	1.91	1.85	1.77	1.58
25	1.94	1.85	1.79	1.71	1.53
30	1.89	1.80	1.74	1.66	1.48
35	1.85	1.76	1.70	1.62	1.45

40	1.82	1.72	1.66	1.59	1.42
50	1.76	1.66	1.60	1.53	1.38
54	1.73	1.64	1.58	1.51	1.37
60	1.71	1.61	1.56	1.49	1.35
70	1.66	1.57	1.52	1.46	1.33
80	1.63	1.54	1.49	1.43	1.30
90	1.60	1.51	1.46	1.41	1.29
100	1.57	1.49	1.44	1.39	1.27
150	1.47	1.40	1.37	1.32	1.22
200	1.42	1.35	1.32	1.28	1.19
300	1.34	1.29	1.26	1.23	1.16
362	1.31	1.26	**1.24**	1.21	1.15
400	1.30	1.25	1.23	1.20	1.14
500	1.27	1.23	1.20	1.18	1.12
1000	1.19	1.16	1.14	1.12	1.09

Summary: A sample size of 362 has a 90% power to detect a relative risk of 1.24 with a significance level (alpha) of 0.05 (two-sided hypothesis).

Exercise No. 9

Table 8 Ratio of the sizes of the sample used in the present research

Group Andhra Pradesh 'A'	Group Odisha 'O'	Group Telangana 'T'	Ratio (5 : 2.5 : 1)	Total	Reason for choosing an unequal sample size
221	100	41	5.4 : 2.5 : 1	362	If the cost of treatment of 'T' is 2.5 times more than 'O' and 5 times more than the treatment of 'A'.

Instead of using 362 subjects, one can use unequal N by substituting any of the following experimental designs, without losing any statistical power. Note that the total sample size increases if one uses unequal N (one must increase N for say, Group 'O' more than one decreases N for group 'T'). This can make sense if treatment 'T' "costs" more (considering expense, hassle and risk) than treatment 'O'. Even though the total sample size goes up, choosing unequal N may reduce the total cost (or risk) of the experiment.

Result: The ratio of the chosen sample comes to 5.4: 2.5: 1 and the total number of respondents are 362 at 95% of confidence interval and at 0.05 level of statistical significance.

Exercise No. 10

Table 9 Repeated Measures Analysis of Variance

A multiple comparison post-test called **Dunnett Test** was carried out to compare all the columns of the tablewith that of the Pilot sample, which was taken here as a control group. Assuming that all the data was collected from a population that followed a Gaussian distribution, we had conducted standard parametric tests. As all the values in each row are matched pairs, so we could perform repeated measures ANOVA.

Gender/ Preference	Pilot sample (Column A)	Contributory Pension Scheme (Column B)	Personal Savings (Column C)	Both (Column D)	Indifferent (Column E)
Male	73	117	20	54	35
Female	27	63	17	40	16
Total	100	180	37	94	51

Table 10 Repeated Measures Analysis of Variance

Col. Title	Pilot sample	CPS	PS	Both	Indifferent
Mean	50	90	18.5	47	25.5
Standard deviation (SD)	32.527	38.184	2.121	9.899	13.43
Sample size (N)	2	2	2.	2	2
Std. error of mean(SEM)	23.002	7.000	1.500	7.000	9.50
Lower 95% conf. limit	-242.24	-253.06	-0.5590	-41.942	-95.207
Upper 95% conf. limit	342.24	433.06	37.559	135.94	146
Minimum	27.000	63.000	17.000	40.000	16.0

Median (50th percentile)   50.000   90.000 18.500 47.000   25.500

| Maximum | 73.000 | 117.00 | 20.000 | 54.000 | 35.000 |

Normality test KSNormality test P value   Too few values

The P value is **0.0475**, considered significant.

Variation among column means is significantly greater than expected by chance.
Dunnett Multiple Comparisons Test
Too few data points. DF must exceed 5.

Intermediate calculations. ANOVA Table:

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatment (between columns)	4	6258.6	1564.7
Individual (between rows)	1	1849.6	1849.6
Random (residual)	4	949.40	237.35
Total	9	9057.6	

$F = 6.592$ =MStreatment/MSresidual

Assumption test: Was the matching effective?
This test uses a second value of F and a different P value.
$F = 7.793$ =(MSindividual/MSresidual)
The P value is 0.0492, considered significant.
Effective matching results in significant variation among themeans. With these data, the matching appears to be effective.

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
Pilot sample	2	50.000	32.527	23.000	50.000
CPS	2	90.000	38.184	27.000	90.000
PS	2	18.500	2.121	1.500	18.500
Both	2	47.000	9.899	7.000	47.000
Indifferent	2	25.500	13.435	9.500	25.500

95% Confidence Interval

Group	Minimum	Maximum	From	To
Pilot sample	27.000	73.000	-242.24	342.24
CPS	63.000	117.00	-253.06	433.06
PS	17.000	20.000	-0.5590	37.559
Both	40.000	54.000	-41.942	135.94
Indifferent	16.000	35.000	-95.207	146.21

Exercise No. 11

Table 11the Two-Way Frequency Table of the Income level and Pension Saving Preferences

Income/ Preferences	Contributory Pension Scheme (CPS)	Personal Savings	Both	Indifferent	Total
Low	100	7	41	28	176
Medium	67	27	48	12	154
High	13	3	5	11	37
Total	180	37	94	51	362

This table shows the frequencies of the two-way frequency table. The sample here contains the responses taken from 362 persons who had voted their preferences towards the retirement plans. The responses have been classified into three groups, viz., the low-, medium-, and high-income classes. Accordingly, the preferences in each of the classes have been categorized into the contributory pension scheme, personal savings, those opting for both and no responses. This table is called a 'frequency table' because entries in it are frequency counts. The entries in the 'total row' and 'total column' are called marginal frequencies or the marginal distribution. Entries in the body of the table are called joint frequencies.

Chi-squared Test for Independence

Chi-square: 35.803
Degrees of Freedom: 6
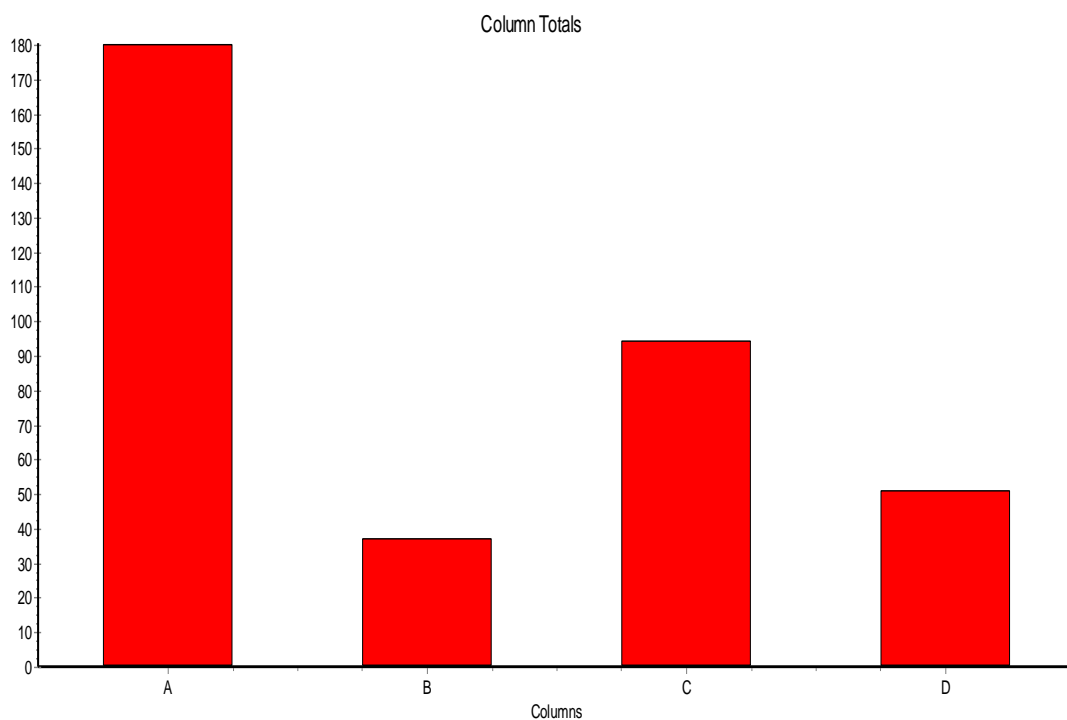
Table size: 3 rows, 4 columns.
The P value is < 0.0001.
The row and column variables are significantly associated.

Summary of Data

Row	Total	Percent
1	176	48.62%
2	154	42.54%
3	32	8.84%
Total	362	100.00%

```
Column        Total      Percent
=============== ========== ========
CPS        180   49.72%
PS        37   10.22%
Both       94   25.97%
Indifferent     51   14.09%
--------------- ----------
Total       362   100.00%
```


Graph 5 Column Total

One-way Analysis of Variance (ANOVA)

The P value is 0.1876, considered not significant.
Variation among column means is not significantly greater than expectedby chance.

Post tests
Post tests were not calculated because the P value was greaterthan 0.05.

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identicalSDs. This assumption is tested using the method of Bartlett.

Bartlett's test can only be performed when every column hasat least five values.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
CPS	Too few values to test.		
PS	Too few values to test.		
Both	Too few values to test.		
Indifferent	Too few values to test.		

Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	3	4148.3	1382.8
Residuals (within columns)	8	5435.3	679.42
Total	11	9583.7	

$F = 2.035$ =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
CPS	3	60.000	43.920	25.357	67.000
PS	3	12.333	12.858	7.424	7.000
Both	3	31.333	23.072	13.321	41.000
Indifferent	3	17.000	9.539	5.508	12.000

95% Confidence Interval

Group	Minimum	Maximum	From	To
CPS	13.000	100.00	-49.113	169.11

PS 3.000 27.000 -19.611 44.277

Both 5.000 48.000 -25.986 88.653

Indifferent 11.000 28.000 -6.699 40.699

* * *

Exercise No. 12

The histogram showing the Frequency Count of the Pension Saving Preferences

Frequency Table 12

Class	Count
37-73	1
73-109	1
109-145	1
145-181	0

The Histogram	
Lowest Score	37
Highest Score	180
Total Number of Scores	4
Number of Distinct Scores	4
Lowest Class Value	0
Highest Class Value	181
Number of Classes	4
Class Range	36

Graph 6

Pension preferences
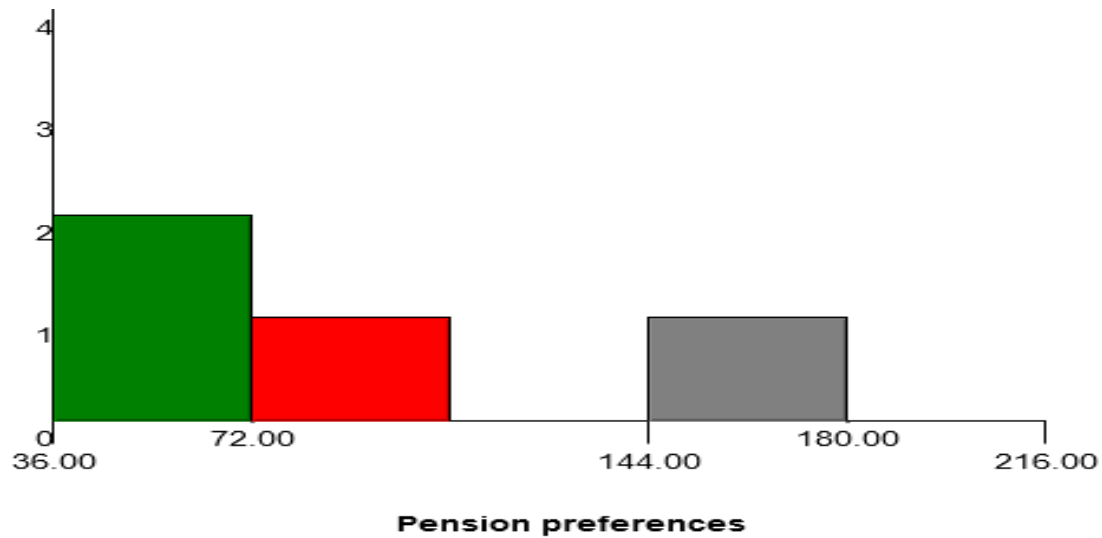
Graph 7 Stem and Leaf Plot

Stems   Leaves

```
10   0
 9
 8
 7
 6   7
 5
 4   18
 3
 2   78
 1   12
 0   357
```

Key 1   2 represents a frequency count of 12

The table may also be analysed graphically with the help of Stem-plots also known as the 'Stem and Leaf Plot'. Although a histogram shows how observations are distributed across groups, it does not show the exact values of individual observations. A different kind of graphical display, called a stem plot or a stem and leaf plot, does show exact values of individual observations. A stem plot is used to display quantitative data, generally from small data sets.

In a stem plot, the entries on the left are called stems; and the entries on the right are called leaves. In the example above, the stems are tens (8 represents 80, 9 represents 90, 10 represents 100, and so on); and the leaves are ones. However, the stems and leaves could be other units - millions, thousands, ones, tenths, etc. Some stem plots include a key to help the user interpret the display correctly. The key in the stem plot given below indicates that a stem of 1 with a leaf of 2 represents a score of 12. Looking at the example above, it is easy to describe the distribution of the frequency counts. Most of the scores are clustered between 3 and 28, with the centre falling in the neighbourhood of 8. The scores range from as low as 3 to as high as 100. The high score of 67 and 100 might be classified as an **outlier**s.

The frequency count 12 in the above table shows the indifference of the medium-income respondents towards the interviewing questionnaire. They either did not respond to the question in particular or did not know what to answer. Therefore, they all have been placed separately in one category called the 'indifferent group'.

There are 12 numbers in the table. The **sum** of which comes to 362. Therefore, the average or **Mean** equals to 30.16667. The **range** is equal to the biggest value minus the smallest value. The biggest value is 100, and the smallest value is 3; so the range is equal to 100 - 3 or 97. Since the data set has an even number of values, the **median** is the average of the middle two values that is 13 and 27. Therefore, the median is (13 + 27)/2 or 20. But we must remember here that the frequency counts do not represent equal proportions taken from each group. The relative frequency distribution for each group has to be calculated before coming to any conclusion. In short, we may say that the distribution is skewed left, bimodal with 3 gaps and one outlier.

Exercise No. 13

Table 13Two-Way Relative Frequency Table of Income level and Preferences

Income/ Preferences	Contributory Personal Savings	Personal Savings	Both	Indifferent	Total
Low-income	0.28	0.02	0.11	0.08	0.49
Medium-income	0.18	0.07	0.13	0.03	0.42
High-income	0.03	0.01	0.01	0.03	0.09
Total	0.50	0.10	0.26	0.14	1.00

The above table is self-explanatory; it shows the preferences for pension savings in the form of relative frequencies. The relative frequencies in the body of the table are called conditional frequencies or the conditional distribution. Following are the two types of tables of relative frequencies across the rows and down the columns. They are the Two-way relative frequency of Rows and Two-way relative frequency of Columns.

Pension preferences vs Income level (contingency table)

Col. title	Total	CPS	PS	Both	Indifferent
Mean	120.67	60	12.33	31.33	17
Standard deviation (SD)	77.571	43.92	12.85	23.07	9.53
Sample size (N)	3	3	3	3	3
Std. error of mean (SEM)	44.786	25.35	7.42	13.32	5.50
Lower 95% conf. limit	-72.04	-49.11	-19.61	-25.98	-6.69
Upper 95% conf. limit	313.38	169.11	44.27	88.65	40.69
Minimum	32.00	13.00	3.00	5.00	11.00
Median (50th percentile)	154.00	67.00	7.00	41.00	12.00
Maximum	176.00	100.00	27.000	48.00	28.00
Normality test KS					
Normality test P value	Too few values				

Kruskal-Wallis Test (Nonparametric ANOVA)

The P value is 0.0766, considered not quite significant.
Variation among column medians is not significantly greater than expected by chance.

The P value is exactly correct (no approximations).

Calculation detail

Group	Number of Points	Sum of Ranks	Mean of Ranks
Total	3	38.00	12.66
CPS	3	31.00	10.33
PS	3	11.00	3.66
Both	3	23.00	7.67
Indifferent	3	17.00	5.67

Kruskal-Wallis Statistic KW = 7.733

Dunn's Multiple Comparisons Test

Mean Rank

Comparison	Difference	P value
Total vs. CPS	2.333 ns	P>0.05
Total vs. PS	9.000 ns	P>0.05
Total vs. Both	5.000 ns	P>0.05
Total vs. Indifferent	7.000 ns	P>0.05
CPS vs. PS	6.667 ns	P>0.05
CPS vs. Both	2.667 ns	P>0.05
CPS vs. Indifferent	4.667 ns	P>0.05
PS vs. Both	-4.000 ns	P>0.05
PS vs. Indifferent	-2.000 ns	P>0.05
Both vs. Indifferent	2.000 ns	P>0.05

Summary of Data

Group	Number of Points	Median	Minimum	Maximum
Total	3	154.00	32.000	176.00
CPS	3	67.000	13.000	100.00
PS	3	7.000	3.000	27.000
Both	3	41.000	5.000	48.000
Indifferent	3	12.000	11.000	28.000

Exercise No. 14

Table 14 Two-Way Relative Frequency Table of Rows

Income/ Preferences	Contributory Pension Scheme	Personal Savings	Both	Indifferent	Total
Low	0.57	0.04	0.23	0.16	1.00
Medium	0.43	0.18	0.31	0.08	1.00
High	0.41	0.09	0.16	0.34	1.00

Each type of relative frequency table makes a distinct contribution to the understanding of relationship between income levels and pension savings activities. For example, "Relative Frequency for Rows" table most clearly shows the probability with which each income group will prefer a certain pension savings activity. For instance, it is easy to see that the probability that a low- income group will prefer CPS is 57%; the probability that the medium- and high-income groups preferring CPS is 43% and 41%; and so on.

Table 15 Two-way Relative Frequency Table of the Columns:

Income/ Preferences	Contributory Pension Scheme	Personal Savings	Both	Indifferent
Low	0.55	0.19	0.44	0.55
Medium	0.38	0.73	0.51	0.24
High	0.07	0.08	0.05	0.21
Total	1.00	1.00	1.00	1.00

If we look at the Relative Frequency for Columns, the table shows that within the CPS group 55% were found to be from the low- income group and 38% voted from the medium- and only 7% were from the high-income group

Exercise No. 15

Table 16 the Parameters shown for each of the Pension Saving Preferences

Parameters/ Preferences	CPS	PS	Both	Indifferent	Total (Population)
Mean	60	12.33	31.33	17	120.66
Median	67	7	41	12	154
Mode	100	7	41	28	176

Exercise No.16

Table 17 Single Sample Z score Calculations

Population Mean (μ):	120.66
Population Variance (σ^2):	4011.55
Sample Mean (M):	60
Sample Size (n):	180

Z Score Calculations:

$$Z = (M - \mu) / \sqrt{(\sigma^2 / n)}$$

$$Z = (60 - 120.66) / \sqrt{(4011.55 / 180)}$$

$$Z = -60.66 / 4.72085$$

$$Z = -12.84939$$

Significance Level:

○ 0.01

○ 0.05

○ 0.10

Is it One-tailed or two-tailed hypothesis?

○ One-tailed

○ Two-tailed

The z score is -12.84939. The p value is 0. The result is statistically significant at $p < 0.05$

P Value from Z Score Calculator

If you need to derive a Z score from raw data,

Z score: | -12.84 |

Significance Level:

○ 0.01

○ 0.05

○ 0.10

Is it One-tailed or two-tailed hypothesis?

○ One-tailed

○ Two-tailed

The P-Value is < 0.00001.

The result is significant at p < 0.05.

Exercise No.17

Simple Variance and Standard Deviation Calculation

Scores (CPS Column)

```
100,67,13

M: 60
```

Deviation (x - M)

```
40
7
-47
```

Squared Dev.

```
1600
49
2209

S: 3858
```
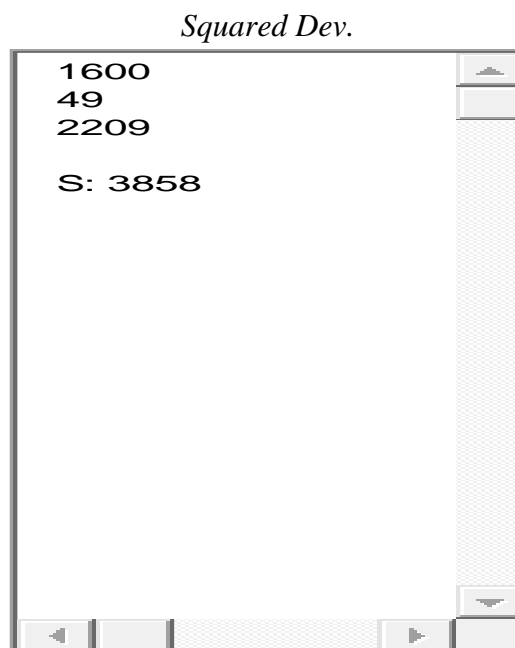
Variance & Standard Deviation Calculations

N: 3
M: 60
SS: 3858
$s^2 = SS/(N - 1) = 3858/(3-1) = 1929$
$s = \sqrt{s^2} = \sqrt{1929} = 43.92$

Population or Sample

○   Population

○   Sample

Variance = 1929.

Standard Deviation = 43.92038.

Accurate - result.

Scores (PS)

```
7,27,3

M: 12.33
```

Deviation (x - M)

```
-5.33
14.67
-9.33
```

Squared Dev.

```
28.44
215.11
87.11

S: 330.67
```
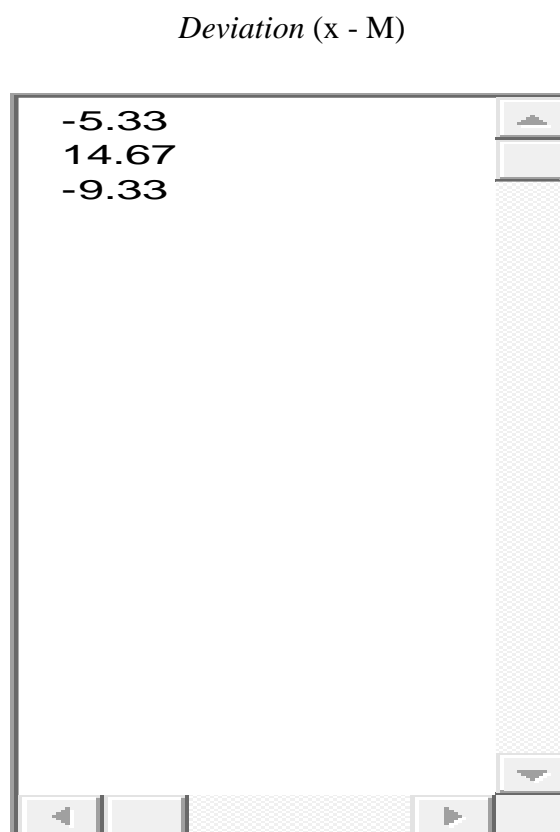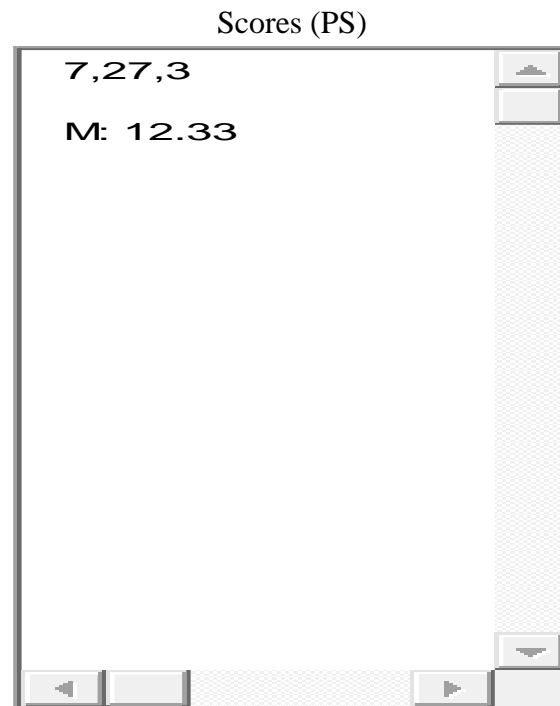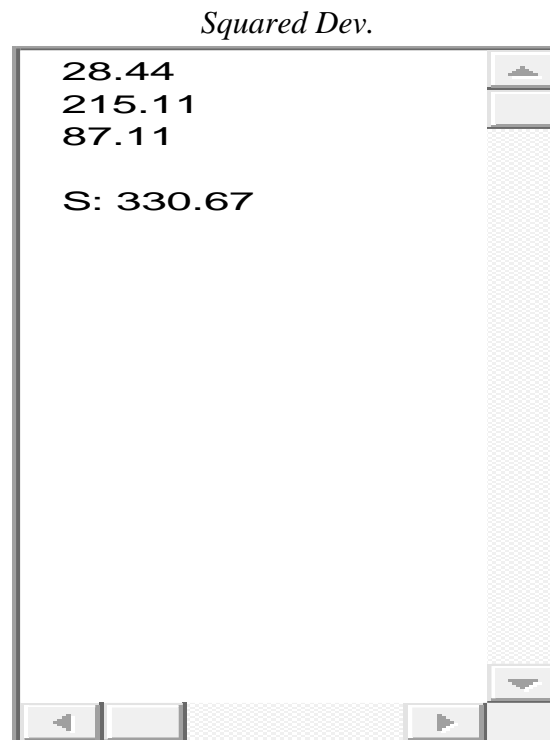
Variance & Standard Deviation Calculations

N: 3
M: 12.33
SS: 330.67
$s^2 = SS/(N - 1) = 330.67/(3-1) = 165.33$
$s = \sqrt{s^2} = \sqrt{165.33} = 12.86$

Population or Sample

◯ Population

◯ Sample

Variance = 165.33333.
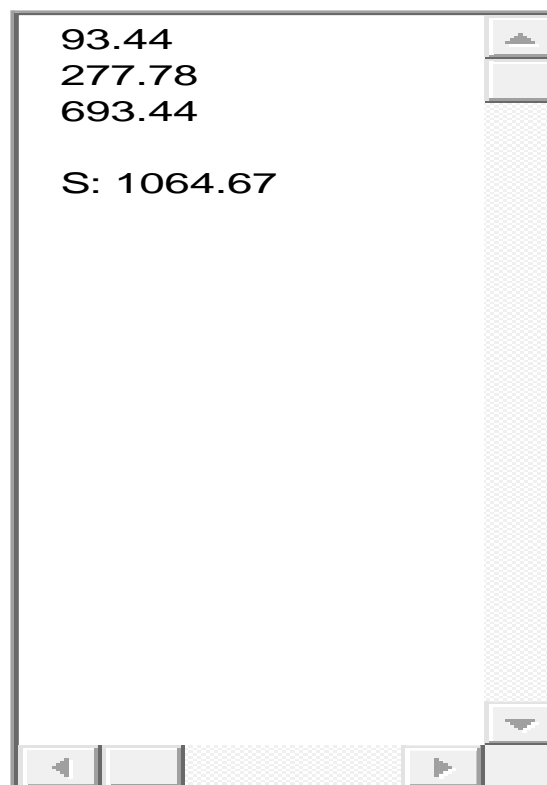
Standard Deviation = 12.85820.

Accurate - result.

Scores (Both)

```
41,48,5

M: 31.33
```

Deviation (x - M)

```
9.67
16.67
-26.33
```

Squared Dev.

```
93.44
277.78
693.44

S: 1064.67
```
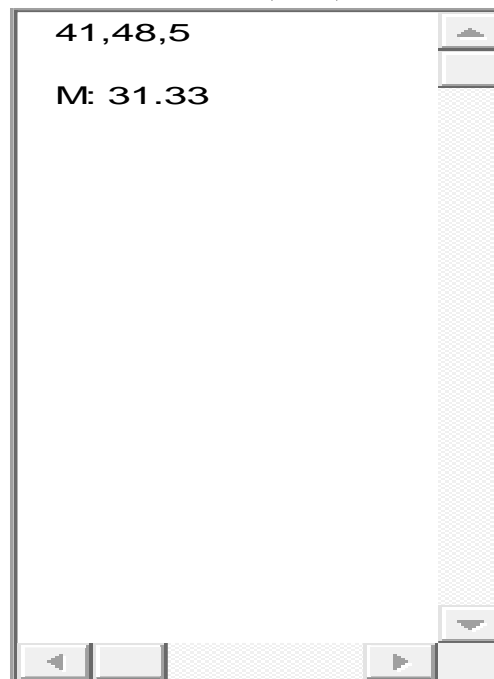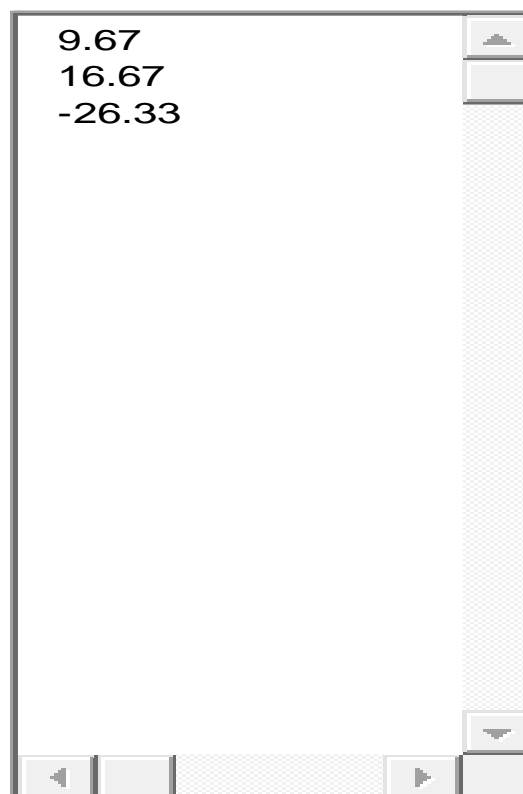
Variance & Standard Deviation Calculations

N: 3
M: 31.33
SS: 1064.67
$s^2 = SS/(N - 1) = 1064.67/(3-1) = 532.33$
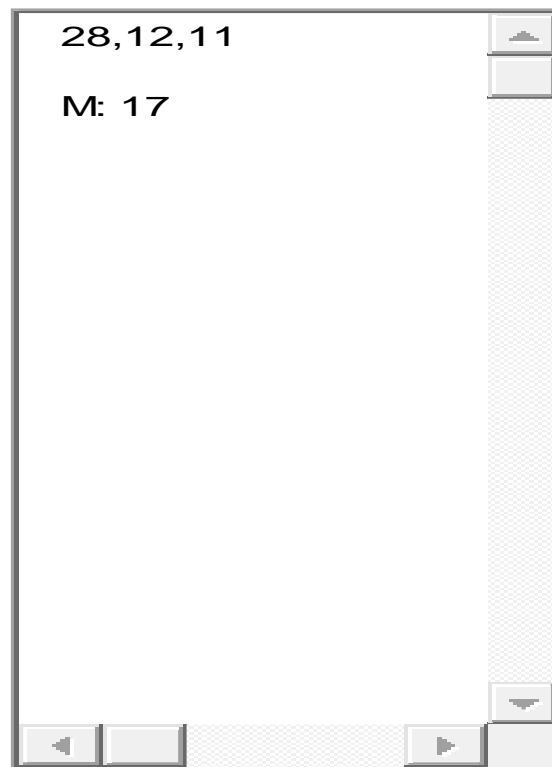$s = \sqrt{s^2} = \sqrt{532.33} = 23.07$

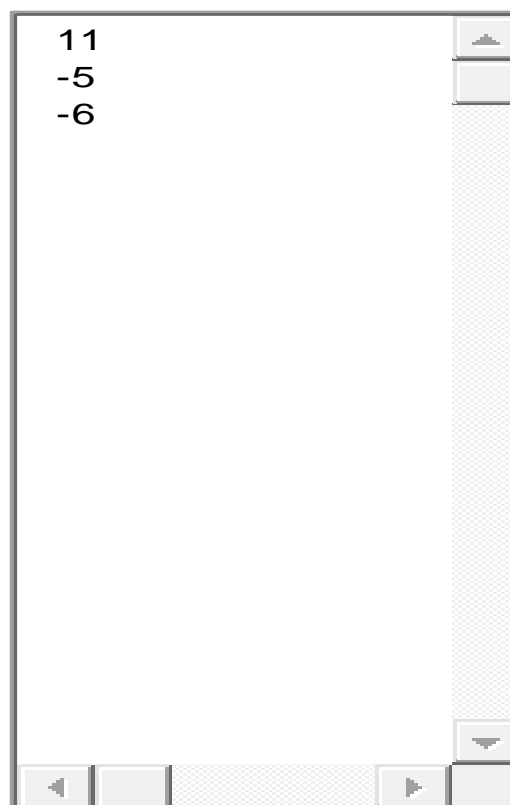*Population or Sample*

○ Population

○ Sample

Variance = 532.33333.

Standard Deviation = 23.07235.

Scores (Indifferent)

28,12,11

M: 17

Deviation (x - M)

11
-5
-6

Squared Dev.

```
121
25
36

S: 182
```

Variance & Standard Deviation Calculations

N: 3
M: 17
SS: 182
$s^2 = SS/(N - 1) = 182/(3-1) = 91$
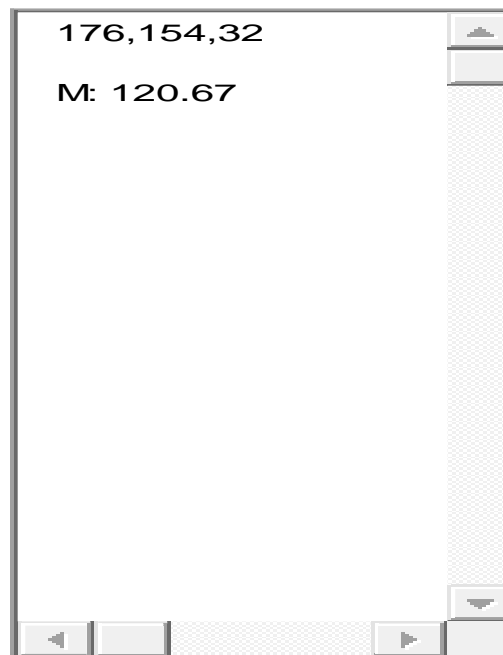$s = \sqrt{s^2} = \sqrt{91} = 9.54$
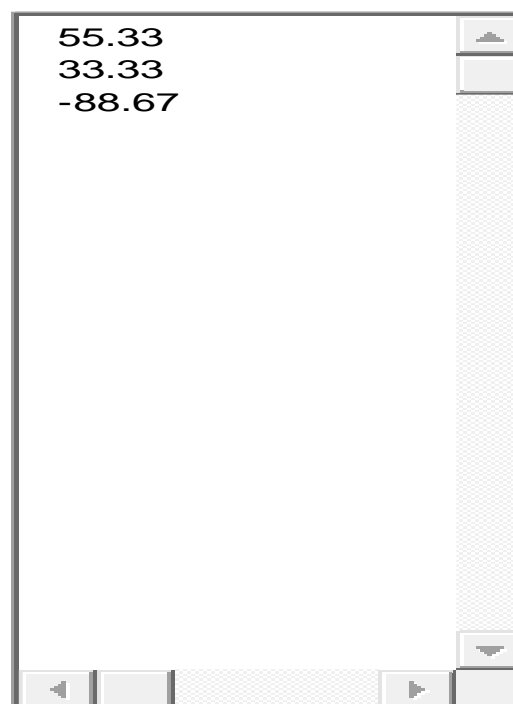
Population or Sample

○ Population
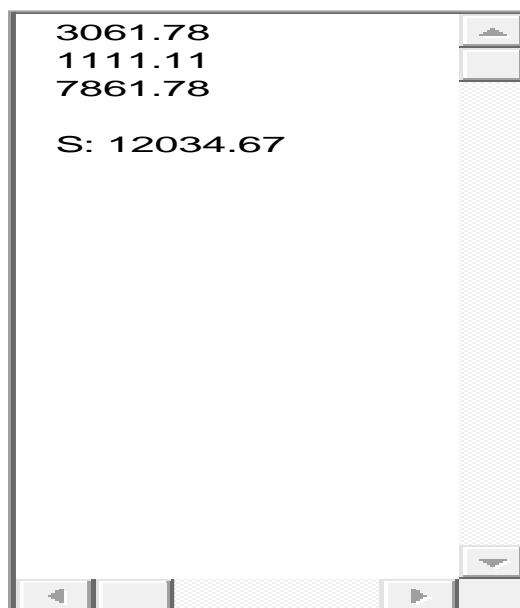
○ Sample

Variance = 91.

Standard Deviation = 9.53939

Scores (Row Totals)

```
176,154,32

M: 120.67
```

Deviation (x - M)

```
55.33
33.33
-88.67
```

Squared Dev.

```
3061.78
1111.11
7861.78

S: 12034.67
```

Variance & Standard Deviation Calculations

N: 3
M: 120.67
SS: 12034.67
$\sigma^2 = SS/N = 12034.67/3 = 4011.56$
$\sigma = \sqrt{\sigma^2} = \sqrt{4011.56} = 63.34$

Population or Sample

○ Population

○ Sample

Variance = 4011.55556.

Standard Deviation = 63.33684.

Exercise No.18

T-Test Calculator for 2 Independent Means

Population/Group 1 (CPS)

100,67,13

Population/Group 2 (PS)

7,27,3

Significance Level:

○ 0.01

◉ 0.05

○ 0.10

Is it One-tailed or two-tailed hypothesis?

Table 18 Analyzed: Ordinary one-way ANOVA of Data 1   Data 1

ANOVA summary	
F	4.765
P value	0.0828
P value summary	ns
Are differences among means statistically significant? (P < 0.05)	No
R square	0.7814
Brown-Forsythe test	
F (DFn, DFd)	+infinity (3, 4)
P value	< 0.0001
P value summary	****
Significantly different standard deviations? (P < 0.05)	Yes
Bartlett's test	
Bartlett's statistic (corrected)	
P value	
P value summary	
Significantly different standard deviations? (P < 0.05)	

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
				F (3, 4) =	P =
Treatment (between columns)	6223	3	2074	4.765	0.0828
Residual (within columns)	1741	4	435.3		
Total	7964	7			

Data summary

Number of treatments (columns)	4
Number of values (total)	8

◯ One-tailed

◉ Two-tailed

The T-value is 1.804066. The P-Value is 0.072774. The result is *not* significant at p < 0.05.

Exercise No.19

Table 18 Gender and their Preferences

Gender/ Preference	Contributory Pension Scheme (Column A)	Personal Savings (Column B)	Both (Column C)	Indifferent (Column D)	Total (Column E)
Male	117	20	54	35	226
Female	63	17	40	16	136
Total	180	37	94	51	362

Table 19 Parameters relating to the Pension Preferences at 95% confidence interval

Gender	CPS			PS			Both			Indifferent			Total		
	Mean	ULL	LLL	Mean	ULL	LLL	Mean	ULL	LLL	Mean	ULL	LLL	Mean	ULL	LLL
Male	0.33	0.38	0.28	0.27	0.39	0.18	0.29	0.36	0.22	0.34	0.44	0.25	0.31	0.32	0.30
Female	0.18	0.22	0.14	0.23	0.34	0.14	0.21	0.28	0.16	0.16	0.24	0.10	0.19	0.22	0.16
Total	0.50	0.56	0.45	0.50	0.62	0.38	0.50	0.57	0.43	0.50	0.60	0.40	0.50	0.54	0.46

Column Statistics

It is very important to understand the column statistics which is given above in a tabulated form where the parameters are shown in fractions. Each value is divided by its column total. Confidence intervals are calculated at 95% and I assumed that the binomial data of each entered value is the actual number of objects or events not normalized in any way.

Exercise No.20

Table 20Chi Square Test of Independence

Results

	CPS to UL	Personal Savings	Both	Indifferent	Row Totals
Low Income	100 (87.51) [1.78]	7 (17.99) [6.71]	41 (45.70) [0.48]	28 (24.80) [0.41]	176
Medium Income	67 (76.57) [1.20]	27 (15.74) [8.05]	48 (39.99) [1.60]	12 (21.70) [4.33]	154
High Income	13 (15.91) [0.53]	3 (3.27) [0.02]	5 (8.31) [1.32]	11 (4.51) [9.35]	32
Column Totals	180	37	94	51	362 (Grand Total)

Null Hypothesis

Ho: Income level and voting preferences are independent.
Ha: Income level and voting preferences are not independent

The chi-square statistic is 35.8029. The P-Value is < 0.00001. The result is very significant at $p < 0.05$.

The chi-square test for independence asks whether there is an association between the variable that defines the rows and the variable that defines the columns.

Table 21 ManualCalculation of X^2 of Independence

n_{ij}	n_{ij}^2	$n_{io} * n_{oj}$	$n_{ij}^2 / n_{io}n_{oj}$
100	10000	180 * 176 = 31680	0.31565657
67	4489	180 * 151 = 27720	0.16194084
13	169	180 * 32 = 5760	0.02934028
7	49	37 * 176 = 6512	0.00752457
27	729	37 * 154 = 5698	0.12793963
3	9	37 * 32 = 1184	0.00760135
41	1681	94 * 176 = 16544	0.10160783
48	2304	94 * 154 = 14476	0.15915999
5	25	94 * 32 = 3008	0.00831117
28	784	51 * 176 = 8976	0.08734403
12	144	51 * 154 = 7854	0.01833461
11	121	51 * 32 = 1632	0.07414216
Total			1.09890303

$$DF = (Ncolumns-1) * (Nrows-1)$$
$$= 4-1 *3-1$$
$$= 3*2$$
$$= 6$$

$$X^2 = \sum \quad n_{ij}^2 / n_{io}n_{oj} - n$$

$$= 362 * 1.09890303 – 362$$

$$= 397.80289686 – 362$$

$$= 35.80289686$$

The Chi-Square Statistic is 35.8029

For 6 degrees of freedom and at 50% significant level, the value of $X^2_{0.050} = 12.592$, and

The rejection region of chi-square for testing of Ho : R, $X^2 \geq 12.592$.

Therefore, the income preferences and the pension saving preferences are not independent.

Exercise No. 21

The Spearman Rank Correlation

Atwo-way frequency (table 6) was used to calculate the Spearman Rank Correlation

Number of points = 9

Spearman r = 0.5798 (corrected for ties)

Test: Is r significantly different than zero?

The two-tailed P value is 0.1080, considered not significant.

The P value may be inaccurate because of ties.

Exercise No. 22

Table 22 Contingency table shows the observed cell totals, the expected cell totals and the chi-square statistic for each cell.
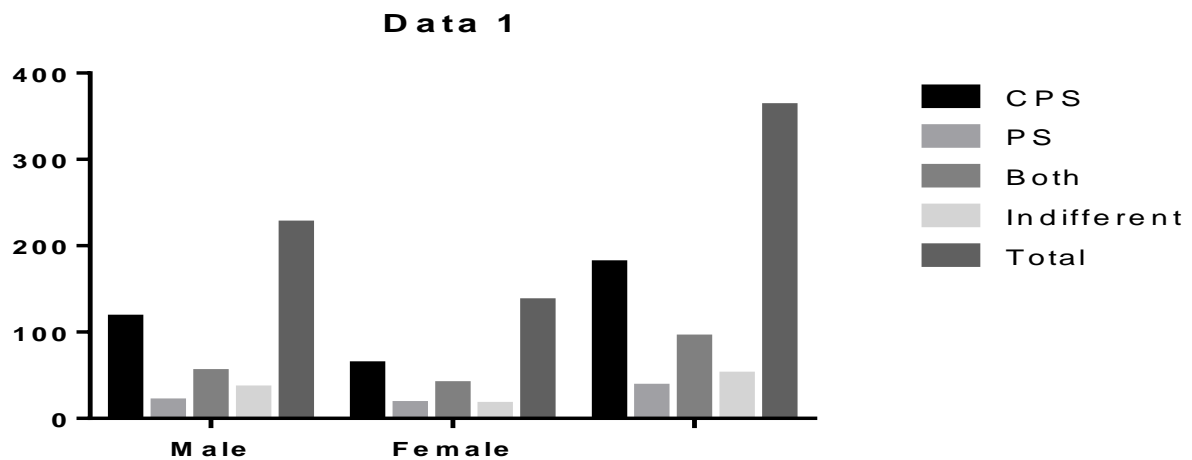
Null Hypothesis

H_0: Gender and voting preferences are independent.
H_a: Gender and voting preferences are not independent

DF = (r - 1) * (c - 1) = (2 - 1) * (4 - 1) = 3

Results

	CPS	PS	Both	Indifferent	*Row Totals*
Male	117 (112.38) [0.19]	20 (23.10) [0.42]	54 (58.69) [0.37]	35 (31.84) [0.31]	226
Female	63 (67.62) [0.32]	17 (13.90) [0.69]	40 (35.31) [0.62]	16 (19.16) [0.52]	136
Column Total	180	37	94	51	**362 (Grand Total)**

Graph 8

The chi-square statistic is 3.444. The P-Value is 0.328103. The result is *not*   significant at p < 0.05

Table 23 Manual Calculation of X^2 of Independence

N_{ij}	n_{ij}^2	$n_{io} * n_{oj}$	$n_{ij}^2/n_{io}n_{oj}$
117	13689	180*226 = 40680	0.33650
63	3969	180*136 = 24480	0.16213
20	400	37*226 = 8362	0.04783
17	239	37*136 = 5032	0.05743
54	2916	94*226 = 21244	0.13726
40	1600	94*136 = 12784	0.12515
35	1225	51*226 = 11526	0.10628
16	256	51*136 =6936	0.03690
			$\sum = 1.00948$

$$X^2 = n \sum n_{ij}^2/ n_{io}n_{oj} - n$$

$$X^2 = 362 \sum 1.00948 - 362$$

$$= 365.43176 - 362$$

$$= 3.43176$$

DF= 3

$X^2_{0.050}$ at 3DF = 7.815

P Value = 0.328103

The chi-square statistic is 3.444. The P-Value is 0.328103. The result is *not* significant at p < 0.05

Therefore, we accept the null hypothesis and conclude that the gender and their preferences are independent of each other.

Exercise No. 23

Table 24 Row Statistics of the Gender and their Preferences

Gender/Preferences	Mean	SD	SEM	N
Male	90.400	84.32852	37.713	5
Female	54.400	49.5308	22.151	5
Total	144.800	133.6177	59.456	5

Exercise No. 24

Table 25showing the same data relating to the pension preferences and the gender using the Fisher's Exact Test

Gender	Pension Savings	Indifferent	Total
Male	85 (43%)	15 (8%)	100 (50%)
Female	88 (43%)	12 (6%)	100 (50%)
Total	173 (87%)	27 (14%)	200 (100%)

The Data analysed

The two-sided P value is 0.6796, considered not significant. The row/column association is not statistically significant.

Relative risk = 0.9659

95% Confidence Interval: 0.8656 to 1.078 (using the approximation of Katz.)

Difference between the two proportions

Top row (male): Fraction in the left column: 0.8500

95% Confidence Interval of that fraction: 0.7645 to 0.9134

Bottom row (female): Fraction in the left column: 0.8800

95% Confidence Interval of that fraction: 0.8001 to 0.9365

Difference

Difference between the fractions: 0.03000

Standard error of the difference: 0.04833

95% Confidence level of difference = -0.06474 to 0.1247

Fisher's Exact test using Yate's Continuity with two-sided P- value, also to calculate odds-ratio i.e., to analyse retrospective case-control studies.

The two-sided P value is 0.6796, considered not significant.

The row/column association is not statistically significant.

Odds Ratio

Odds ratio= 0.7727

95% Confidence Interval: 0.3418 to 1.747 (using the approximation of Woolf.)

Standard error of the difference: 0.04833

95% confidence interval of difference: -0.06474 to 0.1247

The two-sided P value is 0.6796, considered not significant.

The row/column association is not statistically significant.
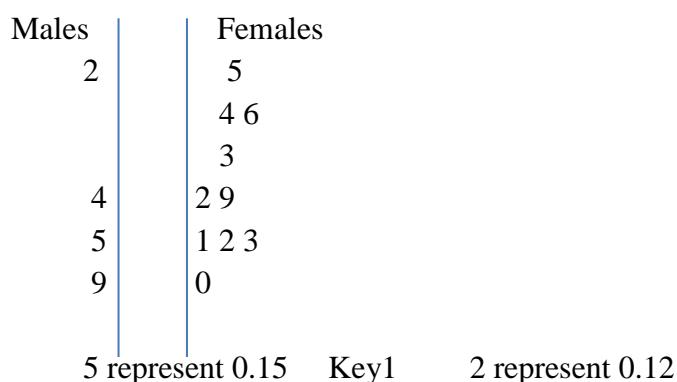
Sensitivity and specificity

Variable	Value	95% Confidence Interval
Sensitivity	0.4913	0.4148 to 0.5684
Specificity	0.4444	0.2550 to 0.6468
Positive Predictive Value	0.8500	0.7645 to 0.9134
Negative Predictive Value	0.1200	0.06351 to 0.1999
Likelihood Ratio	0.8844	

Exercise No. 25

Table 26 Two-way relative frequency table of rows shows the data collected consisting of 362 individuals displayed in proportions:

Gender/ Preference	Contributory Pension Scheme	Personal Savings	Both	Indifferent	Total
Male	0.52	0.09	0.24	0.15	1.00
Female	0.46	0.13	0.29	0.12	1.00

Graph 9Back-to-Back Stem-plots

```
  Males   │ │   Females
     2    │ │    5
          │ │    4 6
          │ │    3
     4    │ │2 9
     5    │ │1 2 3
     9    │ │0


  5 represent 0.15    Key1      2 represent 0.12
```

The back-to-back stem-plot and the area chart show the pension savings pattern of a random sample of males and females. The females gave more weightage to responses than the males - a median of 0.21 for the females versus 0.195 of the males. The mean for the above data was found to be 0.25 for both the groups and the mode for the males is 0.52 and for the females is 0.46. The range for the group of males is 0.37 as

compared to the females of 0.34 which is given in proportions. Both distributions were roughly equal-shaped, although there was more variation among the males. And finally, if we see the stem-plot, there were few gaps and outliers in either group.

**Graph 10 Area Chart of the data contained in Table 19**
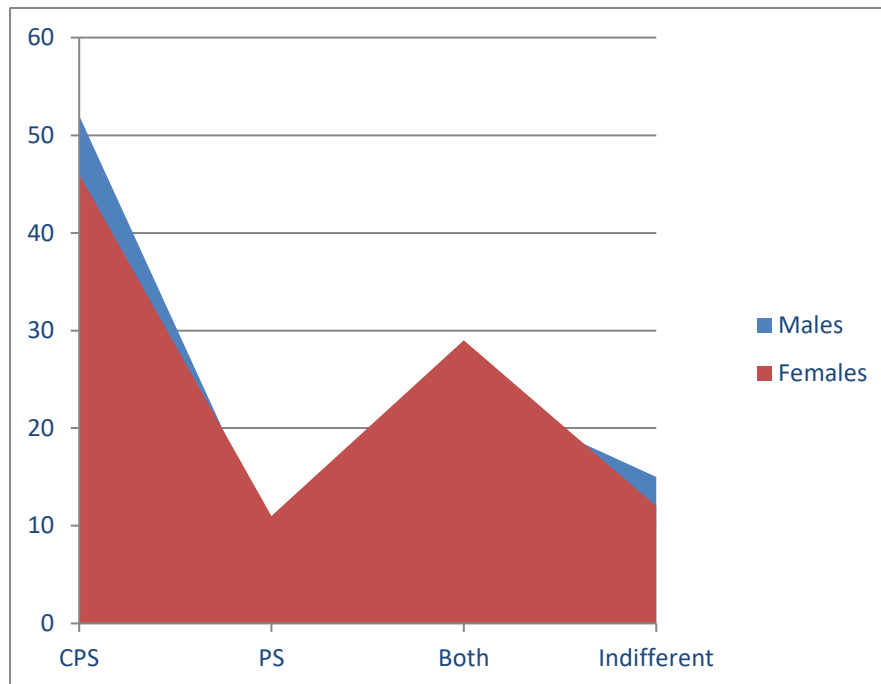
If we look at the sample, 52% of the males had voted for the CPS as against 46% of the females. That means 49% of the total sample preferred the CPS which is nothing but the mean (average) of the two groups preferring it. That is, the % males opting the CPS plus the females preferring it divided by the number of groups in the total sample; which comes to 52 + 46 / 2 = 49%. We can infer safely from the above observation that 49% had straightaway given their preference for a CPS to the unorganized sector workers.

Exercise No. 26

Table 27 Two-way relative frequency table of columns represented in proportions:

Gender/ Preference	Contributory Pension Scheme	Personal Savings	Both	Indifferent
Male	0.65	0.54	0.57	0.69
Female	0.35	0.46	0.43	0.31
Total	1.00	1.00	1.00	1.00

Graph 12Dot-plot 10*10 for CPS column

T o t a l = 1 8 0
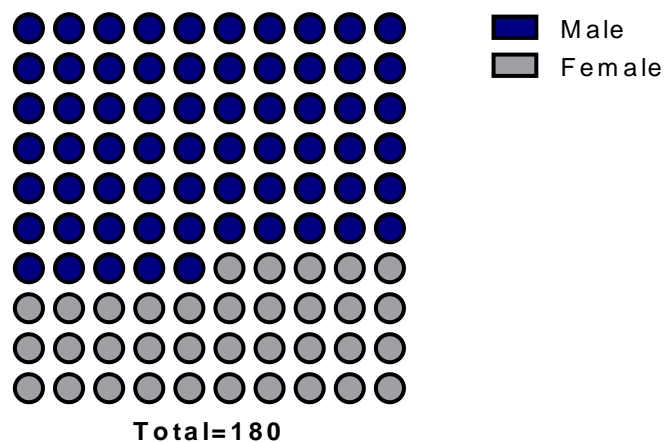
Exercise No. 27

Table 28 Pension Savings Preferences of the Total Sample

Preferences/	CPS	PS	Both	No Response
Total 362	180	37	94	51

Let us calculate the variance of a sample consisting of four observations: {180, 37, 94 and 51}. First, we need to compute the sample mean.

$$\mu = (180 + 37 + 94 + 51) / 4 = \mathbf{90.5}$$

Then we plug all of the known values into formula for the variance of a population, as shown below:

$$s^2 = \Sigma (x_i - x)^2 / (n - 1)$$

$\sigma^2 = \Sigma(X_i-\mu)^2/n-1$
$\sigma^2 = [(180 - 90.5)^2 + (37 - 90.5)^2 + (94 - 90.5)^2 + (51 - 90.5)^2] / 4-1$
$\sigma^2 = [(89.5)^2 + (-53.5)^2 + (3.5)^2 + (-39.5)^2] / 4-1$
$\sigma^2 = 12445/3 = \mathbf{4148.33}$

Based on the same sample observations, Icalculated the best estimate of the standard deviation of the population. The sample mean, which we have already computed earlier, is 90.5, and we plug all of the known values into formula for the standard deviation of a sample, as shown below:

$S = sqrt[\Sigma(x_i-x)^2/(n-1)]$
$s = sqrt \{[(180 - 90.5)^2 + (37 - 90.5)^2 + (94 - 90.5)^2 + (51 - 90.5)^2] / 4-1 \}$

s =   {[sqrt   {$(89.5)^2$ + $(-53.5)^2$ + $(3.5)^2$ + $(-39.5)^2$]   /   4-1}

s = sqrt { 12445/3} = sqrt (4148.33) = 64.40753 = **64.41**

Exercise No. 28

Table 29 of Trade-Offs shows the difference between group mean and hypothetical   mean where N = 362, 90% confidence interval and 0.05 significance level

Test chosen: Sample size for one-sample t test

Expected SD = **64.40756**

Significance level (alpha) = 0.05 (two-tailed)

		Power			
N	**99%**	**95%**	**90%**	**80%**	**50%**
3	202.78	170.54	153.35	132.54	92.72
4	163.09	137.16	123.34	106.60	74.57
5	140.27	117.97	106.08	91.68	64.14
6	124.98	105.11	94.51	81.69	57.15
7	113.81	95.72	86.07	74.39	52.04
8	105.20	88.47	79.56	68.76	48.10
9	98.29	82.66	74.33	64.24	44.94
10	92.58	77.86	70.02	60.51	42.33
12	83.64	70.34	63.25	54.67	38.25
14	76.87	64.65	58.14	50.25	35.15
16	71.52	60.15	54.09	46.75	32.70
18	67.15	56.48	50.79	43.89	30.71
20	63.50	53.40	48.02	41.50	29.04
25	56.47	47.49	42.70	36.91	25.82
30	51.35	43.19	38.83	33.56	23.48
35	47.41	39.87	35.86	30.99	21.68
40	44.26	37.22	33.47	28.93	20.24
50	39.48	33.20	29.85	25.80	18.05
60	35.97	30.25	27.20	23.51	16.45
70	33.26	27.97	25.15	21.74	15.21
80	31.08	26.14	23.50	20.31	14.21
90	29.28	24.62	22.14	19.14	13.39

100	27.76	23.35	20.99	18.14	12.69
150	22.62	19.03	17.11	14.79	10.34
180	20.64	17.36	15.61	13.49	9.44
200	19.57	16.46	14.80	12.79	8.95
300	15.97	13.43	12.08	10.44	7.30
362	14.53	12.22	**10.99**	9.50	6.64
400	13.82	11.62	10.45	9.03	6.32
500	12.36	10.39	9.35	8.08	5.65
1000	8.73	7.35	6.61	5.71	3.99

Summary: A sample size of 362 has a 90% power to detect a difference between group mean and hypothetical mean of 10.99 with a significance level (alpha) of 0.05 (two-tailed).

Graph 13
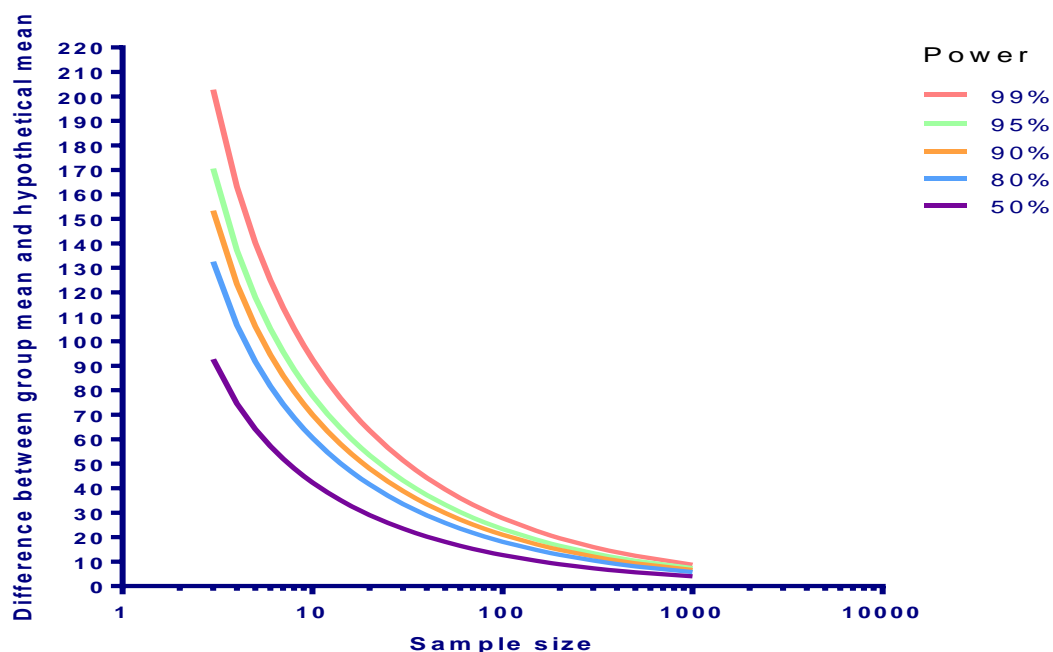
Alternative explanation using confidence intervals: (Instat and Statmate based calculations)

If many experiments with N = 362 are performed, then 90% of these experiments (the power), the width of the 95% confidence interval for the difference between group mean and hypothetical mean will extend 10.99 or less in each direction. In the remaining 10% of the experiments, the 95% confidence interval will be found to be wider than that.

Exercise No. 29

Position of a value

Statisticians, often talk about the **position** of a value**,** relative to other values in a set of observations**.** The most common measures of position are percentiles, quartiles, and standard scores (aka, z-scores).

The Range

The **range** is the difference between the largest and smallest values in a set of values. For example, consider the following numbers: 180, 94, 51, and 37. For this set of numbers of our collected data of different income groups vis- a-vis their preferences, the range would be 180 – 37 = 143. In other words, thewidest range of pension preferences of all the unorganized sector workers indelineated groups of income level is **143**.

The Interquartile Range (IQR)

The **interquartile range** (IQR) is a measure of variability, based on dividing a data set into quartilesTheinterquartile range is also defined as the difference between the largest and smallest values in the middle 50% of a set of data. To compute an interquartile range using this definition, we first remove observations from the lower quartile. Then, we remove observations from the upper quartile. Then, from the remaining observations, we compute the difference between the largest and smallest values. For example, consider the following numbers: 180, 94, 51 and 37 which represent the total of the pension saving preferences of each group, after we remove observations from the lower and upper quartiles, we are left with: 94 and 51. So, the interquartile range (IQR) would be 94-51 **= 43.** We can market our CPS pension model to this range of the population who would be the ready takers of the proposed scheme.

Percentiles

Assume that the elements in a data set are rank ordered from the smallest to the largest. The values that divide a rank-ordered set of elements into 100 equal parts are called **percentiles**.

An element having a percentile rank of P_i would have a greater value than i percent of all the elements in the set. Thus, the observation at the 50th percentile would be denoted P_{50}, and it would be greater than 50 percent of the observations in the set. An observation at the 50th percentile would correspond to the median value in the set.

Quartiles

Quartiles divide a rank-ordered data set into four equal parts. The values that divide each part are called the first, second, and third quartiles; and they are denoted by Q_1, Q_2, and Q_3, respectively.

Note the relationship between quartiles and percentiles. Q_1 corresponds to P_{25}, Q_2 corresponds to P_{50}, Q_3 corresponds to P_{75}. Q_2 is the median value in the set.

Exercise No. 30

Standard Scores (z-Scores) for the CPS sample

A **standard score** (aka, a **z-score**) indicates how many standard deviations an element is from the mean. A standard score can be calculated from the following formula.

$z = (X - \mu) / \sigma$

Where z is the z-score, X is the value of the element, μ is the mean of the population, and σ is the standard deviation.

Suppose, the value of the element is 180 (which is in the instance; the preference given by the males and females of the sample voting for the CPS), 90.5 is the mean of the sample, and 64.41 is the standard deviation of that sample; then the Z-score (Standard Score) may be calculated as follows:

Z= (180 – 90.5)/ 64.41

 = 89.5/64.41

 = 1.3895

 = **1.4**

Here is how to interpret z-scores[2]:

So, the Z score equal to 1.4 represents an element, in this data (frequency count of CPS); that is 1.4 standard deviations greater than the mean of the sample. The standard score therefore, for the CPS is1.4; suggesting the possibility of including the unorganized sector workers 1.4 times morethan what can be envisaged into the ambit of the pension equations and thereby, giving a meaning to the ADB project that had suggested that India will be in a position to take up this ordeal in near future.
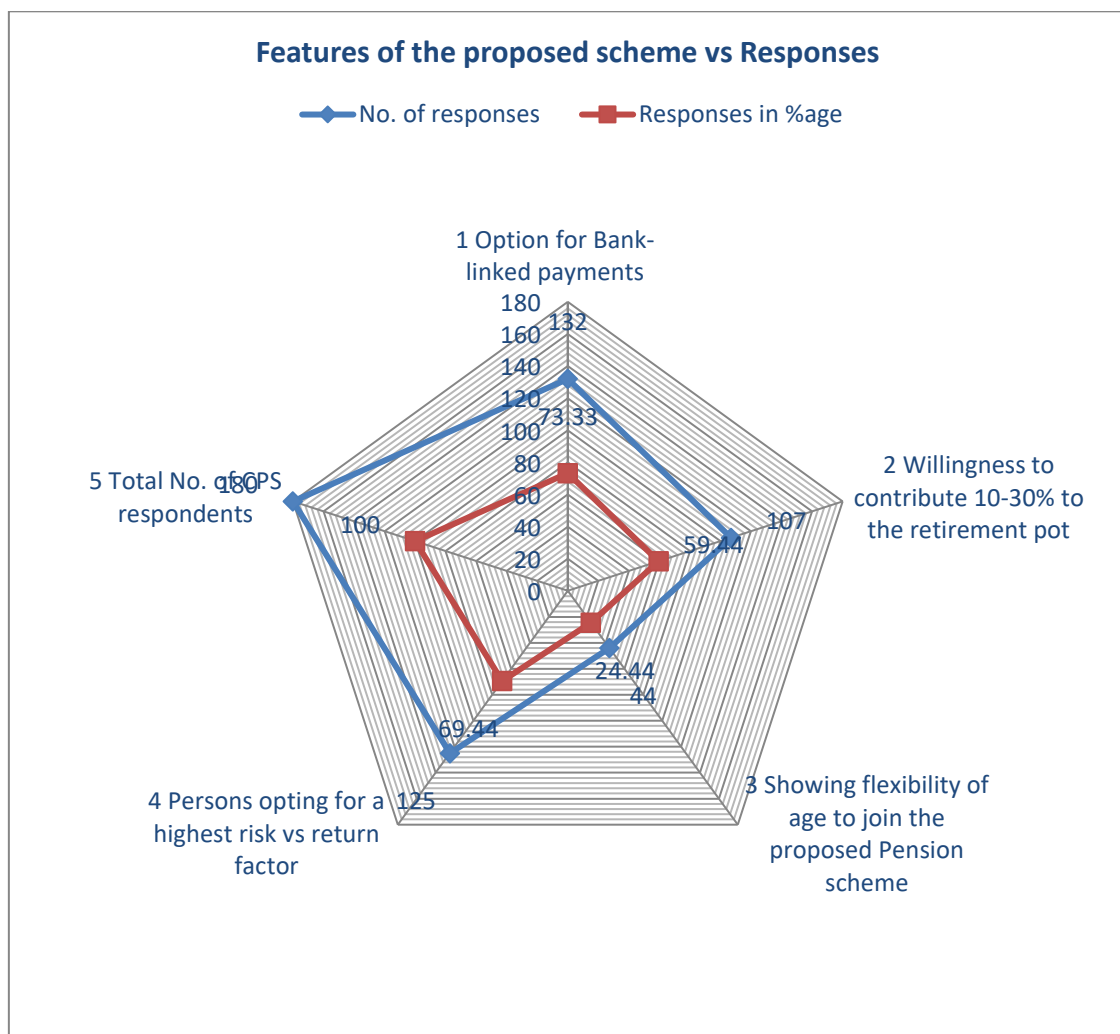
Exercise No. 31

Table 30The responses from the CPS group in relation to the following aspects are worth noting:

S.No.	Categories	No. of responses	Responses in

---

[2]A score less than 0 represent an element less than the mean and a z-score greater than '0' represent an element greater than the mean. A z-score equal to 0 represents an element equal to the mean. A z-score equal to 1 represents an element that is 1 standard deviation greater than the mean; a z-score equal to 2, 2 standard deviations greater than the mean; etc. A z-score equal to -1 represents an element that is 1 standard deviation less than the mean; a z-score equal to –2, 2 standard deviations less than the mean; etc.

			%age
1	Option for Bank-linked payments	132	73.33
2	Willingness to contribute 10-30% to the retirement pot	107	59.44
3	Showing flexibility of age to join the proposed Pension scheme	44	24.44
4	Persons opting for a highest risk vs return factor	125	69.44
	Total No. of CPS respondents	180	100.00

Features of the proposed scheme vs Responses

Exercise No. 32

Table 31 shows the Income Level and Pension Savings Preferences

Income groups	CPS	PS
Low	100	7
Medium	67	27
High	13	3

Column statistics of CPS:

Mean (Average): 60

Standard deviation: 43.92038

Variance (Standard deviation)

1929

Population Standard deviation

35.86084

Variance (Population Standard deviation)

1286

Column statistics of PS

Mean (Average)

12.33333

Standard deviation

12.8582

Variance (Standard deviation)

165.33333

Population Standard deviation

10.49868

Variance (Population Standard deviation)

110.22222

The average of both the SDs is 43.9238 + 12.8582/2 =28.391

<u>**Exercise No. 33**</u>

Table 32Pearson 'r' factor

A correlation coefficient was calculated to find the variability between two matched pairs of a given sample. Following is the result given in a table form below:
Pearson r factor is 0.2904 at 0.05 significance level and 95% confidence level.

Null Hypothesis:

N_o = The CPS and PS are independent of each other.
N_a = The CPS and PS are not independent of each other.

Statistics	CPS vs. PS
Pearson r	
R	0.2904
95% confidence interval	
R squared	0.08433
P value	
P (two-tailed)	0.8124
P value summary	Ns
Significant? (alpha = 0.05)	No

Number of XY Pairs

3

X Y D a t a : C o r r e l a t i o n o f D a t a 1
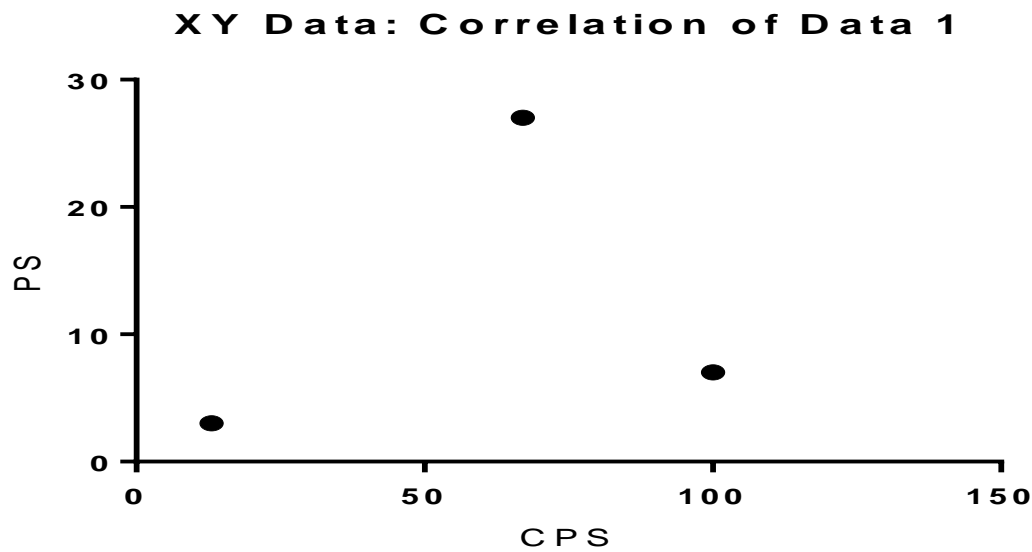
Graph 14

Exercise No. 34

Table 33 Friedman's test

Friedman's test is a nonparametric test that compares three or more paired groups. In the instant case, the gender and their pension saving patterns have been subjected to a One-way ANOVA test.

Table Analysed	Data 1
Friedman test	
P value	0.0009
Exact or approximate P value?	Exact
P value summary	***
Are means significantly different? (P < 0.05)	Yes
Number of groups	5
Friedman statistic	11.47
Data summary	
Number of treatments (columns)	5
Number of subjects (rows)	3

Number of families	1				
Number of comparisons per family	10				
Alpha	0.05				

Dunn's multiple comparisons test	Rank sum diff.	Significant?	Summary		
CPS vs. PS	8.000	No	ns		A-B
CPS vs. Both	3.000	No	ns		A-C
CPS vs. Indifferent	7.000	No	ns		A-D
CPS vs. Total	-3.000	No	ns		A-E
PS vs. Both	-5.000	No	ns		B-C
PS vs. Indifferent	-1.000	No	ns		B-D
PS vs. Total	-11.00	Yes	*		B-E
Both vs. Indifferent	4.000	No	ns		C-D
Both vs. Total	-6.000	No	ns		C-E
Indifferent vs. Total	-10.00	No	ns		D-E

Test details	Rank sum 1	Rank sum 2	Rank sum diff.	n1	n2
CPS vs. PS	12.00	4.000	8.000	3	3
CPS vs. Both	12.00	9.000	3.000	3	3
CPS vs. Indifferent	12.00	5.000	7.000	3	3
CPS vs. Total	12.00	15.00	-3.000	3	3
PS vs. Both	4.000	9.000	-5.000	3	3
PS vs. Indifferent	4.000	5.000	-1.000	3	3
PS vs. Total	4.000	15.00	-11.00	3	3
Both vs. Indifferent	9.000	5.000	4.000	3	3
Both vs. Total	9.000	15.00	-6.000	3	3

| Indifferent vs. Total | 5.000 | 15.00 | -10.00 | 3 | 3 |

Exercise No. 35

Table 34Pearson Correlation Coefficient 'r' for every pair of Y data sets (correlation matrix), assuming that the data are sampled from Gaussian distribution. The option of a two-tailed standard p value with a confidence interval of 95% has been chosen for the analysis[3]

	CPS	PS	Both	Indifferent
CPS	-	0.2904006	0.859035	0.8198605
PS	0.2904006	-	0.7393202	-0.3098009
Both	0.859035	0.7393202	-	0.4111839
Indifferent	0.8198605	-0.3098009	0.4111839	-

Exercise No. 36

**Table 35 Non-parametric Spearman correlation** for the given data:

Spearman coefficient r	CPS	PS	Both	Indifferent
CPS	-	0.500	0.500	1.000
PS	0.500	-	1.000	0.500
Both	0.500	1.000	-	0.500
Indifferent	1.000	0.500	0.500	-

---

[3]Report created by GraphPadStatMate 2.00.   24-06-2015 03:24:45 PM

Exercise No. 37

Table 36Relative frequency table of the means of the samples of each pensioncategory:

Pension preferences	CPS	PS	Both	Indifferent	Total
Frequency of the means	49.72	10.21	25.96	1.08	100
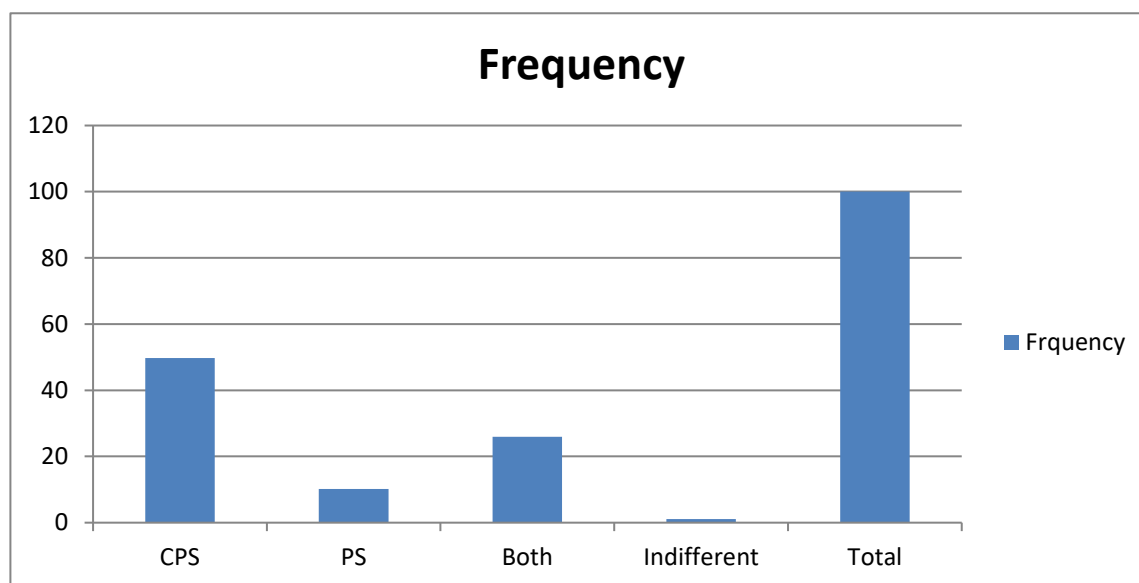
Graph   **15**

Exercise No. 38

Table 37Repeated one-way ANOVA summary

Table Analysed	Data 1
Repeated measures ANOVA summary	
Assume sphericity?	No
F	13.18
P value	0.0669
P value summary	ns

Statistically significant (P < 0.05)?	No
Geisser-Greenhouse's epsilon	0.2535
R square	0.8682

Was the matching effective?

F	5.732
P value	0.0285
P value summary	*
Is there significant matching (P < 0.05)?	Yes
R square	0.1589

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
Treatment (between columns)	95220	4	23805	F (1.014, 2.028) = 13.18	P = 0.0669
Individual (between rows)	20713	2	10356	F (2, 8) = 5.732	P = 0.0285
Residual (random)	14453	8	1807		
Total	130386	14			

Data summary

Number of treatments (columns)	5
Number of subjects (rows)	3

Exercise No. 39

Table 38Parts of Whole Analysis: The Binomial test for CPS column

Table analysed	Data 1
Column analysed	Column A
Binomial test	
P (one-tailed)	< 0.0001
P (two-tailed)	< 0.0001
P value summary	****
Is discrepancy significant (P < 0.05)?	Yes

Outcome	Expected #	Observed #	Expected %	Observed %	95% CI of Observed %
Male	90.00	117	50.00	65.00	57.55 to 71.95
Female	90.00	63	50.00	35.00	28.05 to 42.45
TOTAL	180.0	180.0	100.0	100.00	

Exercise No. 40

Z Test Calculator for 2 Population Proportions

Proportion (or total number) of individuals from sample Population 1 that have the characteristic in question (for example, High income sample)

13

Total number of individuals in sample Population 1

32

Proportion (or total number) of individuals from sample Population 2 that have the characteristic in question (for example, Medium- income sample)

67

Total number of individuals in sample Population 2

154

Significance Level:

○ 0.01

○ 0.05

○ 0.10

One-tailed or two-tailed hypothesis

○ One-tailed

○ Two-tailed

The Z-Score is -0.2996. The p-value is 0.38209. The result is *not* significant at p <0.05. The proportion of Yes or No responses for Observation 1 is 0.406. The proportion for Observation 2 is 0.435.

Z Test Calculator for 2 Population Proportions

Proportion (or total number) of individuals from sample Population 1 that have the characteristic in question (for example, High income sample)

| 13 |

Total number of individuals in sample Population 1

| 32 |

Proportion (or total number) of individuals from sample Population 2 that have the characteristic in question (for example, Low-income sample)

| 100 |

Total number of individuals in sample Population 2

| 176 |

Significance Level:

○ 0.01

○ 0.05

○ 0.10

One-tailed or two-tailed hypothesis

○ One-tailed

○　Two-tailed

The Z-Score is -1.6916. The p-value is 0.04551. The result is significant at $p < 0.05$. The proportion of Yes or No responses for Observation 1 is 0.406. The proportion for Observation 2 is 0.568.

Exercise No. 41

Table 39Fraction of the Total: Each value is divided by the row total:

	CPS Mean	CPS UL	CPS LL	PS Mean	PS UL	PS LL
Male	25.88496	30.18314	21.90562	4.424779	6.751198	2.723394
Female	23.16176	28.63723	18.28144	6.250	9.818451	3.682663

Both Mean	Both UL	Both LL	Indifferent Mean	Indifferent UL	Indifferent LL
11.9469	15.29928	9.103593	7.743363	10.60479	5.452568
14.70588	19.48245	10.7185	5.882353	9.376976	3.3993

Total Mean	Total UL	Total LL
50.000	54.70704	45.29297
50.000	56.09753	43.90247

Exercise No. 42

The Row Stats of the Table 40 is given below showing the parameters against their subjects:

Gender/Parameters	Mean	SD	N
Male	90.400	84.329	5
Female	54.400	49.531	5

Exercise No. 43

Fraction of the Total 41: Each value divided by the grand total

	CPS	PS	Both	Indifferent	Total
Male	0.08080111	0.01381216	0.03729282	0.02417127	0.1560774
Female	0.04350829	0.01174033	0.02762431	0.01104972	0.09392265
Total	0.1243094	0.02555249	0.06491713	0.035221	0.250

Exercise No. 44

Table 42One-way Analysis of Variance (ANOVA)

The P value is 0.0325, considered significant.
Variation among column means is significantly greater than expected by chance.
Test for linear trend between column means and column number:
Slope = 18.900   r squared = 0.0968

Is the linear trend statistically significant?
The P value is 0.1143, considered not significant:
There is not a significant linear trend.

Is the nonlinear variation statistically significant?
The P value is 0.0343, considered significant.

After accounting for the linear trend, the remaining variation among column means is significant.
This result was obtained from dividing variation among columns into linear and nonlinear   components:

Source of	Degrees of	Sum of	Mean

variation	freedom	squares	square
Between columns: Linear 1	14288	14288	
Between columns: Not linear	3	57126	19042
Residuals (within columns)	15	76220	5081.3
Total	19 147635		

F (linear trend) = 2.8119   =MSlinear/MSresidual

F (nonlinear trend) = 3.7475   =MSnonlinear/MSresidual

Assumption test: Are the standard deviations of the groups equal?

ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.

Bartlett statistic (corrected) = 15.137

The P value is 0.0044.

Bartlett's test suggests that the differences among the SDs are very significant.

Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.

Assumption test: Are the data sampled from Gaussian distributions?

ANOVA assumes that the data are sampled from populations that follow Gaussian distributions.

This assumption is tested using **the method Kolmogorov and Smirnov**:

Group	KS	P Value	Passed normality test?
CPS		Too few values to test.	
PS		Too few values to test.	
Both	Too few values to test.		
Indifferent	Too few values to test.		
Total		Too few values to test.	

Intermediate calculations of ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	4	71415	17854
Residuals (within columns)	15	76220	5081.3
Total	**19**	**147635**	

F = 3.514 =(MS treatment/MS residual)

Summary of Data

Number   Standard

ofStandard   Error of

Group	Points	Mean	Deviation	Mean	Median
CPS	4	90.000	69.900	34.950	83.500
PS	4	18.500	16.197	8.098	17.000
Both	4	47.000	36.560	18.280	44.500
Indifferent	4	25.500	18.699	9.350	20.000
Total	**4**	**181.00**	**136.28**	**68.140**	**165.00**

95% Confidence Interval

Group	Minimum	Maximum	From	To
CPS	13.000	180.00	-21.211	201.21
PS	3.000	37.000	-7.269	44.269
Both	5.000	94.000	-11.168	105.17
Indifferent	11.000	51.000	-4.251	55.251
Total	**32.000**	**362.00**	**-35.820**	**397.82**

Exercise No. 45

Table 43Repeated Measures Analysis of Variance

The P value is 0.0043, considered very significant.
Variation among column means is significantly greater than expected by chance.
<u>Test for linear trend between column means and column number</u>
Slope = 18.900   r squared = 0.0968
Is the linear trend statistically significant?
The P value is 0.0382, considered significant.
There is a significant linear trend.
Is the nonlinear variation statistically significant?
The P value is 0.0050, considered very significant.

After accounting for the linear trend, the remaining variation among column means is significant. This result was obtained from dividing variation among columns into linear and nonlinear components:

Source of variation	Degrees of freedom	Sum of squares	Mean square
Between columns: Linear	1	14288	14288
Between columns: Not linear	3	57126	19042
Individual (between rows)	3	44573	14858
Random (residual)	12	31647	2637.3
Total	19	147635	

F (linear trend) = 5.4179   =MSlinear/MSresidual

F (nonlinear trend) = 7.2204   =MSnonlinear/MSresidual

Intermediate calculations.(ANOVA Table):

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatment (between columns)	4	71415	17854
Individual (between rows)	3	44573	14858
Random (residual)	12	31647	2637.3
Total	19	147635	

F = 6.770 =MStreatment/MSresidual

Assumption test: Was the matching effective?

This test uses a second value of F and a different P value.

F = 5.634   =(MSindividual/MSresidual

The P value is 0.0121, considered significant.

Effective matching (or blocking) results isin significant variation among means. With these data, the matching appears to be effective.

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median
CPS	4	90.000	69.900	34.950	83.500
PS	4	18.500	16.197	8.098	17.000
Both	4	47.000	36.560	18.280	44.500
Indifferent	4	25.500	18.699	9.350	20.000
Total	4	181.00	136.28	68.140	165.00

95% Confidence Interval

Group	Minimum	Maximum	From	To
CPS	13.000	180.00	-21.211	201.21
PS	3.000	37.000	-7.269	44.269
Both	5.000	94.000	-11.168	105.17
Indifferent	11.000	51.000	-4.251	55.251
Total	32.000	362.00	-35.820	397.82

Exercise No. 46

Table 44Friedman Test (Nonparametric Repeated Measures ANOVA)

The values in each row are matched pairs.

The P value is 0.0001, considered extremely significant.

Variation among column medians is significantly greater than expected by chance.

The P value is exactly correct (no approximations).

Calculation detail

Group	Sum of Ranks
CPS	16.000
PS	5.000
Both	11.000
Indifferent	8.000
Total	20.000

Number of Rows = 4

Number of Columns = 5

Friedman Statistic Fr = 14.600

Dunn's Multiple Comparisons Test

If the difference between rank sum means is greater than 12.559 then the P value is less than 0.05.

Comparison	Rank Sum Difference	P value
CPS vs. PS	11.000 ns	P>0.05
CPS vs. Both	5.000 ns	P>0.05
CPS vs. Indifferent	8.000 ns	P>0.05
CPS vs. Total	-4.000 ns	P>0.05
PS vs. Both	-6.000 ns	P>0.05
PS vs. Indifferent	-3.000 ns	P>0.05
PS vs. Total	-15.000 **	P<0.01
Both vs. Indifferent	3.000 ns	P>0.05
Both vs. Total	-9.000 ns	P>0.05
Indifferent vs. Total	-12.000 ns	P>0.05

Summary of Data

Group	Number of Points	Median	Minimum	Maximum
CPS	4	83.500	13.000	180.00
PS	4	17.000	3.000	37.000

Both	4	44.500	5.000	94.000
Indifferent	4	20.000	11.000	51.000
Total	4	165.00	32.000	362.00

Exercise No. 47

Table 45 Number of respondents Interested in Pension Vs Age groups

Age-groups	CPS Males.	CPS Females	PS Males	PS .Females	Both Males	Both Females.	Indifferent Males	Indifferent Females.
18-28	4	3	1	0	7	8	3	8
28-38	29	10	1	2	9	7	6	2
38-48	52	15	4	2	10	14	10	6
48-58	21	3	5	3	10	12	4	6
58-68	20	12	7	10	9	5	2	1
68-78	9	2	1	1	0	3	1	2
	135	45	19	18	45	49	26	25
Total		180		37		94		51

D a t a   1

Legend:
- 3.89% 7 18-28
- 21.67% 39 28-38
- 37.22% 67 38-48
- 13.33% 24 48-58
- 17.78% 32 58-68
- 6.11% 11 68-78

T o t a l = 1 8 0
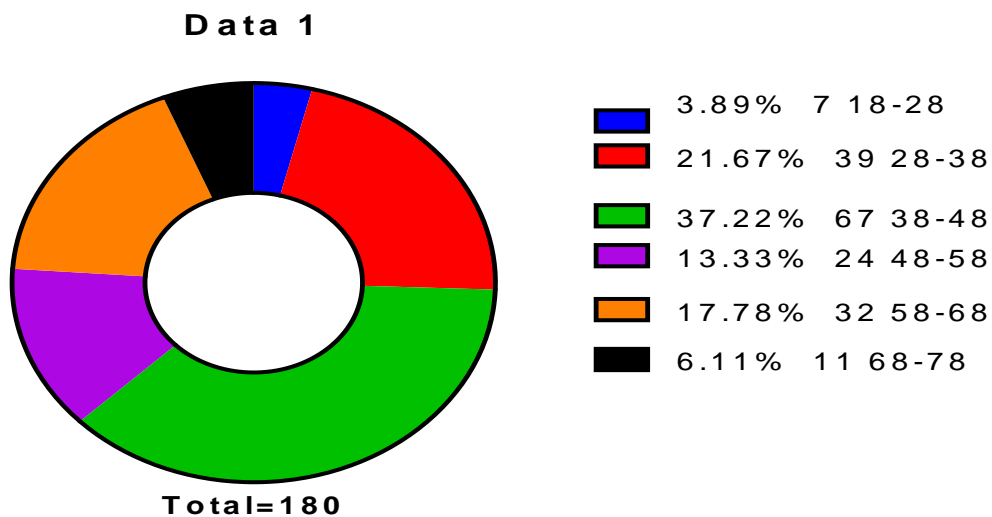
Graph 16 showing the relative frequency distribution of the CPS across the age-groups
    (Legend: %, Value, Age-Group)

Part Analysis of the Table 56

Table 46Divided by Column total (expressed in %)

	CPS M	CPS F	PS M	PS F	Both M	Both F	Indiff M	Indiff F
18-28	2.962963	6.666667	5.263158	0.000	15.55556	16.32653	11.53846	32.000
28-38	21.48148	22.22222	5.263158	11.11111	20.000	14.28571	23.07692	8.000
38-48	38.51852	33.33334	21.05263	11.11111	22.22222	28.57143	38.46154	24.000
48-58	15.55556	6.666667	26.31579	16.66667	22.22222	24.4898	15.38462	24.000
58-68	14.81482	26.66667	36.84211	55.55555	20.000	10.20408	7.692308	4.000
68-78	6.666667	4.444445	5.263158	5.555555	0.000	6.122449	3.846154	8.000
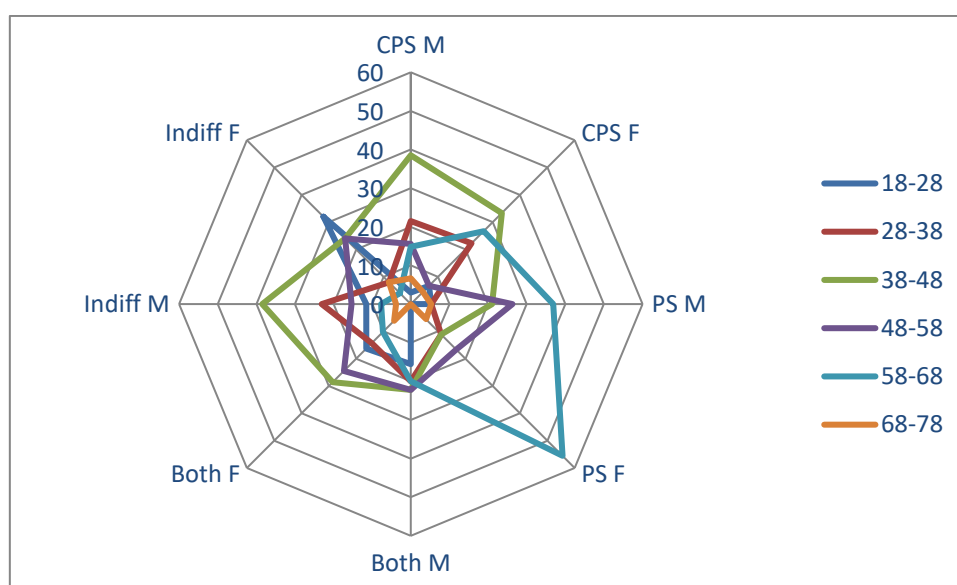
Graph 17

Table 47Divided by Row total (expressed in %)

Age-Groups	CPS M	CPS F	PS M	PS F	Both M	Both F	Indiff M	Indiff F
18-28	11.76471	8.823529	2.941176	0.000	20.58823	23.52941	8.823529	23.52941
28-38	43.93939	15.15152	1.515152	3.030303	13.63636	10.60606	9.090909	3.030303
38-48	46.0177	13.27434	3.539823	1.769912	8.849558	12.38938	8.849558	5.309734
48-58	32.8125	4.6875	7.8125	4.6875	15.625	18.750	6.250	9.375
58-68	30.30303	18.18182	10.60606	15.15152	13.63636	7.575758	3.030303	1.515152
68-78	47.36842	10.52632	5.263158	5.263158	0.000	15.78947	5.263158	10.52632

Table 48Divided by Grand Total (expressed in %)

Age-groups	CPS M	CPS F	PS M	PS F	Both M	Both F	Indiff M	Indiff F
18-28	1.104972	0.8287293	0.2762431	0.000	1.933702	2.209945	0.8287293	2.209945
28-38	8.011049	2.762431	0.2762431	0.5524862	2.486188	1.933702	1.657459	0.5524862
38-48	14.36464	4.143646	1.104972	0.5524862	2.762431	3.867403	2.762431	1.657459
48-58	5.801105	0.8287293	1.381216	0.8287293	2.762431	3.314917	1.104972	1.657459
58-68	5.524862	3.314917	1.933702	2.762431	2.486188	1.381216	0.5524862	0.2762431
68-78	2.486188	0.5524862	0.2762431	0.2762431	0.000	0.8287293	0.2762431	0.5524862

Table 49 showing the summary stats

Age-Groups	CPS M	CPS F	PS M	PS F	Both M	Both F	Indiff M	Indiff F
Mean	22.5	7.5	3.17	3	7.5	8.17	4.33	4.17
SEM	6.94	2.26	1.05	1.46	1.57	1.70	1.33	1.67
N	6	6	6	6	6	6	6	6
SD	17.00	5.54	5.54	3.58	3.83	4.17	3.27	2.85
Lower 95% Ci	4.65	1.68	1.68	-0.76	3.48	3.80	0.90	1.17
Upper 95% Ci	40.35	13.31	13.31	6.76	11.52	12.54	7.76	7.16
Minimum	4.0	2.0	2.0	0.0	0.0	3.0	1.0	1.0
Median	20.5	6.5	6.5	2.0	9.0	7.5	3.5	4.0
Maximum	52.0	15.0	15.0	10.0	10.00	14.0	10.0	8.0
Normality Test	0.20	0.29	0.29	0.33	0.32	0.18	0.21	0.27
p-value	>0.10	>0.10	>0.10	0.0359	0.0565	>0.10	>0.10	>0.10
Passed normality test	yes	yes	Yes	yes	yes	yes	yes	Yes

Graph 20
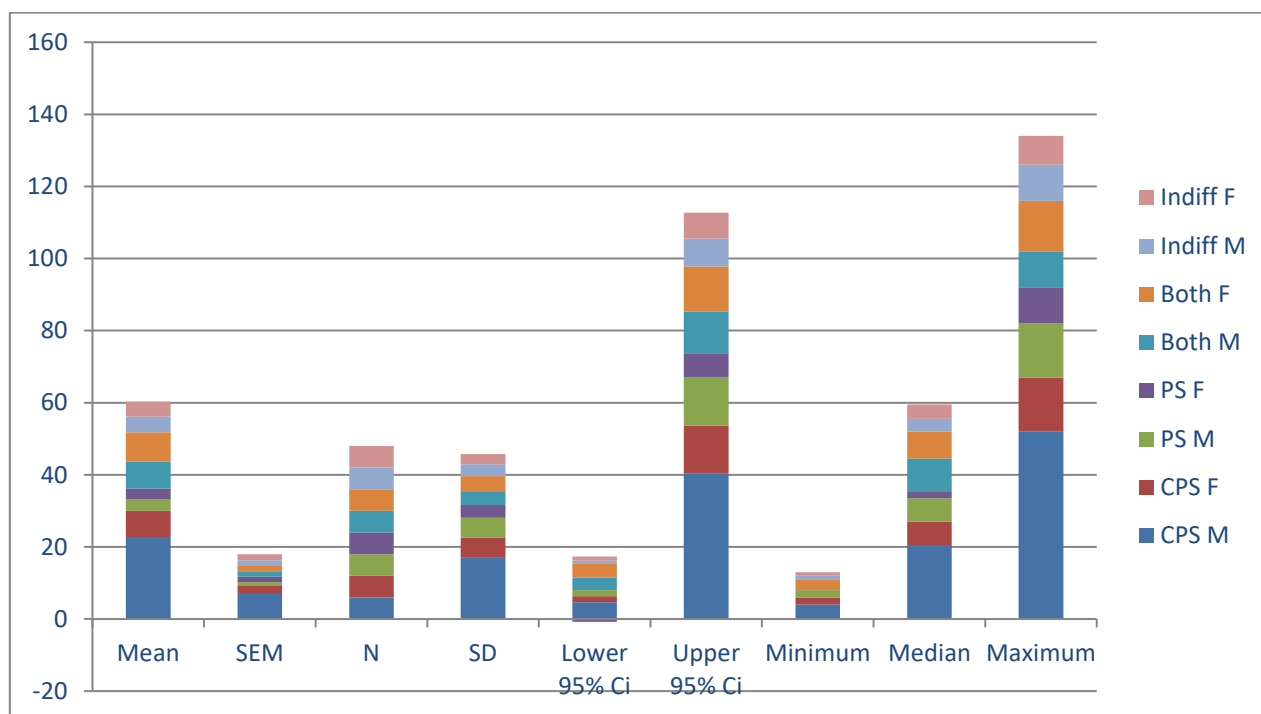
One-way Analysis of Variance (ANOVA)of Table 56.

The P value is 0.0004, considered extremely significant.
Variation among column means is significantly greater than expected by chance.

Tukey-Kramer Multiple Comparisons Test

If the value of q is greater than 4.521 then the P value is less than 0.05.

Comparison	Mean Difference	q	P value
CPS Males vs CPS Females	15.000	5.262 *	P<0.05
CPS Males vs PS Males	19.333	6.782 ***	P<0.001
CPS Males vs PS Females	19.500	6.840 ***	P<0.001
CPS Males vs Both Males	15.000	5.262 *	P<0.05
CPS Males vs Both Females	14.333	5.028 *	P<0.05
CPS Males vs Indiff Males	18.167	6.373 **	P<0.01
CPS Males vs Indiff Females	18.333	6.431 **	P<0.01
CPS Females vs PS Males	4.333	1.520 ns	P>0.05
CPS Females vs PS Females	4.500	1.579 ns	P>0.05
CPS Females vs Both Males	0.000	0.000 ns	P>0.05
CPS Females vs Both Females	-0.6667	0.2339 ns	P>0.05
CPS Females vs Indiff Males	3.167	1.111 ns	P>0.05
CPS Females vs Indiff Females	3.333	1.169 ns	P>0.05

PS Males vs PS Females   0.1667 0.05847 ns P>0.05
PS Males vs Both Males   -4.333   1.520 ns P>0.05
PS Males vs Both Females   -5.000   1.754 ns P>0.05
PS Males vs Indiff Males   -1.167 0.4093 ns P>0.05
PS Males vs Indiff Females   -1.000 0.3508 ns P>0.05
PS Females vs Both Males   -4.500   1.579 ns P>0.05
PS Females vs Both Females   -5.167   1.812 ns P>0.05
PS Females vs Indiff Males   -1.333 0.4677 ns P>0.05
PS Females vs Indiff Females   -1.167 0.4093 ns P>0.05
Both Males vs Both Females   -0.6667 0.2339 ns P>0.05
Both Males vs Indiff Males   3.167   1.111 ns P>0.05
Both Males vs Indiff Females   3.333   1.169 ns P>0.05
Both Females vs Indiff Males   3.833   1.345 ns P>0.05
Both Females vs Indiff Females   4.000   1.403 ns P>0.05
Indiff Males vs Indiff Females   0.1667 0.05847 ns P>0.05

Difference	Mean Difference	95% Confidence Interval From	To
CPS Males - CPS Females	15.000	2.112	27.888
CPS Males - PS Males	19.333	6.445	32.221
CPS Males - PS Females	19.500	6.612	32.388
CPS Males - Both Males	15.000	2.112	27.888
CPS Males - Both Females	14.333	1.445	27.221
CPS Males - Indiff Males	18.167	5.279	31.055
CPS Males - Indiff Females	18.333	5.445	31.221
CPS Females - PS Males	4.333	-8.555	17.221
CPS Females - PS Females	4.500	-8.388	17.388
CPS Females - Both Males	0.000	-12.888	12.888
CPS Females - Both Females	-0.6667	-13.555	12.221
CPS Females - Indiff Males	3.167	-9.721	16.055
CPS Females - Indiff Females	3.333	-9.555	16.221
PS Males - PS Females	0.1667	-12.721	13.055
PS Males - Both Males	-4.333	-17.221	8.555
PS Males - Both Females	-5.000	-17.888	7.888
PS Males - Indiff Males	-1.167	-14.055	11.721
PS Males - Indiff Females	-1.000	-13.888	11.888
PS Females - Both Males	-4.500	-17.388	8.388
PS Females - Both Females	-5.167	-18.055	7.721
PS Females - Indiff Males	-1.333	-14.221	11.555
PS Females - Indiff Females	-1.167	-14.055	11.721
Both Males - Both Females	-0.6667	-13.555	12.221
Both Males - Indiff Males	3.167	-9.721	16.055
Both Males - Indiff Females	3.333	-9.555	16.221

  Both Females - Indiff Males   3.833 -9.055 16.721
   Both Females - Indiff Females   4.000 -8.888 16.888
Indiff Males - Indiff Females   0.1667 -12.721 13.055
Assumption test: Are the standard deviations of the groups equal?
ANOVA assumes that the data are sampled from populations with identical SDs. This assumption is tested using the method of Bartlett.
Bartlett statistic (corrected) = 35.176
The P value is < 0.0001.
Bartlett's test suggests that the differences among the SDs isextremely significant.
Since ANOVA assumes populations with equal SDs, you should consider transforming your data (reciprocal or log) or selecting a nonparametric test.
Assumption test: Are the data sampled from Gaussian distributions?
ANOVA assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method
Kolmogorov and Smirnov:

Group	KS	P Value	Passed normality test?
CPS Males	0.2018.	>0.10	Yes
CPS Females.	0.2916.	>0.10	Yes
PS Males.	0.3011	0.0951	Yes
PS Females	0.3333	0.0359	No
Both Males.	0.3188	0.0565	Yes
Both Females.	0.1826	>0.10	Yes
Indiff Males	0.2073	>0.10	Yes
Indiff Females.	0.2758	>0.10	Yes

At least one column failed the normality test with $P < 0.05$.
Consider using a nonparametric test or transforming the data (i.e. converting to logarithms or reciprocals).
Intermediate calculations. ANOVA table

Source of variation	Degrees of freedom	Sum of squares	Mean square
Treatments (between columns)	7	1713.6	244.80
Residuals (within columns)	40	1950.3	48.758
Total	47	3663.9	

F = 5.021 =(MStreatment/MSresidual)

Summary of Data

Group	Number of Points	Mean	Standard Deviation	Standard Error of Mean	Median

```
  CPS Males      6     22.500  17.003    6.941   20.500
  CPS Females    6      7.500   5.541    2.262    6.500
  PS Males       6      3.167   2.563    1.046    2.500
  PS Females     6      3.000   3.578    1.461    2.000
  Both Males     6      7.500   3.834    1.565    9.000
  Both Females   6      8.167   4.167    1.701    7.500
Indiff Males     6      4.333   3.266    1.333    3.500
Indiff Females   6      4.167   2.858    1.167    4.000
```

```
  95% Confidence Interval
  Group    Minimum  Maximum    From       To
=============== ======== ======== ========== ==========
  CPS Males    4.000  52.000     4.654   40.346
 CPS Females   2.000  15.000     1.684   13.316
  PS Males     1.000   7.000    0.4770    5.856
  PS Females   0.000  10.000   -0.7552    6.755
  Both Males.          0.000  10.000     3.476  11.524
 Both Females  3.000  14.000     3.793  12.541
Indiff Males   1.000  10.000    0.9053    7.761
Indiff Females 1.000   8.000     1.167    7.16
```

Transforming data to create a Gaussian distribution

The type of data collected was the number of counts (C) and the C comes from the Poisson distribution. The normalizing of the distribution was done by transforming the data to the square root of C. Table 60 shows the transformed data for non-parametric analysis.

Table 50 transformed data of Table 56 to perform a non-parametric test.

Age-group	CPS M	CPS F	PS M	PS F	Both M	Both F	Indiff M	Indiff F
18-28	2	1.73	1	0	2.64	2.82	1.73	2.82
28-38	5.38	3.16	1	1.41	3	2.64	2.45	1.41
38-48	7.21	3.87	2	1.41	3.16	3.74	3.16	2.45
48-58	4.58	1.73	2.23	1.73	3.16	3.46	2	2.45
58-68	4.47	3.46	2.64	3.16	3	2.23	1.41	1
68-78	3	1.41	1	1	0	1.73	1	1.41

Kruskal-Wallis Test (Nonparametric ANOVA)

The P value is 0.0134, considered significant.
Variation among column medians is significantly greater than expected by chance.
The P value is approximate (from chi-square distribution) because at least one column has two or more identical values.

Calculation detail

Group	Number of Points	Sum of Ranks	Mean of Ranks
CPS Males	6	241.00	40.167
CPS Females	6	169.00	28.167
PS Males	6	90.000	15.000
PS Females	6	85.000	14.167
Both Males	6	174.50	29.083
Both Females	6	185.50	30.917
Indiff Males	6	119.00	19.833
Indiff Females	6	112.00	18.667

Kruskal-Wallis Statistic KW = 17.693 (corrected for ties)

Dunn's Multiple Comparisons Test

Comparison	Mean Rank Difference	P value
CPS Males vs. CPS Females	12.000	ns P>0.05
CPS Males vs. PS Males	25.167	ns P>0.05
CPS Males vs. PS Females	26.000	* P<0.05
CPS Males vs. Both Males	11.083	ns P>0.05
CPS Males vs. Both Females	9.250	ns P>0.05
CPS Males vs. Indiff Males	20.333	ns P>0.05
CPS Males vs. Indiff Females	21.500	ns P>0.05

CPS Females vs. PS Males   13.167 ns P>0.05

CPS Females vs. PS Females   14.000 ns P>0.05

CPS Females vs. Both Males   -0.9167 ns P>0.05

CPS Females vs. Both Females   -2.750 ns P>0.05

CPS Females vs. Indiff Males   8.333 ns P>0.05

CPS Females vs. Indiff Females   9.500 ns P>0.05

PS Males vs. PS Females   0.8333 ns P>0.05

PS Males vs. Both Males   -14.083 ns P>0.05

PS Males vs. Both Females   -15.917 ns P>0.05

PS Males vs. Indiff Males   -4.833 ns P>0.05

PS Males vs. Indiff Females   -3.667 ns P>0.05

PS Females vs. Both Males   -14.917 ns P>0.05

PS Females vs. Both Females   -16.750 ns P>0.05

PS Females vs. Indiff Males   -5.667 ns P>0.05

PS Females vs. Indiff Females   -4.500 ns P>0.05

Both Males vs. Both Females   -1.833 ns P>0.05

Both Males vs. Indiff Males   9.250 ns P>0.05

Both Males vs. Indiff Females   10.417 ns P>0.05

Both Females vs. Indiff Males   11.083 ns P>0.05

Both Females vs. Indiff Females   12.250 ns P>0.05

Indiff Males vs. Indiff Females   1.167 ns P>0.05

Summary of Data

Group	Number of Points	Median	Minimum	Maximum
CPS Males	6	4.525	2.000	7.210
CPS Females	6	2.445	1.410	3.870

PS Males	6	1.500	1.000	2.640	
PS Females	6	1.410	0.000	3.160	
Both Males	6	3.000	0.000	3.160	
Both Females	6	2.730	1.730	3.740	
Indiff Males	6	1.865	1.000	3.160	
Indiff Females	6	1.930	1.000	2.820	

Exercise No. 48

Table No. 51Showing Income vs. Attributes of the respondents opting for CPS

Annual Income	Literacy and Education				Sex		Marriage		Age-groups			Pension-holders
	0-5th	5-10th	Inter	Degree	Male	Female	Unmarried	Married	18-38	38-58	58-78	
≤ 5K	11	4	0	0	11	4	0	15	6	7	2	1
≤10K	11	3	0	0	11	3	0	14	5	5	4	4
≤20K	45	5	4	2	40	16	1	55	10	28	18	14
≤30K	19	8	2	2	16	15	0	31	10	17	4	5
≤40K	15	10	0	3	20	8	1	27	13	11	4	0
≤50K	7	4	0	8	16	3	12	7	9	8	2	0
≤60K	0	3	1	13	10	7	7	10	11	5	1	5
Total	108	37	7	28	124	56	21	159	64	81	35	29
	180				180		180		180			29

Graph 21
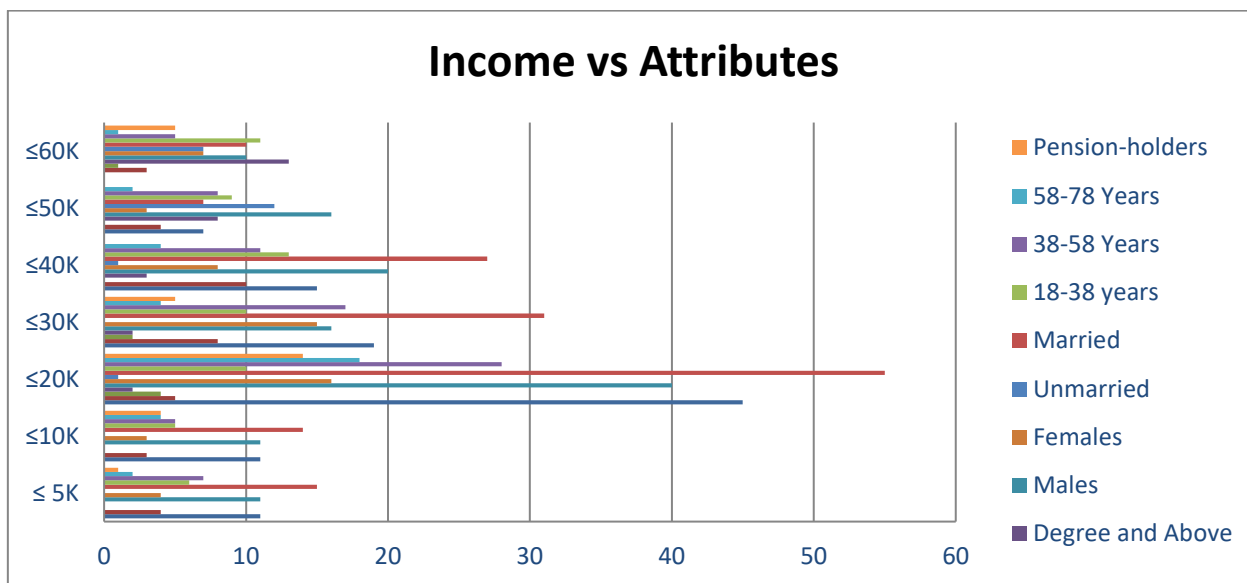
Table 52 Each value is divided by its column total

Income	0-5th	5-10th	Inter	Degree	Males	Females	Married	Unmarried	18-38	38-58	58-78	Pension-Holders
5K	10.185199	10.810801	0.000	0.000	8.870968	7.142857	0.000	9.433962	9.375	8.641975	5.714286	3.448276
10K	10.185199	8.108109	0.000	0.000	8.870968	5.357143	0.000	8.805031	7.8125	6.172839	11.42857	13.7931
20K	41.666666	13.513511	57.142866	7.142857	32.258066	28.571433	4.761905	34.591199	15.625	34.567907	51.42857	48.2758
30K	17.592599	21.621622	28.571433	7.142857	12.903233	26.785711	0.000	19.496866	15.625	20.987655	11.42857	17.24138
40K	13.888889	27.027033	0.000	10.714299	16.129032	14.285711	4.761905	16.981113	20.3125	13.580255	11.42857	0.000
50K	6.481482	10.810801	0.000	28.571433	12.903233	5.357143	57.142866	4.402515	14.0625	9.876543	5.714286	0.000
60K	0.000	8.108109	14.285711	46.428577	8.064516	12.5003	33.333338	6.289308	17.1875	6.172839	2.857143	17.24138

Graph 22

Table 53 Each value is divided by its column total

Income	0-5th	5-10th	Inter	Degree	Males	Females	Married	Unmarried	18-38	38-58	58-78	Pension-Holders
5K	18.03279	6.557377	0.000	0.000	18.03279	6.557377	0.000	24.59016	9.836065	11.47541	3.278688	1.639344
10K	18.33333	5.000	0.000	0.000	18.33333	5.000	0.000	23.33333	8.333333	8.333333	6.666667	6.666667
20K	18.90756	2.100834	1.680672	0.840336	16.80672	6.722689	0.420168	23.10924	4.201681	11.76471	7.563026	5.882353
30K	14.72868	6.201551	1.550388	1.550388	12.40310	11.62791	0.000	24.03101	7.751938	13.17829	3.100775	3.875969
40K	13.39286	8.928572	0.000	2.67857	17.85714	7.142857	0.892857	24.10714	11.60714	9.821428	3.571429	0.000
50K	9.210527	5.263158	0.000	10.52632	21.05263	3.947368	15.78947	9.210527	11.84211	10.52632	2.631579	0.000
60K	0.000	4.109589	1.369863	17.80822	13.69863	9.589041	9.58904	13.69863	15.06849	6.849315	1.369863	6.849315

Graph 23

Table 54 Each value divided by its grand total

	0-5th	5-10th	Inter	Degree	Males	Females	Married	Unmarried	18-38	38-58	58-78	Pension-Holders
5K	1.468625	0.5340454	0.000	0.000	1.468625	0.5340454	0.000	2.002670	0.8010681	0.9345794	0.2670227	0.1335114
10K	1.468625	0.4005340	0.000	0.000	1.468625	0.4005340	0.000	1.869159	0.6675568	0.6675568	0.5340454	0.5340454
20K	6.008011	0.6675568	0.5340454	0.2670227	5.3404	2.136182	0.1335114	7.343124	1.335114	3.738318	2.403208	1.869159
30K	2.536716	1.068091	0.2670227	0.2670227	2.136182	2.002670	0.000	4.138852	1.335114	2.269693	0.5340454	0.6675568
40K	2.002670	1.335114	0.000	0.4005340	2.670227	1.068091	0.1335114	3.604806	1.735648	1.468625	0.5340454	0.000
50K	0.9345794	0.5340454	0.000	1.068091	2.136182	0.4005340	1.602136	0.9345794	1.201602	1.068091	0.2670227	0.000
60K	0.000	0.4005340	0.1335114	1.735648	1.335114	0.9345794	0.9345794	1.335114	1.468625	0.6675568	0.1335114	0.6675568

Graph 24

Income vs Attributes

Legend: 0-5th, 5-10th, Inter, Degree, Males, Females, Married, Unmarr ied, 18-38, 38-58, 58-78

Exercise No. 49

Table 55Bland Altman Test to calculate the Bias and Agreement[4]

Category	Method A (No. of the Respondents opting for the CPS alone)	Method A (%)	Method B (No. of the respondents opting for the CPS and PS both plus CPS alone)	Method (%)
Males	117	65	171	62.40
Females	63	35	103	37.60

Data sets:

Data set with method A: CPS
Data set with Method B: CPS alone and Both CPS +PS
We had calculated the following formula and the same have been tabulated as given below:

---

1) Difference (A-B) Vs Average;
2) Ratio (A/B) Vs. Average;
3) %Difference (100 * A-B/Average) Vs Average;
4) Difference (B-A) Vs. Average;
5) Ratio (B/A) Vs. Average; and
6) % Difference (100 * B-A/Average) Vs, Average.

Table 56 Bias and Agreement

Bias vs Agreement	1	2	3	4	5	6
Bias	0.0	0.9863	-1.540	0.00	1.017	1.540
SD of Bias	3.677	0.07836	7.951	3.677	0.08081	7.951
95% limits of Agreement	-7.207 to 7.207	0.8327 to 1.140	-17.12 to 14.04	-7.207 to 7.207	0.8588 to 1.176	-14.04 to 17.12

1) Table 57Bland Altman Test of Difference Vs Average

Category/Parameters	Average	Difference
Male	63.70	2.60
Female	36.30	-2.60

Graph 25

There was not much difference found in the results using both the methods; it was only ± 2.60. This shows that both the genders showed the same interest in the CPS type of pension scheme.

2) Table 58Bland Altman Test of Average Vs Ratio

Category/Parameters	Average	Ratio
Male	63.70	1.042
Female	36.30	0.931
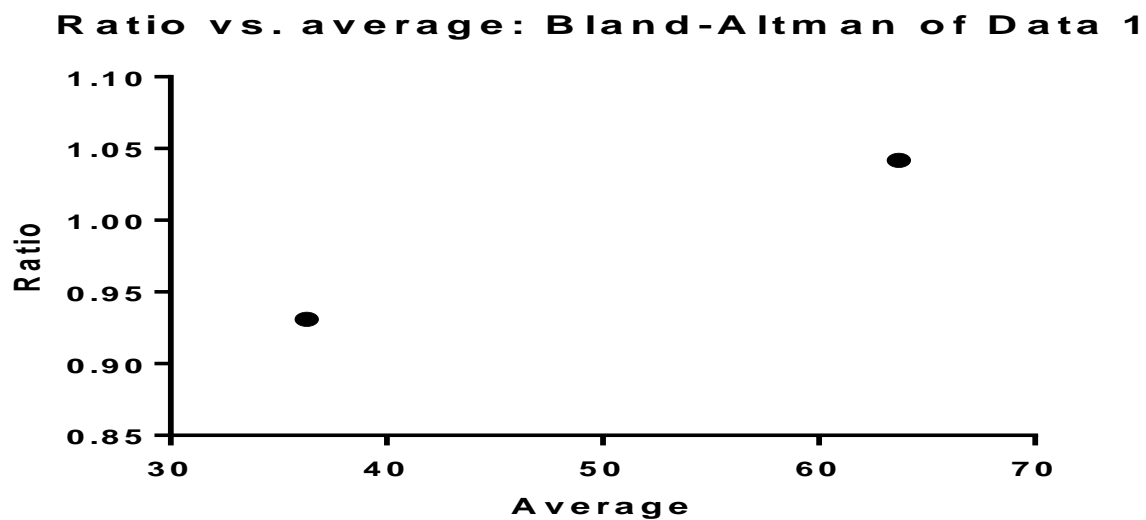
Graph 26

There is not much Bias in agreement as can be seen from the ratios of males and females obtained from the two sets of data. This test reiterates the assumption that the most preferred pension scheme is the CPS even when two different methods have been applied to check the bias and agreement.

3) Table 59Bland Altman Test of %Difference and Average

Category/ Parameters	Average	%Difference
Males	63.70	4.082
Females	36.30	-7.163

Graph 27

The % difference ranged from -7.163 to 4.082 which is marginal and a significant result; which shows that the responses at best can vary between the given ranges.

% Difference vs. average: Bland-Altman of Data 1
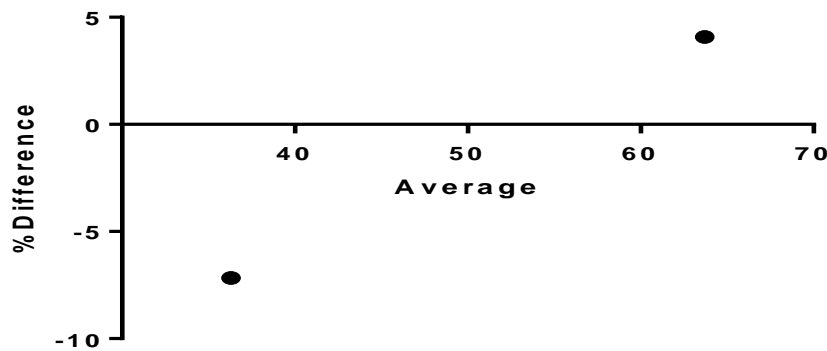
3) Table 60Bland Altman Test of Difference Vs Average

Category/ Parameters	Average	Difference
Males	63.70	-2.60
Females	36.30	2.60

Difference vs. average: Bland-Altman of Data 1
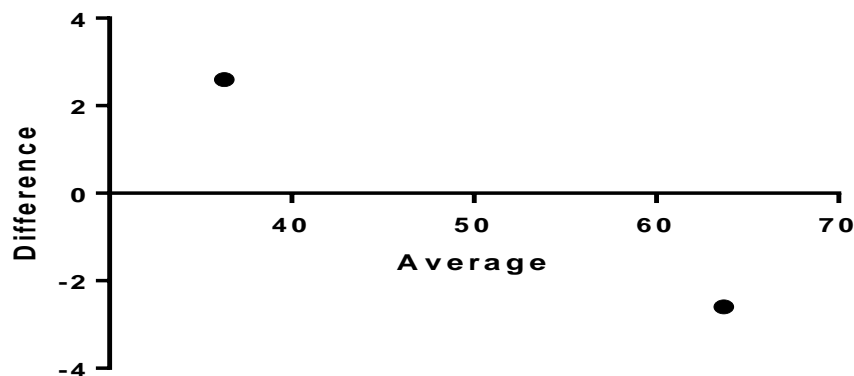
Graph 28

Either way the difference comes to ±2.60 for the males or females. This difference is very narrow and thus supports the hypothesis that the takers of CPS are there even in a low-income economies like India and it shows that the unorganized sector workers are generally inclined towards securing their old-age incomes.

4) Table 61Bland Altman Test of Average Vs Ratio

Category/ Parameters	Average	Ratio
Males	63.70	0.960
Females	36.30	1.074
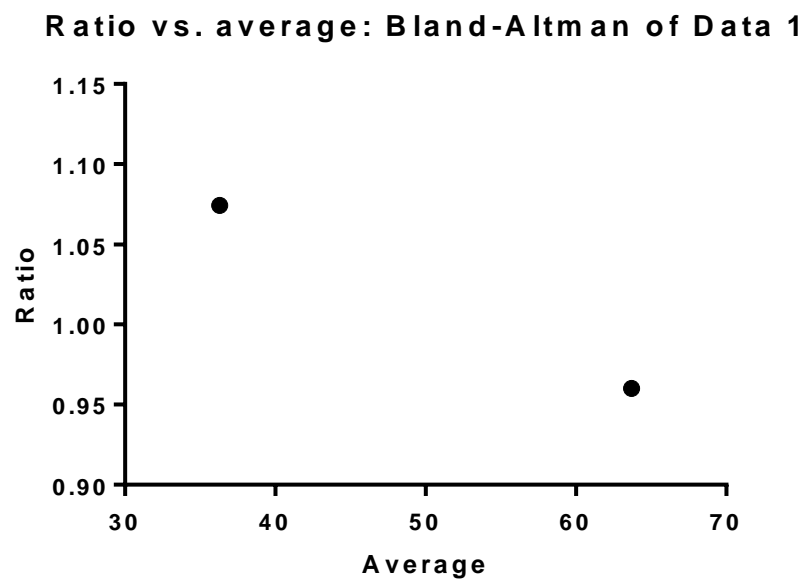
Graph 29

The difference in ratios between males and females is less than 0.1; the two methods gave almost the same results for the given sets of data. There is not much change in the preference for the CPS either way.

5) Table 62Bland Altman Test of % Difference Vs Average

Category/Parameters	Average	% Difference
Males	63.70	-4.082
Females	36.30	7.163

% Difference vs. average: Bland-Altman of Data 1
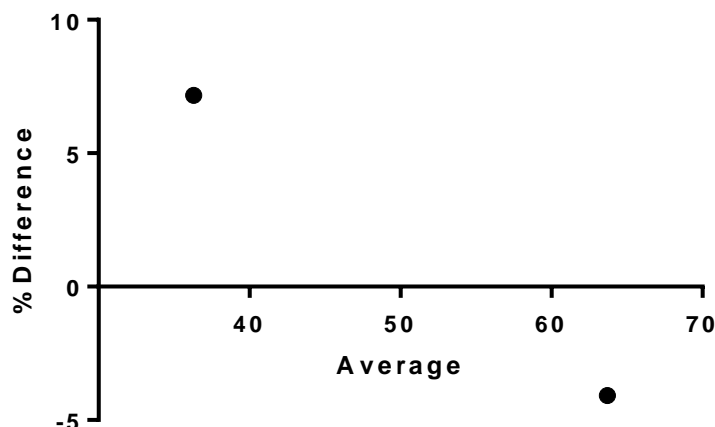
Graph 29

Summary: The % Difference calculated shows only a range of -4.082 to 7.163 for both the sets of data for CPS. In other words, we can merge both the columns of 'CPS' and 'Both for CPS + PS' for analysis purposes. However, to keep the purity of the data alive; I have maintained the columns separate as it includes also the respondents opting for PS.

There is not much bias in agreement using both the methods as is verified using Bland Altman Tests.

Exercise No. 50

Linear Regression Test[5]

Table 63 Raw Data for the Linear Regression Test

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
18	14	18	0	0	0	1	13	1	4	10	13	3	0	0	4	0	0
19	13	14	2	1	2	13	2	4	13	15	8	7	0	4	1	0	1
143	88	79	6	1	0	0	102	35	6	125	113	16	6	8	16	1	0

A step-wise linear regressionwas run using willingness to buy into CPS model with CPS as a dependent variable and 17 features (Y1 – Y17) of the proposed model as the independent variables.

X CPS for Odisha, Telangana and A.P (Row-wise)

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[5] http://www.graphpad.com/guides/prism/6/curvefitting/index.htm?reg_how_linear_regression_works.htm© 1995-2015 GraphPad Software, Inc visited on 14.07.2015

Y1 Bank Linked payments

Y210% contribution to the retirement account

Y320% contribution to the retirement account

Y430% contribution to the retirement account

Y5More than 30% contribution to the retirement account

Y6   Flexibility of age in joining the proposed scheme

Y7   High risk factor vs. return factor

Y8   Medium risk factor vs. return factor

Y9   Low risk factor vs. return factor

Y10 Married respondents

Y11 0 – 5th Std.

Y12 5 – 10th Std.

Y13 Intermediate Std.

Y14 Degree& above

Y15 Pension receivers

Y16 LIC membership holders

Y17 stipend/ scholarship holders

The linear regression model assumes that X values are exactly correct, and that experimental error or biological variability only affects the Y values. This is rarely the case, but it is sufficient to assume that any imprecision in measuring X is very small compared to the variability in Y.

Table 64 Linear Regression Table expressed in relative percentages

X	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
100	77.8	100	0	0	0	5.6	72.2	5.6	22.2	56	72.2	16.7	0	0	22.2	0	0
100	68.4	73.7	10.5	5.2	10.5	68.4	10.5	21.1	68.4	79	42.1	37	0	21.5	5.2	0	5.2
100	61.5	55.2	4.2	0.7	0	0	71.3	24.5	4.2	87.41	79	11.2	4.2	5.6	11.2	0.7	0

The percentages indicated by the respondents for each variable were used to run the Regression. The findings indicate that the best fit predictors of willingness to buy CPS are as follows:

1) Personal savings,
2) 3 per cent routing fromearnings through government schemesat source,into retirement pots; and
3) Having opportunity to avail both the above options.

Table 65 Linear Regression Tabular Results[6]

Best-fit values	Y1	Y2	Y3	Y4
Slope	0.5983 ± 0.01112	0.5058 ± 0.03134	0.04026 ± 0.01363	0.004064 ± 0.006928
Y-intercept when X=0.0	2.434 ± 0.9332	6.652 ± 2.631	0.2513 ± 1.144	0.4228 ± 0.5815
X-intercept when Y=0.0	-4.069	-13.15	-6.244	-104.0
1/slope	1.671	1.977	24.84	246.0
95% Confidence Intervals				
Slope	0.4571 to 0.7396	0.1076 to 0.9040	-0.1330 to 0.2135	-0.08396 to 0.09209
Y-intercept when X=0.0	-9.422 to 14.29	-26.77 to 40.08	-14.29 to 14.79	-6.965 to 7.811
X-intercept when Y=0.0	-29.30 to 13.60	-301.5 to 36.60	-infinity to +infinity	-infinity to +infinity
Goodness of Fit				
R square	0.9997	0.9962	0.8971	0.2560
Sy.x	1.130	3.186	1.386	0.7043
Is slope significantly non-zero?				
F	2896	260.4	8.720	0.3442
DFn, DFd	1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000
P value	0.0118	0.0394	0.2079	0.6622
Deviation from zero?	Significant	Significant	Not Significant	Not Significant
Data				
Number of X values	3	3	3	3
Maximum number of Y replicates	1	1	1	1
Total number of values	3	3	3	3
Number of missing values	0	0	0	0
Runs test for Linearity				
Points above line	2	2	1	1
Points below line	1	1	2	2
Number of runs	3	3	3	3
P value (runs test)	1.0000	1.0000	1.0000	1.0000
Deviation from linearity	Not Significant	Not Significant	Not Significant	Not Significant

---

[6] Also see Linear Regression Line contained in the Annexure.

Equation		Y = 0.5983*X + 2.434	Y = 0.5058*X + 6.652	Y = 0.04026*X + 0.2513	Y = 0.004064*X + 0.4228

	Y5	Y6	Y7	Y8	Y9
	-0.007935 ± 0.01397	-0.05564 ± 0.08386	0.7585 ± 0.08179	0.2612 ± 0.01905	-0.01964 ± 0.06274
	1.143 ± 1.172	8.005 ± 7.039	-6.508 ± 6.865	-2.337 ± 1.599	8.845 ± 5.266
	144.0	143.9	8.581	8.949	450.3
	-126.0	-17.97	1.318	3.829	-50.91
	-0.1854 to 0.1695	-1.121 to 1.010	-0.2808 to 1.798	0.01911 to 0.5032	-0.8168 to 0.7775
	-13.75 to 16.04	-81.43 to 97.44	-93.74 to 80.72	-22.65 to 17.98	-58.06 to 75.76
	-infinity to +infinity	-infinity to +infinity	-infinity to +infinity	-667.6 to 63.44	-infinity to +infinity
	0.2440	0.3057	0.9885	0.9947	0.08928
	1.420	8.525	8.315	1.937	6.378
	0.3228	0.4402	85.99	187.9	0.09803
	1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000
	0.6711	0.6271	0.0684	0.0464	0.8068
	Not Significant	Not Significant	Not Significant	Significant	Not Significant
	3	3	3	3	3
	1	1	1	1	1
	3	3	3	3	3
	0	0	0	0	0
	1	1	2	1	1
	2	2	1	2	2
	3	3	3	3	3
	1.0000	1.0000	1.0000	1.0000	1.0000
	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
	Y = -0.007935*X + 1.143	Y = -0.05564*X + 8.005	Y = 0.7585*X - 6.508	Y = 0.2612*X - 2.337	Y = -0.01964*X + 8.845

Y10	Y11	Y12	Y13	Y14	Y15
0.9038 ± 0.02849	0.8230 ± 0.04051	0.08854 ± 0.02721	0.04819 ± 0.0003352	0.04838 ± 0.02749	0.1083 ± 0.02162
-4.229 ± 2.392	-4.714 ± 3.400	3.354 ± 2.284	-0.8914 ± 0.02814	1.097 ± 2.307	0.5030 ± 1.815
4.679	5.728	-37.88	18.50	-22.67	-4.645
1.106	1.215	11.29	20.75	20.67	9.235
0.5418 to 1.266	0.3084 to 1.338	-0.2572 to 0.4343	0.04393 to 0.05245	-0.3009 to 0.3976	-0.1664 to 0.3830
-34.62 to 26.16	-47.91 to 38.48	-25.66 to 32.37	-1.249 to -0.5339	-28.22 to 30.41	-22.55 to 23.56

-42.70 to 30.92	-102.0 to 43.80	-infinity to +infinity	11.78 to 24.56	-infinity to +infinity	-infinity to +infinity
0.9990	0.9976	0.9137	1.000	0.7560	0.9617
2.897	4.118	2.766	0.03408	2.794	2.198
1006	412.9	10.59	20667	3.098	25.08
1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000	1.000, 1.000
0.0201	0.0313	0.1898	0.0044	0.3289	0.1255
Significant	Significant	Not Significant	Significant	Not Significant	Not Significant
3	3	3	3	3	3
1	1	1	1	1	1
3	3	3	3	3	3
0	0	0	0	0	0
1	2	1	2	1	2
2	1	2	1	2	1
3	3	3	3	3	3
1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
					Y
$Y = 0.9038*X - 4.229$	$Y = 0.8230*X - 4.714$	$Y = 0.08854*X + 3.354$	$Y = 0.04819*X - 0.8914$	$Y = 0.04838*X + 1.097$	$=0.1083*X+0.5030$

Y16	Y17
$0.008032 \pm 5.587e{-}005$	-0.003967 ± 0.006984
-0.1486 ± 0.004689	0.5714 ± 0.5862
18.50	144.0
124.5	-252.0
0.007322 to 0.008742	-0.09270 to 0.08477
-0.2082 to -0.08899	-6.876 to 8.019
11.78 to 24.56	-infinity to +infinity
1.000	0.2440
0.005679	0.7099
20667	0.3228
1.000, 1.000	1.000, 1.000
0.0044	0.6711
Significant	Not Significant
3	3
1	1
3	3
0	0
2	1
1	2

3	3
1.0000	1.0000
Not Significant	Not Significant

$$Y = 0.008032*X - 0.1486 \quad Y = -0.003967*X + 0.5714$$

The tabular results first reports the best-fit values of the slope and intercept, along with their standard errors. It also reports the X intercept and the reciprocal of the slope. Below those values, it reports the 95% confidence interval of the slope and both intercepts. At the bottom of the results page, the slope and intercept are reported again in the form of the equation that defines the best-fit line. The slope quantifies the steepness of the line. It equals the change in Y for each unit change in X. It is expressed in the units of the Y-axis divided by the units of the X-axis. If the slope is positive, Y increases as X increases. If the slope is negative, Y decreases as X increases. The Y intercept is the Y value of the line when X equals zero. It defines the elevation of the line. The standard error values of the slope and intercept can be hard to interpret, but their main purpose is to compute the 95% confidence intervals.

Table 66 Linear Regression Normality Test for Residuals

Residual	X	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
Odisha	18	0.795949	2.243855	-0.975943	-0.495974	-0.999994	-6.00361	5.855622	-1.36391
Telangana	19	-0.80237	-2.26195	0.983808	0.499968	1.008	6.052029	-5.90285	1.374911
Andhra Pradesh	143	0.006419	0.018096	-0.00787	-0.004	-0.008006	-0.04842	0.047223	-0.011

Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
-4.49171	-2.03987	2.899813	-1.94787	0.023998	-1.96787	1.5479	0.004	-0.49997
4.527934	2.056319	-2.9232	1.963583	-0.02419	1.983743	-1.56038	0.00403	-0.504
-0.03622	-0.01645	0.023386	-0.01571	0.000194	-0.01587	0.012483	-	-0.00403
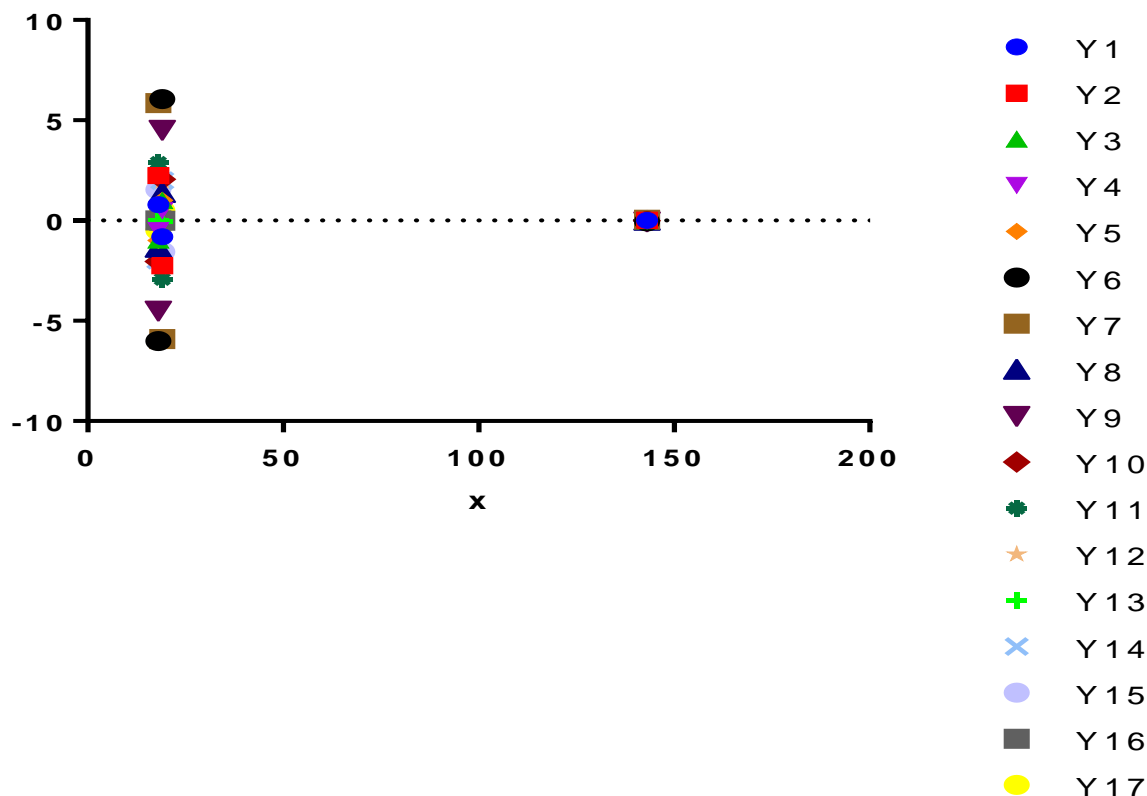
Graph 30

Whether one point is above or below the line is a matter of chance, and does not influence whether another point is above or below the line. In other words, the data points are independent of each other.Linear regression analysis assumes that the scatter of data around the best-fit line is **Gaussian**. The variability is the same all along the curve.Linear regression assumes that scatter of points around the best-fit line has the same standard deviation all along the curve. The assumption is violated if the points with high or low X values tend to be further from the best-fit line.

Graph 31 showing Results of Linear Regression Test

The following choices have been selected:
    A) Interpolate unknown from standard curve.
    B) Compare test to see whether slopes and intercepts are significantly different.
    C) Show the 95% Confidence band of the best fit line and residual plot in graphing option.
    D) Consider each replicate Y value as an individual point.
    E) Calculate the test departure from linearity with runs test;
        a. 95% confidence interval of Y when X=0.0;
        b. 95% confidence interval of X when Y=0.0
    F) Start the range of the regression line at "auto" and end at the regression line at "auto" (automatically calculate)
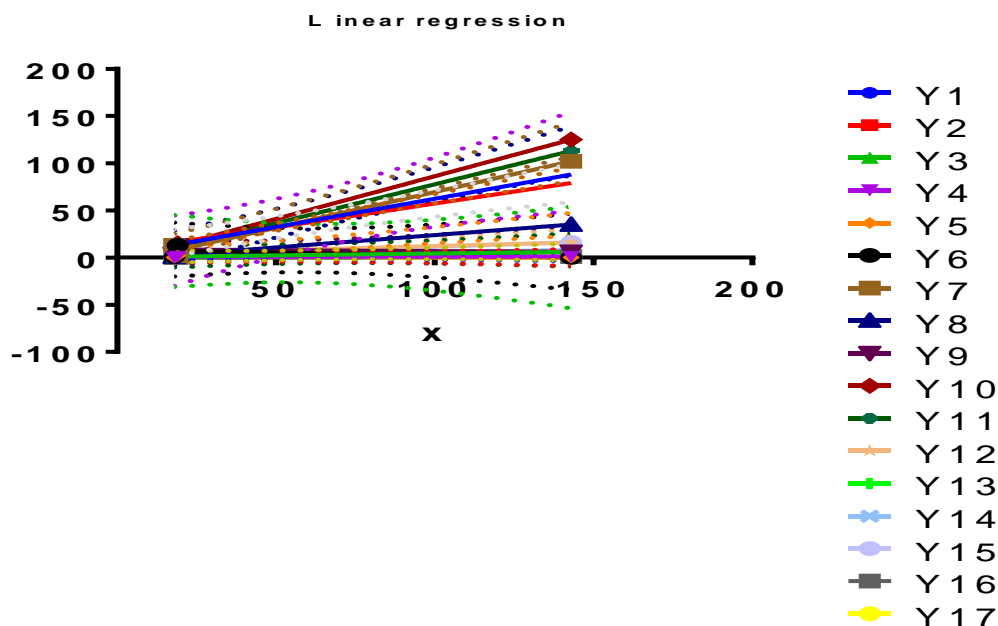
Summary of the Results

Are the slopes equal?

F = 79.0762. DFn=16 DFd=17
P<0.0001

If the overall slopes were identical, there is less than a 0.01% chance of randomly choosing data points with slopes this different. We can conclude that the differences between the slopes are extremely significant. Because the slopes differ so much, it is not possible to test whether the intercepts differ significantly. If we accept the assumptions of linear regression, there is a 95% chance that the 95% confidence interval of the slope contains the true value of the slope, and that the 95% confidence interval for the intercept contains the true value of the intercept. The width of the confidence intervals is determined by the number of data points, their distances from the line, and the spacing of the X values.

Exercise No. 51

Table 67Test chosen: Power of a "not significant" chi-square test comparing two proportions

	N	Proportion "success"
Group 1 (Pilot Sample)	54	0.99
Group 2 (Present Sample)	362	0.9

Table 68of Trade-Offs: For any power chosen, this table shows the risk reduction that can be detected at Significance level (alpha) = 0.05 (two-tailed)

Risk reduction	Power (%)
-0.1644	99
-0.1361	95
-0.1215	**90**
-0.1117	85
-0.1040	80
-0.0975	75
-0.0916	70
-0.0812	60
-0.0715	50
-0.0620	40
-0.0519	30
-0.0402	20
-0.0242	10

Summary: Our experiment had a 90% power to detect a risk reduction of -0.1215 with a significance level (alpha) of 0.05 (two-tailed).

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Exercise No. 52

Table 69 Test chosen: Power of a "not significant" unpaired *t* test of a completed experiment

We had earlier conducted a pilot study with a sample size of 54 respondents and the SD and Variance is used in the present example to understand the concept more clearly. We can compare the means of both the groups i.e., the pilot and present study to determine the power of a completed experiment. Following are the observations that would be useful in arriving at any conclusion.

Pilot Study observations:

Basing on the data provided in the above table; I calculated the SD and the variance as given below:
Mean of the Pilot sample = 50 (Average)
Pilot Sample SD = 39.18377
Total no. of respondents = 54
Population SD = 27
Variance of Population = 729
Significance level (alpha) = 0.05 (two-tailed)

Test chosen: Power of a "not significant" unpaired *t* test

Samples	N	SD
Pilot sample	54	39.18
Present sample	362	64.41

Explanation for 95% power as given by the stat

Assume that the true difference between means is 32.67. Now imagine that we perform many experiments, with the same sample size used in the completed experiment. Due to random sampling, the difference between means equals 32.67 in every experiment. Instead, we'll find that the difference between means will be greater than 32.67 in about half the experiments, and less than 32.67 in the other half.

In 95% (the power) of those experiments, the P value will be less than 0.05 (two-tailed) so the results will be deemed "statistically significant". In the remaining 5% of the experiments, the P value will be greater than 0.05 (two-tailed) so the results will be deemed "not statistically significant" and we will have made a Type II (beta) error.

Table 70 of Trade-offs:

For any power you choose, this table shows the difference between means that can be detected.

Delta	Power (%)
38.84	99
32.67	**95**
29.37	90
27.15	85
25.39	80
23.87	75
22.51	70
20.06	60

17.76	50
15.47	40
13.01	30
10.13	20
6.15	10

Summary: The completed experiment had a 95% power to detect a difference between means of 32.67 with a significance level (alpha) of 0.05 (two-tailed).

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Exercise No. 53

To determine the power of a completed experiment

Test chosen: Power of a "not significant" one-sample t test (to compare a mean with a hypothetical value)
N: 362
SD: 64.41
Significance level (alpha) = 0.05 (two-tailed)

Explanation for 90% power

Table 71 of Trade-Offs: For any power chosen, this table shows the difference between the group mean and hypothetical mean that can be detected.

Delta	Power (%)
14.51	99
12.20	95
10.97	**90**
10.14	85
9.48	80

8.92	75
8.41	70
7.49	60
6.64	50
5.78	40
4.86	30
3.79	20
2.30	10

Summary: Our experiment had a 90% power to detect a difference between the group mean and hypothetical mean of 10.97 with a significance level (alpha) of 0.05 (two-tailed).

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Exercise No. 54

To determine the power of the completed experiment

Test chosen: Power of a "not significant" paired t *test*
Number of pairs: 217 (180 CPS + 37 PS)
SD of the differences: 31.0656
Significance level (alpha) = 0.05 (two-tailed)

Table 72of trade-offs: For any power chosen, this table shows the smallest average difference between pairs that can be detected.

Delta	Power (%)
9.04	99
7.60	95
6.84	**90**
6.32	85
5.91	80
5.56	75
5.24	70
4.67	60

4.13	50
3.60	40
3.03	30
2.36	20
1.43	10

Summary: Our experiment had a 90% power to detect a smallest average difference between pairs of 6.84 with a significance level (alpha) of 0.05 (two-tailed).

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Exercise No.55

To choose a sample size for a future experiment

Test chosen: Sample size for paired *t* test
Expected SD of each group = 28.391
Expected correlation (r) among pairs = 0.2904
Significance level (alpha) = 0.05 (two-tailed)
CPS + PS sample pairs = 217

Detailed explanation:

You requested a detailed explanation for N = 217 and power = 90%.

Assume that the true difference between means is 7.46. Now imagine that you perform many experiments, with N = 217 per group in each experiment. Due to random sampling, you won't find that the difference between means equals 7.46 in every experiment. Instead, you'll find that the difference between means will be greater than 7.46 in about half the experiments, and less than 7.46 in the other half.

In 90% (the power) of those experiments, the P value will be less than 0.05 (two-tailed) so the results will be deemed "statistically significant". In the remaining 10% of the experiments, the difference between means will be deemed "not statistically significant", so you will have made a Type II (beta) error.

Alternative explanation using confidence intervals:

If you perform many experiments with N = 217 in each group, you expect that in 90% of these experiments (the power), the width of the 95% confidence interval for the difference between means will extend 7.46 or less in each direction. In the remaining 10% of the experiments, you will expect the 95% confidence interval to be wider than that.

Table 73 of Trade-offs: For any combination of sample size (N) and power, this table shows the difference between means that can be detected**:** A sample size of 217 (of two groups) has a 90% power to detect a difference between means of 7.46 with a significance level (alpha) of 0.05 (two-tailed).

	Power				
N (# of pairs)	**99%**	**95%**	**90%**	**80%**	**50%**
3	106.49	89.56	80.53	69.60	48.69
4	85.64	72.03	64.77	55.98	39.16
5	73.66	61.95	55.70	48.14	33.68
6	65.63	55.20	49.63	42.90	30.01
7	59.77	50.26	45.20	39.06	27.33
8	55.24	46.46	41.78	36.11	25.26
9	51.61	43.41	39.03	33.74	23.60
10	48.62	40.89	36.77	31.78	22.23
12	43.92	36.94	33.22	28.71	20.08
14	40.37	33.95	30.53	26.39	18.46
16	37.56	31.59	28.40	24.55	17.17
18	35.26	29.66	26.67	23.05	16.13
20	33.35	28.04	25.22	21.80	15.25
25	29.65	24.94	22.42	19.38	13.56
30	26.97	22.68	20.39	17.62	12.33
35	24.90	20.94	18.83	16.27	11.38
40	23.24	19.55	17.58	15.19	10.63
41	22.95	19.30	17.36	15.00	10.49
50	20.73	17.43	15.68	13.55	9.48
54	19.93	16.76	15.07	13.03	9.11
60	18.89	15.89	14.28	12.35	8.64
70	17.46	14.69	13.21	11.41	7.99
80	16.32	13.73	12.34	10.67	7.46
84	15.92	13.39	12.04	10.41	7.28
90	15.37	12.93	11.63	10.05	7.03

100	14.58	12.26	11.02	9.53	6.67
115	13.58	11.42	10.27	8.88	6.21
141	12.26	10.31	9.27	8.01	5.60
150	11.88	9.99	8.98	7.77	5.43
199	10.31	8.67	7.79	6.74	4.71
200	10.28	8.64	7.77	6.72	4.70
217	9.87	8.30	**7.46**	6.45	4.51
221	9.78	8.22	7.39	6.39	4.47
262	8.98	7.55	6.79	5.87	4.10
300	8.39	7.05	6.34	5.48	3.83
362	7.63	6.42	5.77	4.99	3.49
400	7.26	6.10	5.49	4.74	3.32
500	6.49	5.46	4.91	4.24	2.97
1000	4.59	3.86	3.47	3.00	2.10

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Exercise No.56

Indian Workforce Estimates

The following analysis is based on labour force projections derived from theCPS survey and an estimated Total Indian Labour force in 2014:

A) Total weighted distribution of the CPS survey respondents = 652
B) Total respondents in mandated pensions on a weighted scale   = 101
C) Total number of respondents in other salaried groups   = 33
D) Therefore, total unorganized sector respondents are652 less 134= 518
E) Estimated total workforce based on adjusted 2001 Census= 507.71 million[7] persons
F) Estimated total earners in workforce from CPS survey results   = 104.334405million
G) Estimated total workers unsure about their earnings based on
   adjusted 2001 Census   = E-F= 403.375595million
H) Total number of workers who are salaried (organised sector)
   = B+C/A *F = 21.439815million
I) Total number of unorganized sector workers who are earners
   = F-H = 82.89million
J) Total number of unorganized sector workers in India
   = I+G   =**486.27million**

Unemployed workers	403.37 million
Employed workers in unorganized sector	82.89 million
Employed workers in organized sector	21.44 million
Total	507.71 million

Exercise No. 57

Table 74CPS Workforce and their Avocations

Avocations	CPS respondents	% respondents	All-India Estimate
Government Job	14	3.87	19.65 million
Private Job	6	1.66	8.43million
Agricultural Labour	323	89.23	453.03 million
Self-employed	4	1.10	5.58 million
Unemployed	15	4.14	21.02million
Total	362	100.00	507.71million

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[7] The 507.71million estimate is based on the actual population according to the 2001 Census, uprated by 1.8% annual growth factor of the workforce(World Bank Estimate)

Graph 32
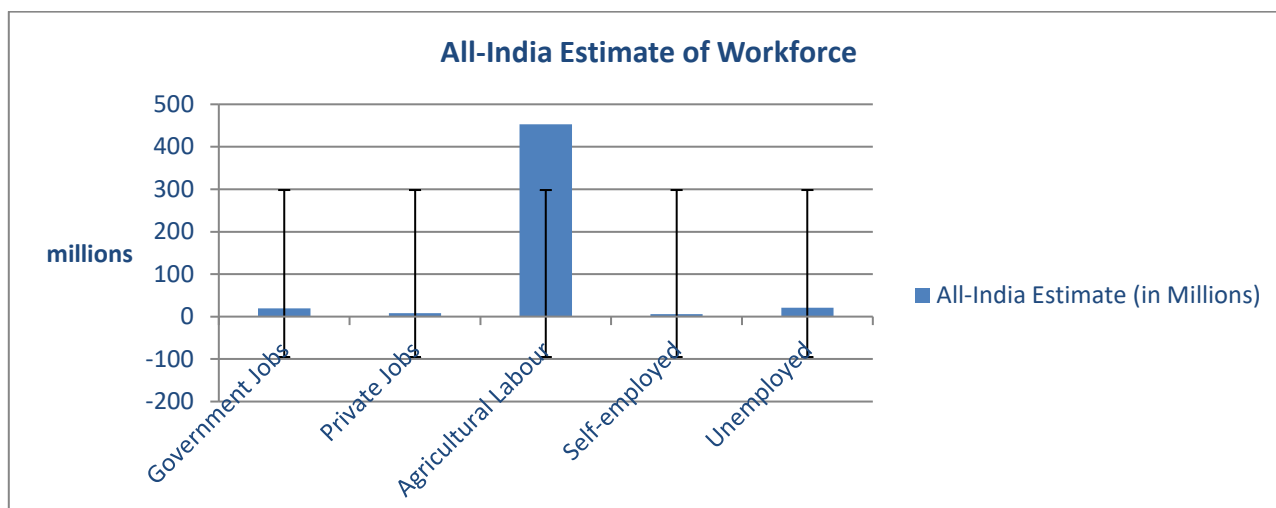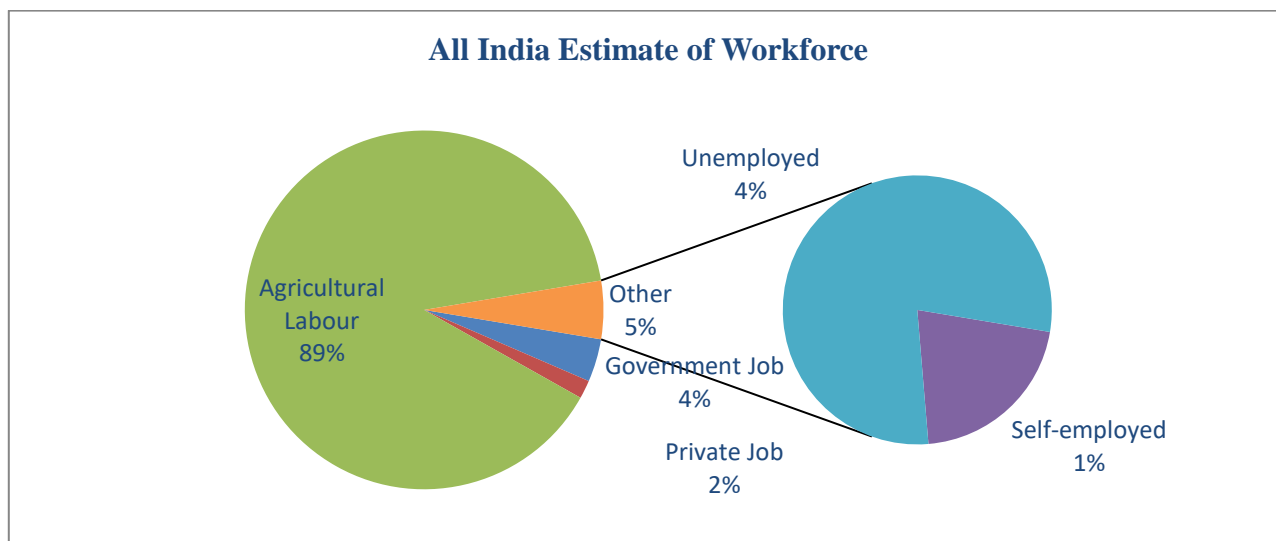
Graph 33 shows error bars of 1standard deviation

Exercise No. 58

Table 75Total Workforce under MGNREGS in India FY 2014-15[8]

Category/workforce	India (In million)	Andhra Pradesh (In million)	Telangana (In Million)	Odisha (In Million)
Total No. of District	658	13	9	30
Total No. of Blocks	6842	655	443	314
Total No. of G.Ps	250111	12996	8866	6232
Total No. of Job Cards	129.20	9.187	6.251	6.54

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[8] Mgnregaweb4.nic.in/netmega/all_lvl_details_dashboard_new.aspx/ visited on D/11.07.2015

Total No. of workers (million)	272.40	20.541	15.542	17.53
Approved Labour Budget (million)	2206.70	195.87	130.87	3.38
Women Person days% with total person days	54.86	5.87	6.10	1.47
Total HHs worked (million)	41.40	3.29	2.46	1.47
Total individuals worked (million)	62.20	5.53	4.39	2.13
%men worked	49.78	45.98	4.28	64.24
% women worked	50.22	54.02	57.16	35.76
Wages in Millions	242148.20	17155.17	11442.31	7155.06
Total expenditure (million)	361583.30	28374.94	16772.95	10713.41

A. Total number of workers covered under MGNREGS   = 272.40 million
B. Total number of workers not covered under MGNREGS as per CPS Research Survey   =235.31 million
C. The total %age of unorganized workers covered under MGNREGS in India= 53.65%
D. Total number of workers eligible for pension under CPS model (A+B) = 507.71 million
E. Total number worked under MGNREGS in FY2014-15   = 62.2 million
F. Total % of the unorganized workers received minimum wages 507.71 minus 62.2 million
                                                        = 12.25%
G. Total expenditure in wage payments for 62.2 million wage-seekers   = Rs.242148.20
H. Total wage payments received by each wage-seeker at an average   = Rs.3893.00

Exercise No.59

Table 76 Annuity Calculator

Withdrawal Amount:	**61.00**	Annual Growth Rate:	**2.2%**
Interval Between Withdrawals:	**Fixed till 60 years**	Length of Annuity:	**20 years**
Starting Principal:	**1000.00**		

Starting Principal: 1000

Annual Growth Rate: 2.2 %

Length of Annuity in Years: 20

Remaining Balance for Term of Annuity

Year	Remaining Balance
1	939.00
2	898.66
3	857.42
4	815.29
5	772.22
6	728.21
7	683.23
8	637.26
9	590.28
10	542.26
11	493.19
12	443.04
13	391.78
14	339.40
15	285.87
16	231.15
17	175.24
18	118.09
19	59.69
20	0.00

Read more: http://www.bankrate.com/calculators/insurance/annuity-calculator.aspx#ixzz3gaTjUSta
Follow us: @Bankrate on Twitter | Bankrate on Facebook/ dt/22.07.2015

Table No. 77 Age-group vs Average Annuity for the group

Age-Group (in years)	Aggregated Contribution Amount till the age of 60 years (K=Rs.1000)	Average Contribution amount for the Age-group (K=Rs.1000)	Average Annuity For a Period of 20 Years (inRs.)	CPS and both CPS + PS opting Respondents as per proposed CPS Model	Personal Savings opting Respondents as per proposed CPS Model	Indifferent towards the questionnaire	Expected %age to be above and below the National Poverty Line
18-28	320-420K	370K	**22570**	22	1	11	**95.92%+of PL**
28-38	220-320K	270K	**16770**	58	3	8	**45.57%+of PL**
38-48	120-220K	170K	**10370**	88	6	16	**9.98%BPL**
48-58	120-20K	70K	**4620**	48	8	10	**59.89%BPL**
58-68	20K	20K	**1220**	44	17	3	**89.41%BPL**
68-78	0	0	**0**	14	2	3	**100%BPL**

The Graph 34 showing the amount of annuity vs age-groups with linear trend line with the equation and squared r value

$y = -4721.4x + 25783$
$R^2 = 0.9592$
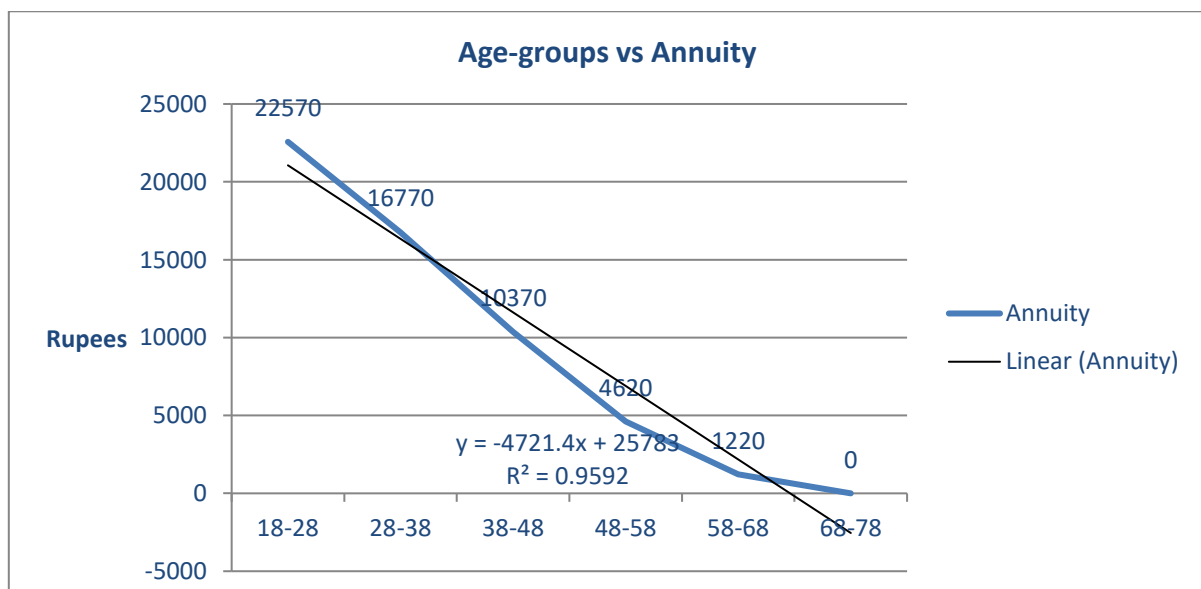
Graph 35 Age-Group vs Income level in the Old-age
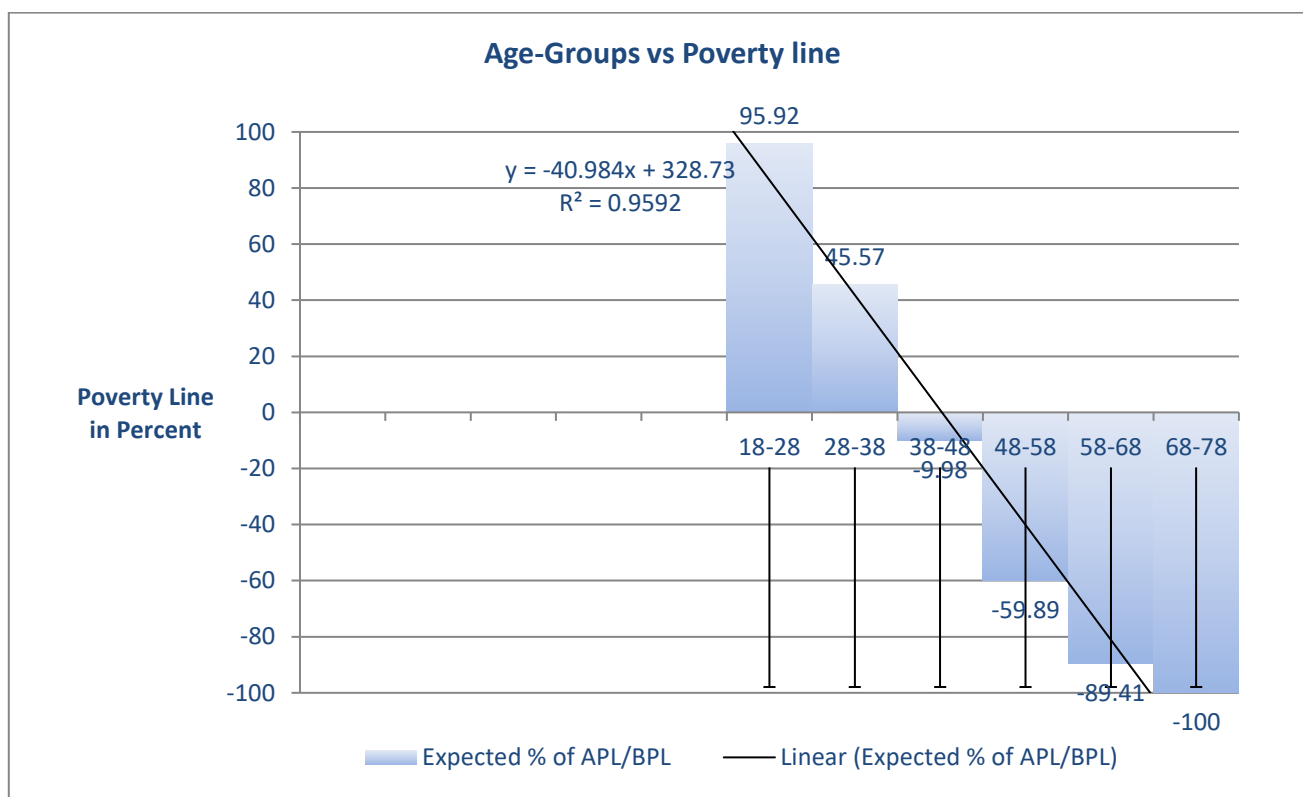
The vertical error bars with standard deviation of 1.0% is displayed in minus direction

Table No. 78 Age-groups with regard to the pension preferences (Rows divided by the grand total)

Age-group	CPS respondents plus B (CPS+PS) opting respondents	%age of CPS respondents	PS respondents	%age of PS respondents	Indifferent	%age Indifferent	Total	Total %
18-28	22	6.07734	5	0.27624	11	3.03867	38	9.39226
28-38	58	16.02209	2	0.82872	8	2.20994	68	19.06077
38-48	88	24.30939	5	1.65745	16	4.41988	109	30.38674
48-58	48	13.25966	7	2.20994	10	2.76243	65	18.23204
58-68	44	12.15469	14	4.69613	3	0.82872	61	17.67955
68-78	14	3.86740	4	0.55248	3	0.82872	21	5.24861
Total	274	75.69057	37	10.22096	51	14.08836	362	99.99997

Table No. 79 Scenario of the Age–groups vs Estimate in millions of the Indian Workforce with respect to the National Poverty Line once absorbed into the proposed model

Age-groups	APL/BPL	CPS + B (in millions)	PS (in millions)	Indifferent (in millions)	Total (in millions)
18-28	95.92%+of PL	30.85353	1.40127	15.42422	47.68412
28-38	45.57%+of PL	81.34529	4.20383	11.21531	96.76952
38-48	9.98%BPL	123.41922	8.41275	22.43570	154.27276
48-58	59.89%BPL	67.31726	11.21531	14.02295	92.56568
58-68	89.41%BPL	61.70707	23.84206	4.20383	89.75805
68-78	100%BPL	19.63314	2.80255	4.20383	26.64462
Total	28.45% APL	384.285699	51.89253	71.52618	507.69473
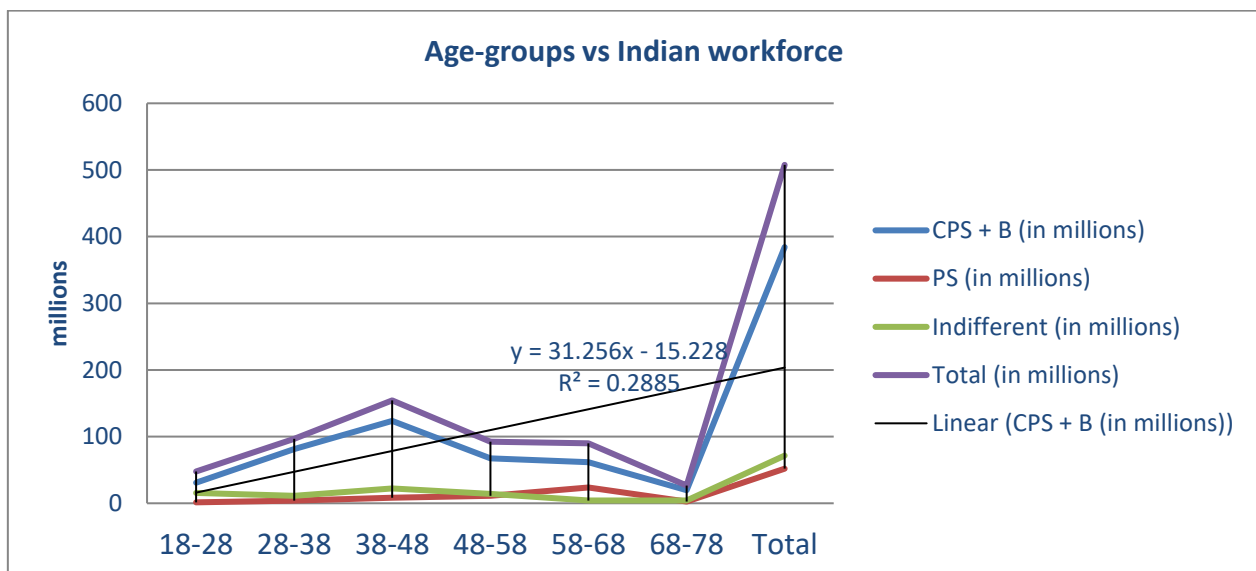
Graph 36 showing Indian workforce across different age-groups with the regression trend equation

Table 80 Life-Cycle Option Asset Allocation

Years in Age	Growth Assets (%)	Debt Assets (%)
23	88.09	11.91
33	64.28	35.72
35	69.08	30.92
39	50.07	49.93
43	40.47	59.53
47	30.87	69.13
53	16.66	83.34
55	11.86	88.14
60	4.76	95.24

Graph 37 showing the Recommended Life-Cycle Option of Investment
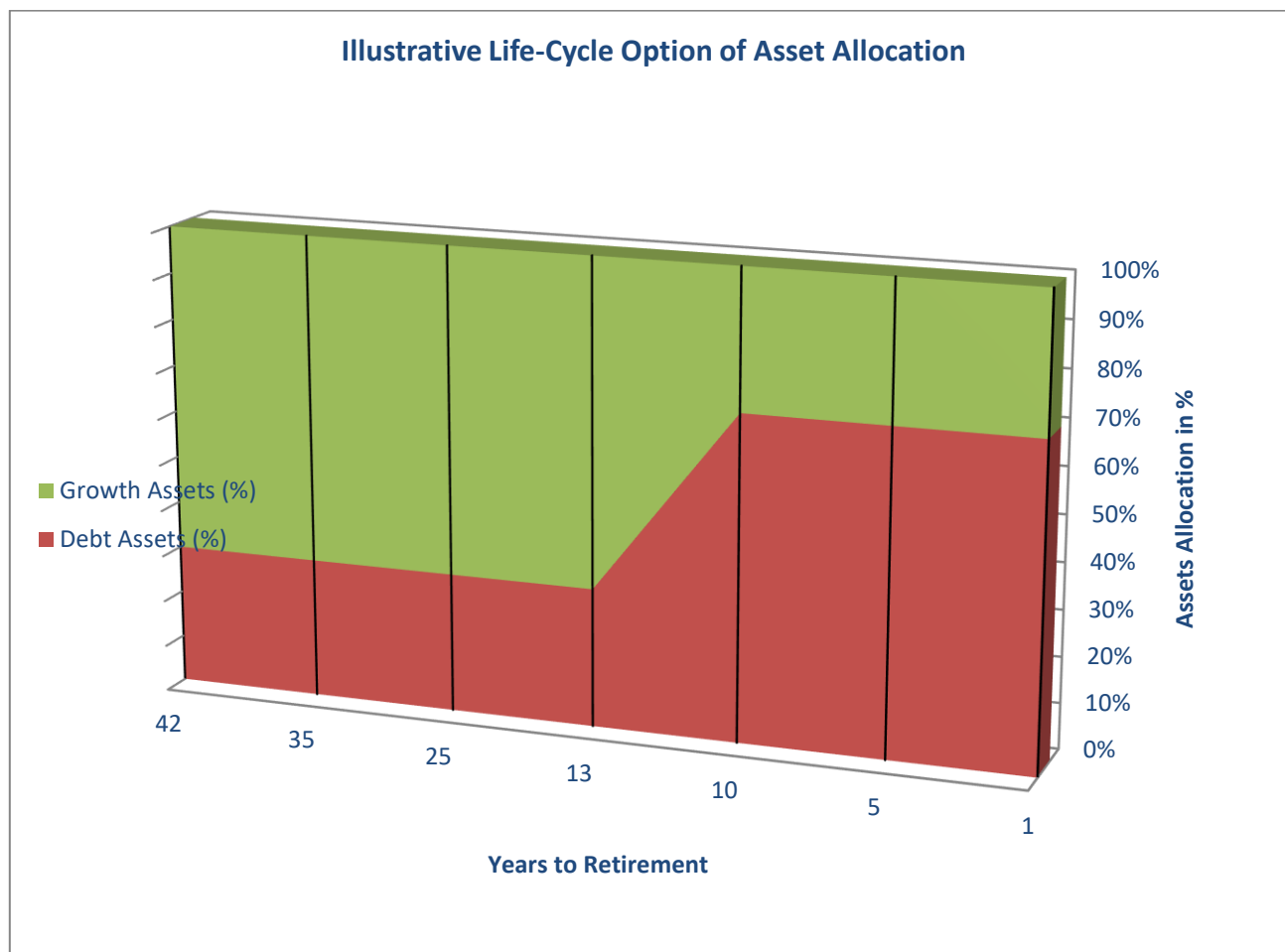
Exercise No. 60

Table No. 81 Illustrative contribution of 10% of the wages earned per annum by the wage-seekers under MGNREGS as Group Pension Policy-Holders.

A SSS Group of MGNREGS	For 100% wages earned , 10% of the contribution in Rs./p.a	For 75% wages earned, 10% of the contribution in Rs./p.a	For 50% wages earned, 10% of the contribution in Rs./p.a	For25% wages earned, 10% of the contribution in Rs./p.a
10 members or 2 house-holds	3300	2475	1650	825
20 members or 4 house-holds	6600	4950	3300	1650

Graph 38 shows the annual percent of the wages earned by the SSS group under MGNREGS and the contribution amount per annum
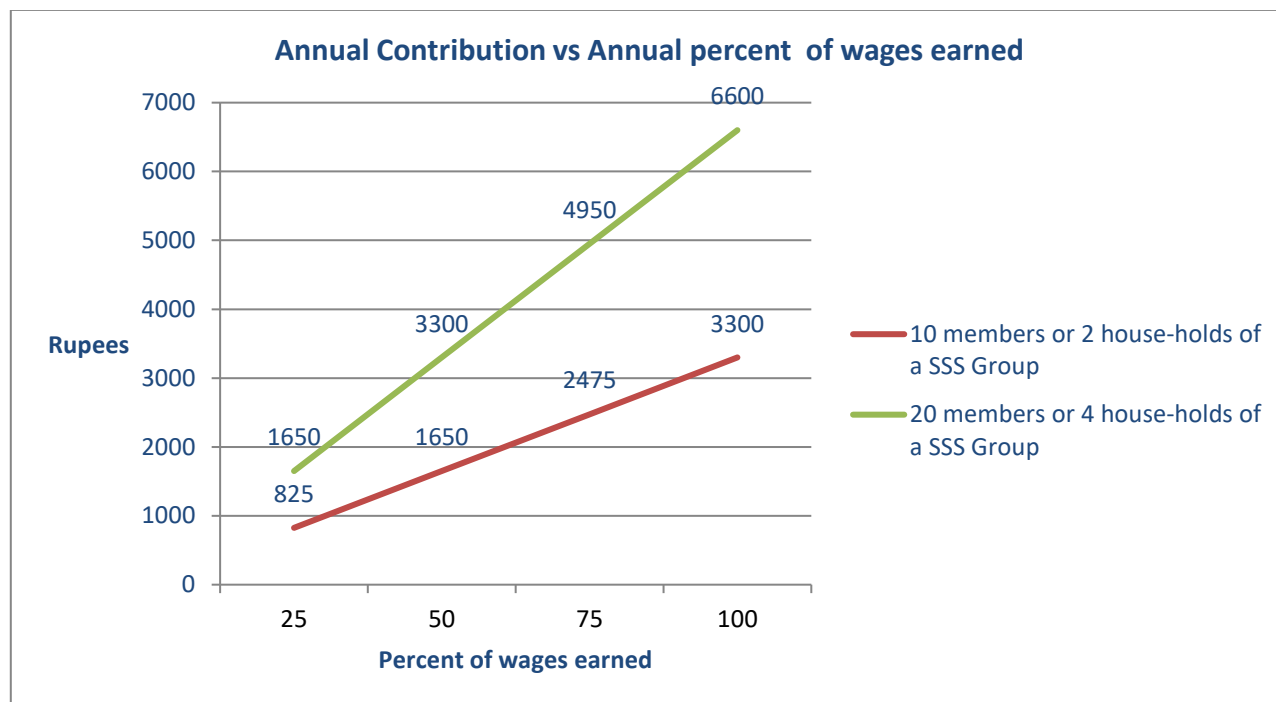
Table No.82 Annuity of Ten years at a Growth Rate of 2.5% per annum to the Group-Pension Policy-Holders contributing at a rate of 10% under MGNREGS

Years of Investment of the SSS Group (4 HHs)	Harvested amount of the SSS group earning 100% wages	Annuity for 100% wages earned p.a	Harvested amount of the SSS group earning 75% wages	Annuity for 75% wages earned p.a	Harvested amount of the SSS group earning 50% wages	Annuity for 50% wages earned p.a	Harvested amount of the SSS group earning 25% wages	Annuity for 25% wages earned p.a
35	231000	25750.02	173250	19312.52	115500	12875.01	57750	6437.51
25	165000	18392.87	123750	13794.66	82500	9196.44	41250	4598.22
15	99000	11035.72	74250	8276.79	49500	5517.86	24750	2758.93
10	66000	7357.15	49500	5517.86	33000	3678.57	16500	1839.29

Graph 39 shows the annuity calculated for the contribution amount for the years of investment
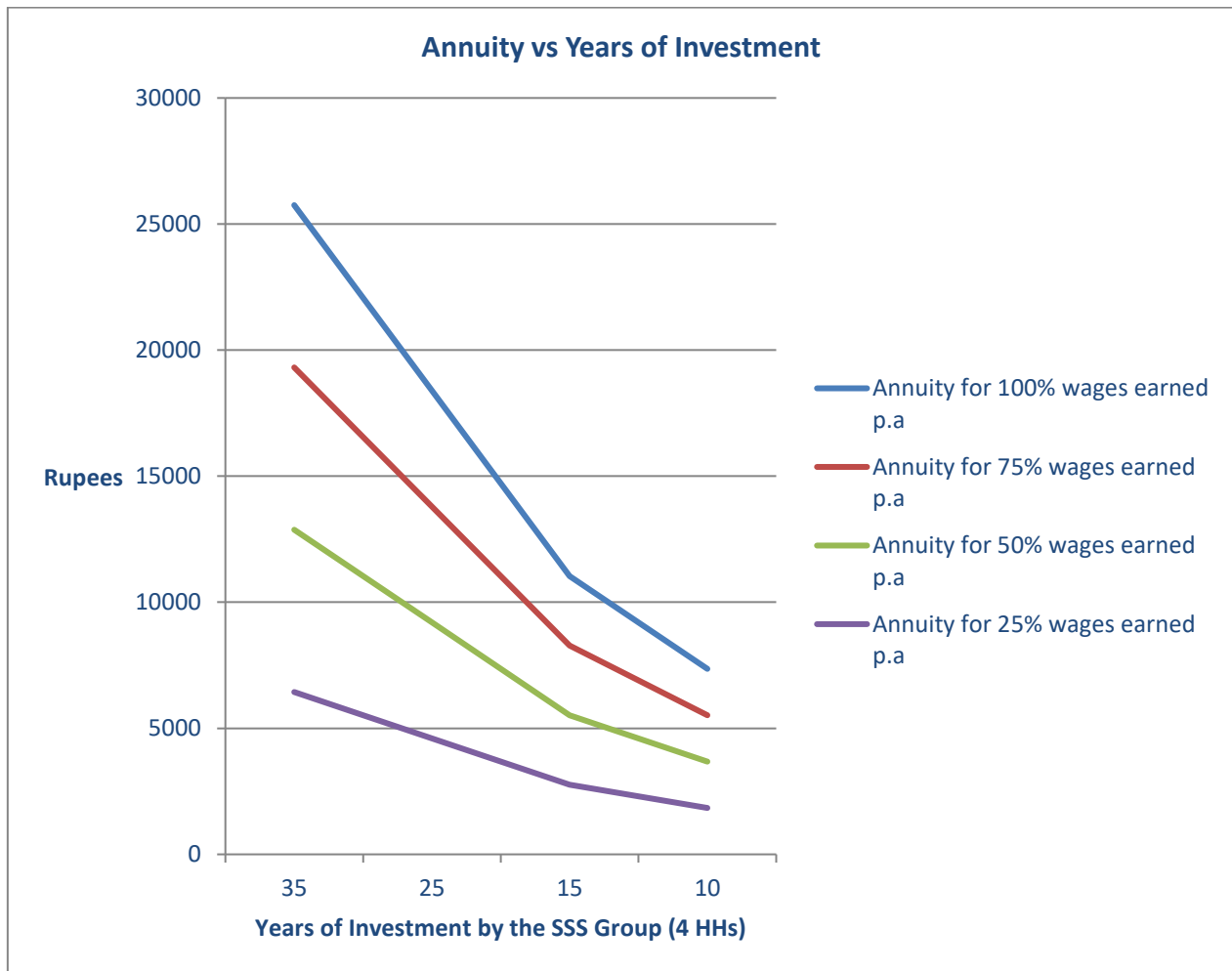
Exercise 61

Data taken from the MGNREGS Government website[9]

Table 83Funds Position

Total Budget	34000
Central Release	32139
Total Expenditure	36047.68
Labour Expenditure	24202.07
Material expenditure	9411.8
Administrative Expenditure	2433.81

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[9] MGNREGS Website visited 10.08.2015

Graph 40 Funds Position

Total Expenditure in MGNREGS 2014-15

Amount in Cr

- Total Budget: 34000
- Central Release: 32139
- Total Expenditure: 36047.68
- Labour Expenditure: 24202.07
- Material expenditure: 9411.8
- Administrative Expenditure: 2433.81
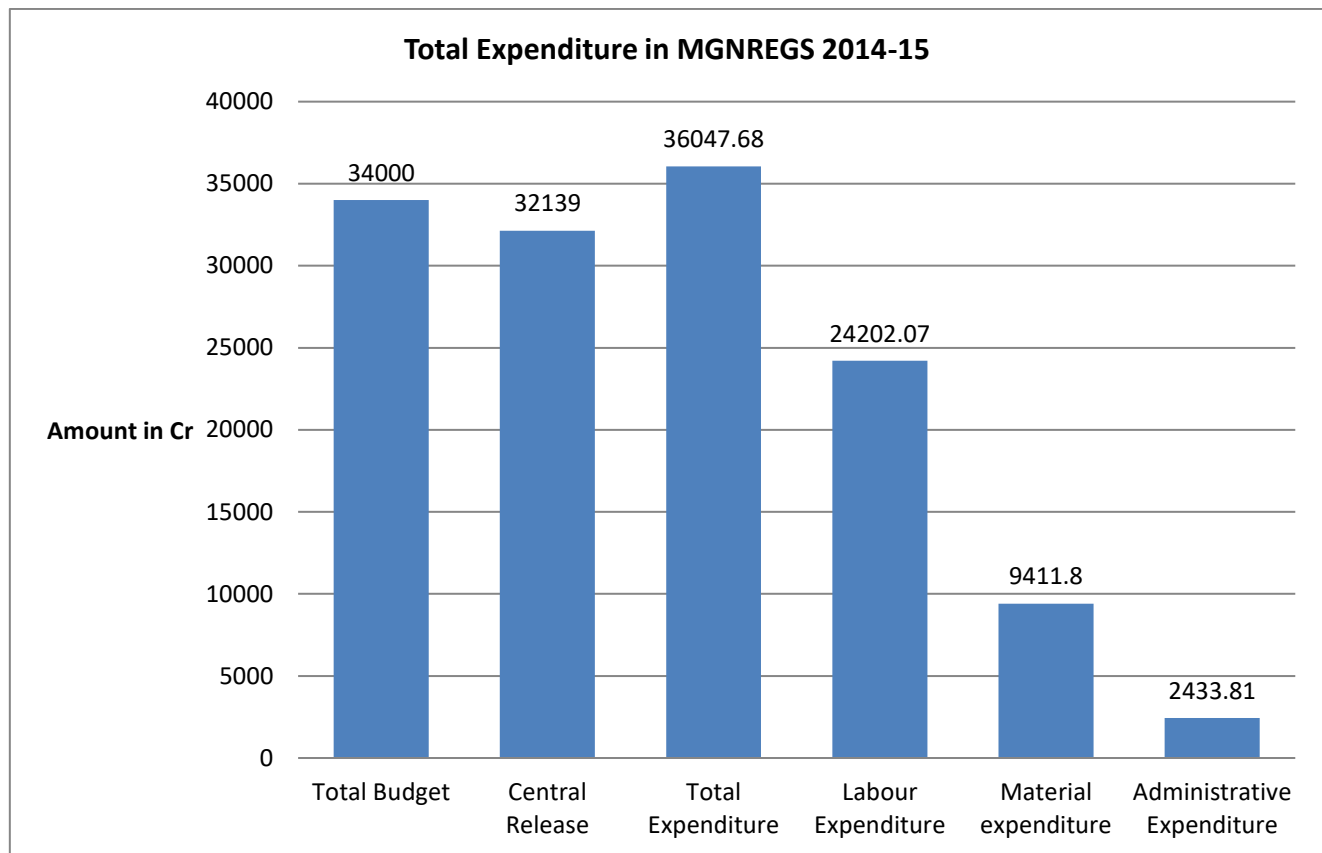
Table No. 83 Households (HHs) and Employment in MGNREGS (2014-15)[10]

States	HHs Registered for Employment	Persons Registered Employment	HHs Demanded Employment	% HHs Demanded Employment	persons demanded employment	% of persons demanded employment	HHs Offered Employment	% HHs Offered Employment	Persons offered employment	% persons offered employment	HHs Provided Employment	% HHs provided Employment	Persons provided employment	% persons provided employment
A.P	915 112 2	2052 9267	3693 362	40.3 5	665 358 1	32.4 1	3677 565	40. 18	66 23 16 3	32. 26	3294 086	35.99	5547 479	27.02
Odi sha	651 126 2	1749 5660	1692 658	25.9 9	259 023 7	14.8 0	1691 486	25. 97	25 88 00	14. 79	1467 859	22.54	2125 008	12.14

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[10] http:164.100.129.6/net nrega/citizen_html/demregister.aspx/ visited 10.08.2015

									5					
Telangana	6223225	15564360	2910114	46.76	5737977	36.86	2901729	46.62	5718654	36.74	2458932	39.51	4394566	28.23
All-India Total	129496172	275043196	46504188	35.91	73156500	26.59	46416378	35.84	72946604	26.52	41395093	31.96	62198311	22.61

Graph No. 41 House-holds and persons provided employment under MGNREGS 2014

Employment at the State and All-India Level
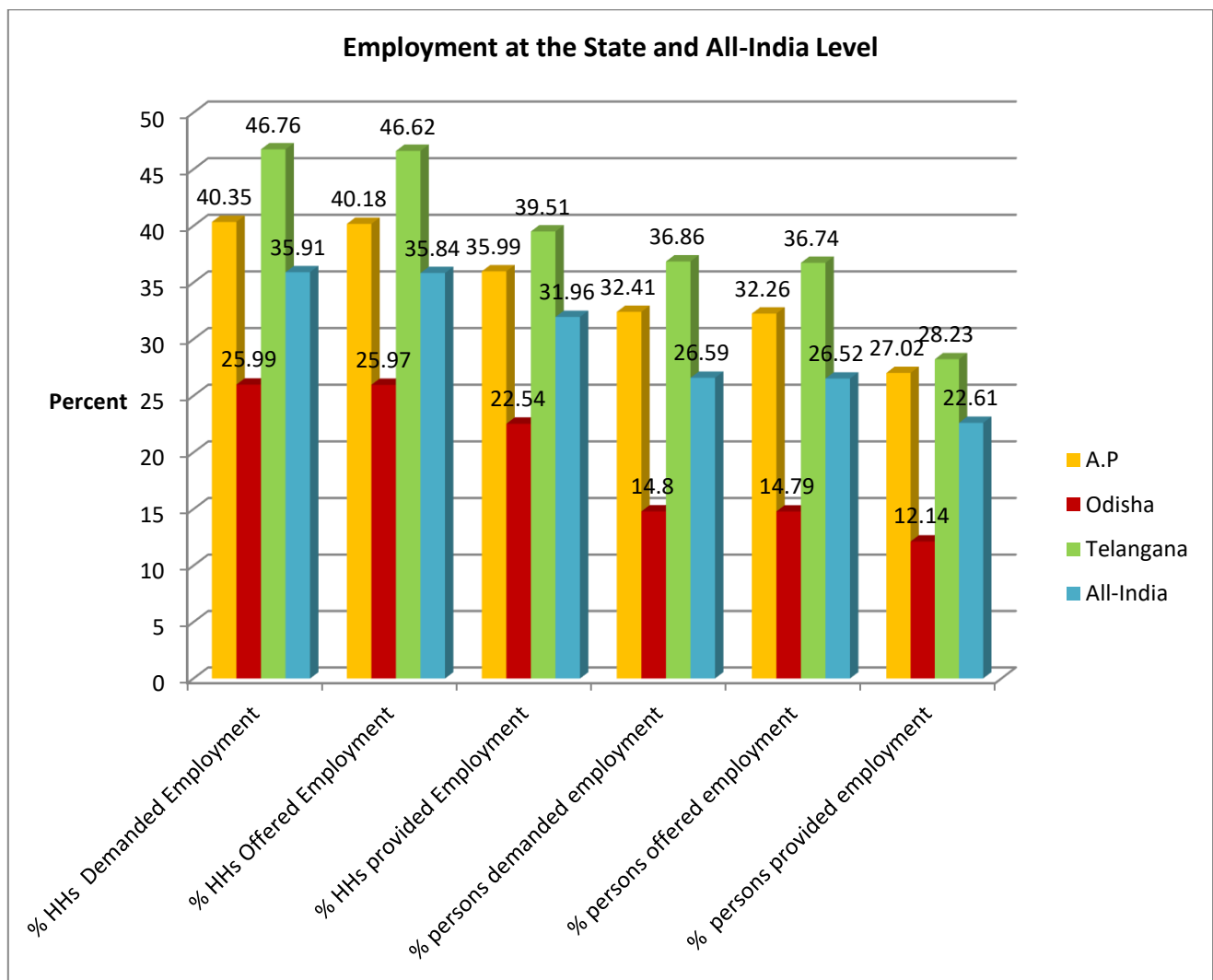
Graph 43 MGNREGS Employments at the All- India Level

Number of House-Holds vs Employment Details
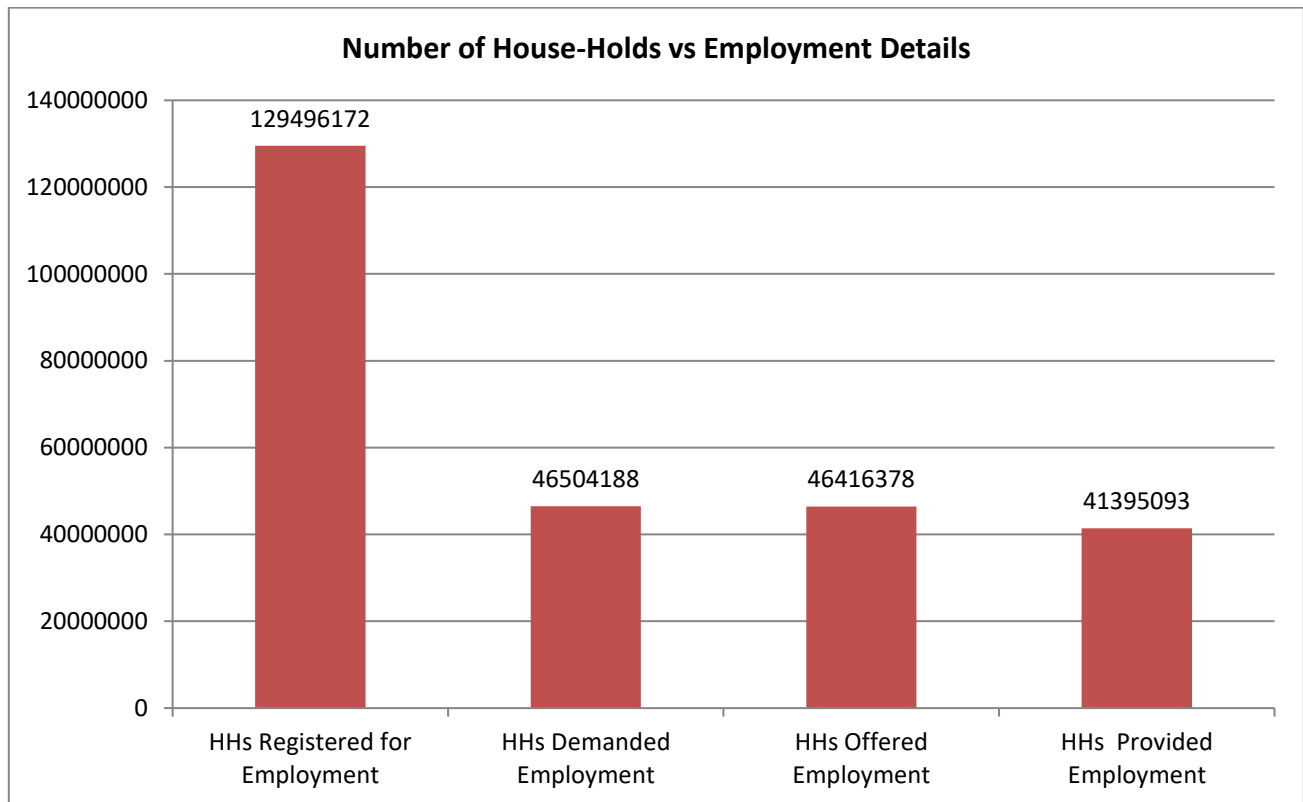
Graph 44 Persons Employed under MGNREGS (2014-15)

All-India Employments under MGNREGS (2014-15)
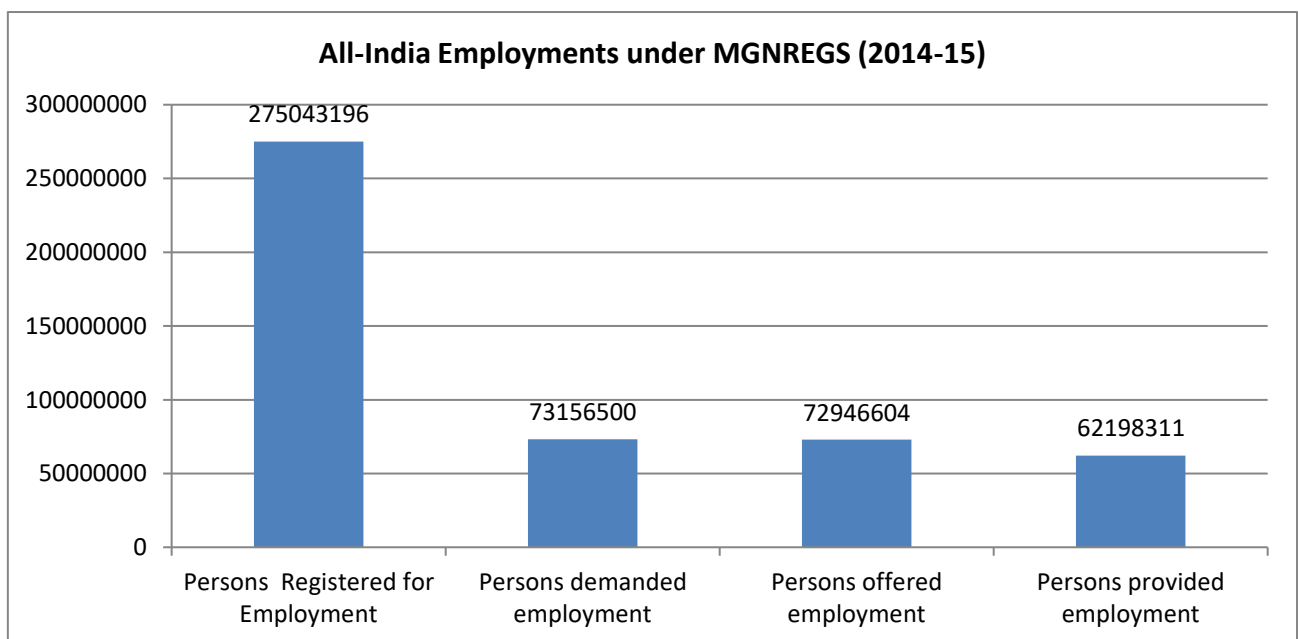
Table No. 84 Average Wage Paid Pattern during the FY2014-15

State	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
A.P	112	118	115	106	121	129	133	136	123	119	119	119
Odisha	162	161	162	163	164	164	164	163	162	160	159	159
Telangana	114	112	108	103	118	125	128	122	135	137	124	131

Graph 45 Showing Patterns of Wages Paid in the Financial Year 2014-15
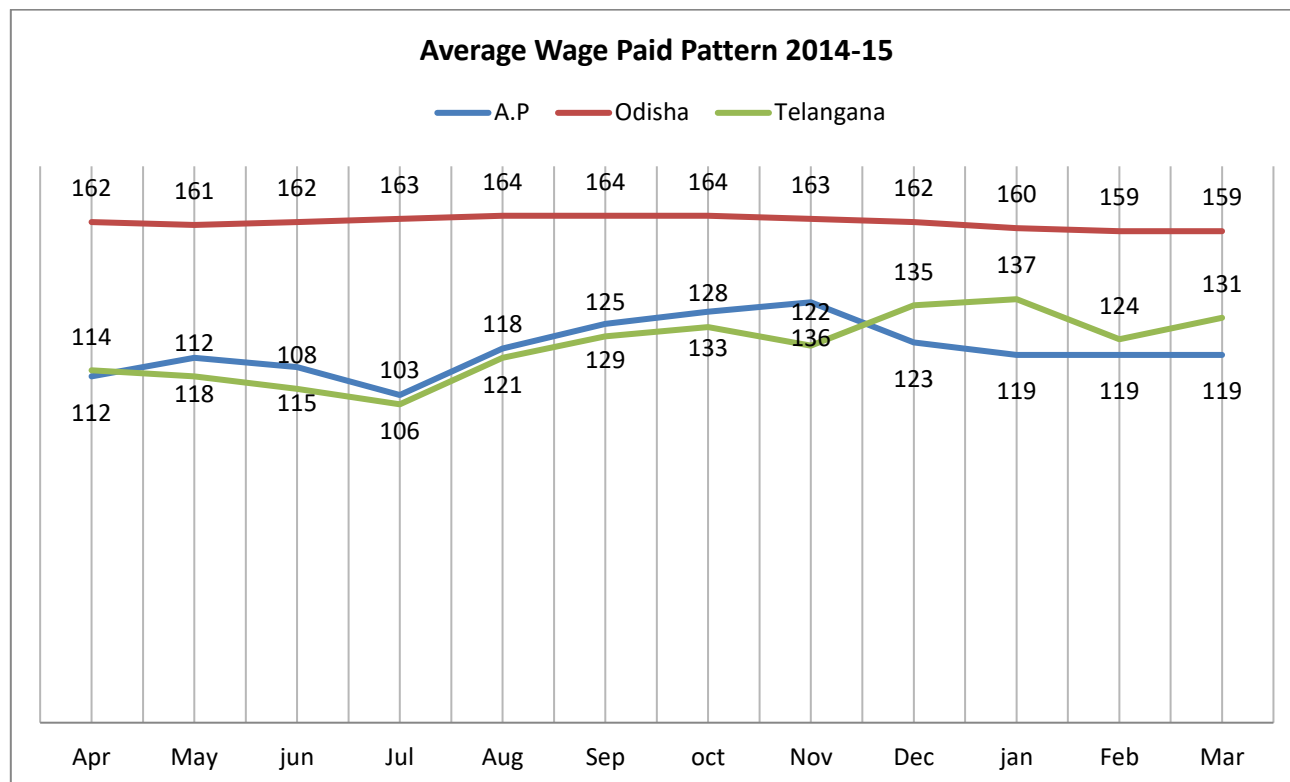
Table No. 85 House-Hold Employment Provided Pattern in FY2014-15

State	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
A.P	1777793	2068883	2148724	1067678	591782	412382	231663	165435	221110	247346	610385	1146450
Odisha	283471	589680	600113	2096007	237171	246540	249665	262302	290628	385396	365969	290448
Telang ana	1259790	1519478	1398102	677467	26.678	225440	154750	129267	150642	223071	581998	836543

Graph 46 showing the Pattern of the House-Holds worked during FY 2014-15
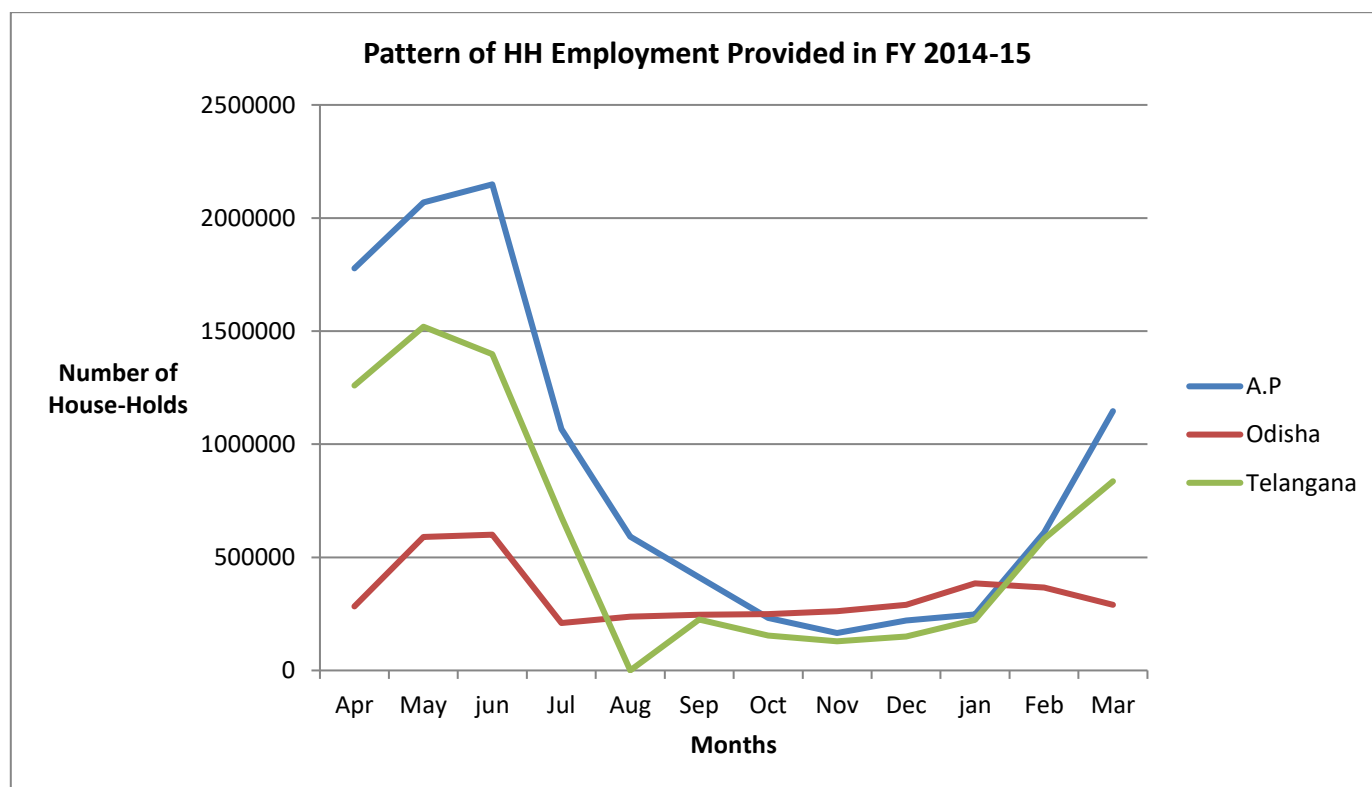
Table No. 86 Caste and Communities Working under MGNREGS

%BC HHs Working	% SC HHs Working	% ST HHs Working	% Minorities HHs Working	% Others HHs Working
42.67	40.61	44.95	32.88	31

Graph No. 47 Caste and Communities working under MGNREGS (2014-15)

Caste and Communities under MGNREGS
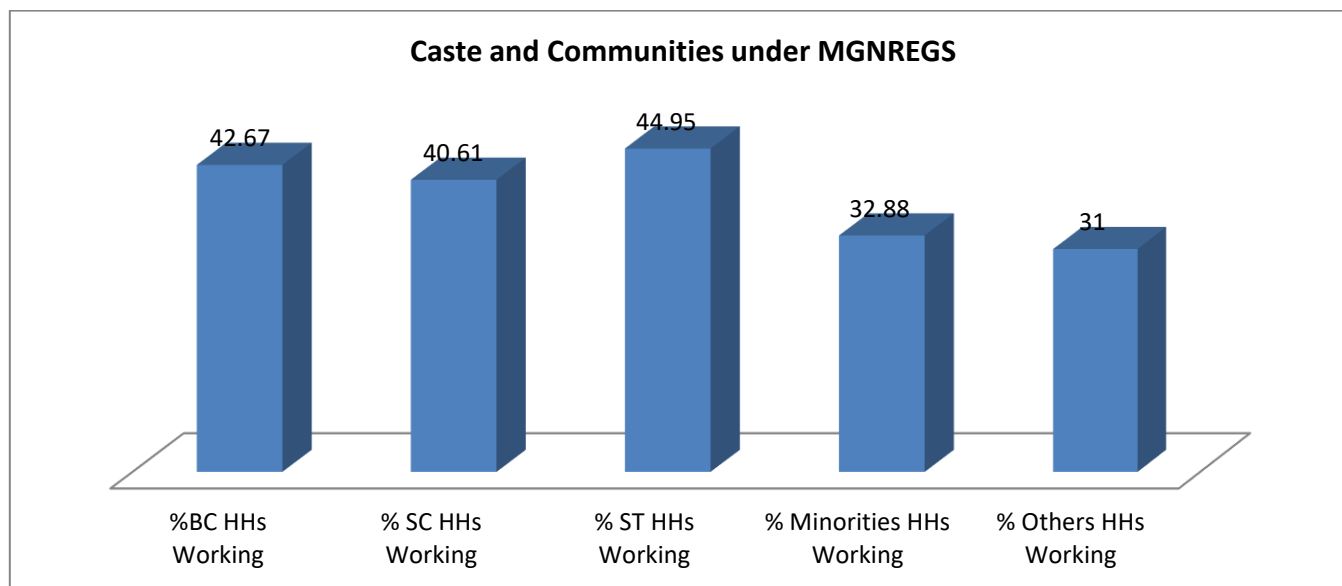
Table No. 87 All-India SHGs and Disabled workers' Participation in MGNREGS

Registered SHGs	SHGs working	SHG working %	Registered Disabled workers	Disabled persons working	Disabled working %
773574	336541	44	194164	75181	39

Graph48 showing the participation of SHGs and Disabled workers in MGNREGS 2014

All-India SHG and Disabled working in MGNREGS
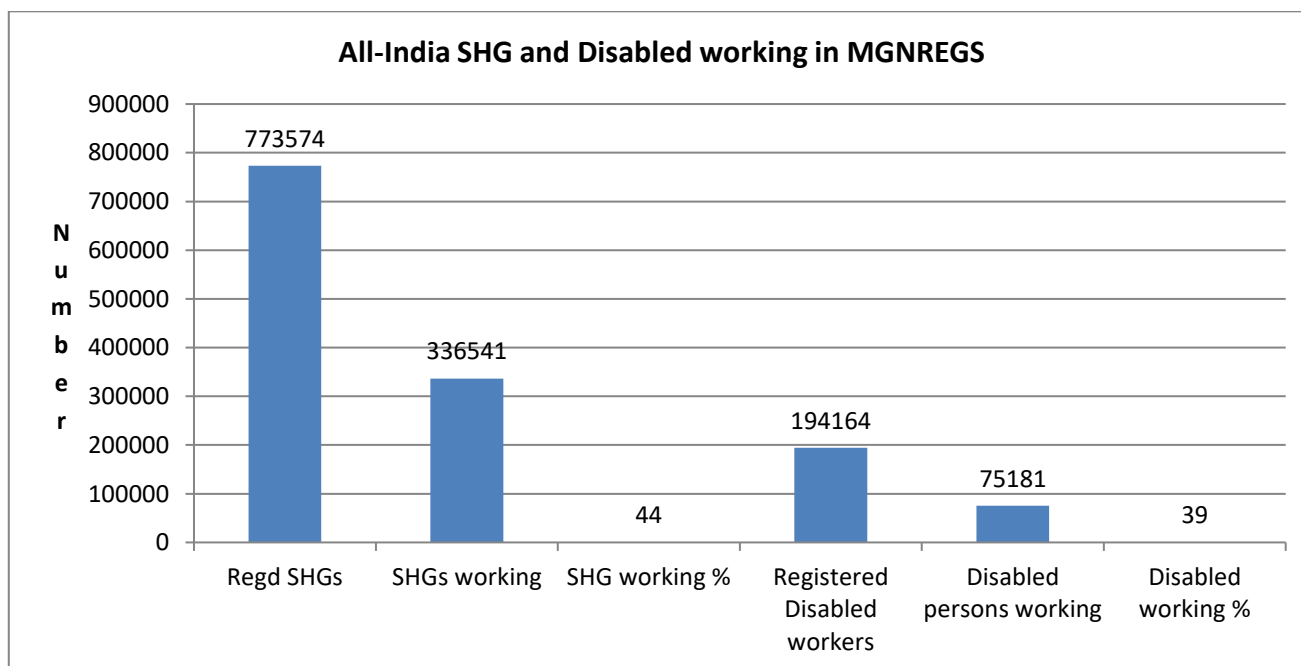
Exercise No.62[11]

The UK's NEST Scheme: Target Achievement of Compulsory Enrolment of Informal Workers for Pensions by their Employers

Table No. 88 Year-wise achievement of compulsory automatic enrolment

Year	Informal Workers Automatically Enrolled into NEST (in millions)
2015	5.2
2014	3
2013	1
2012	Inception year

Graph No. 49 showing the total enrolment since the inception of the NEST

Informal Workers Enrolled for Pensions

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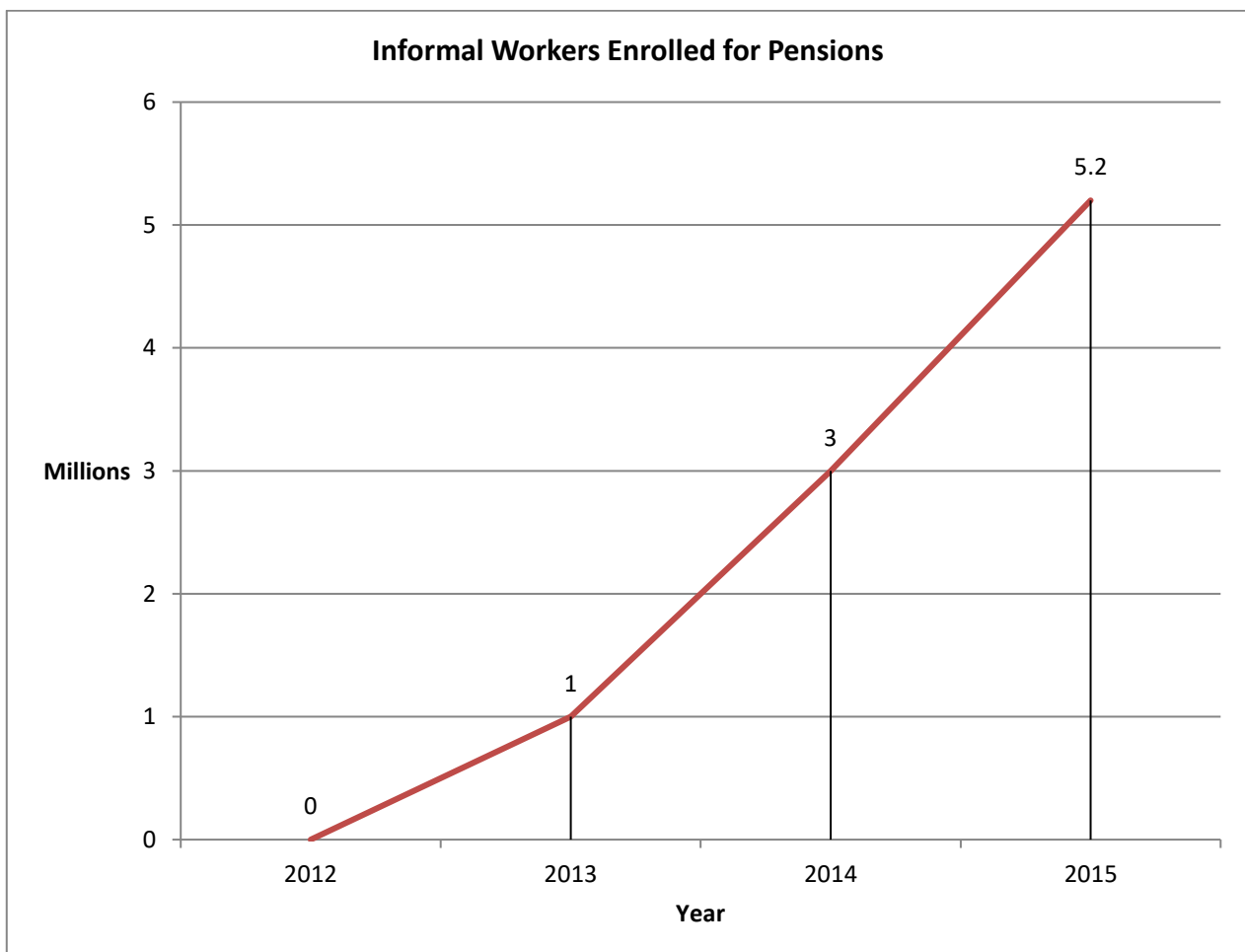
[11] Automatic enrolment commentary analysis April 2014- March 2015,p.5 in www. UK NEST.org

Table No. 89 Employers and the percent achievement of enrolment (in millions)

Year	Large Organizations	Medium-Sized	Small & Micro-Employers	Total
2015	3.848 (74%)	1.3(25%)	0.052(1%)	5.2

Graph 50 shows the employer's participation in enrolling theiremployees/workers in the NEST

Total enrolment of the Eligible Job-holders by the end of 2015
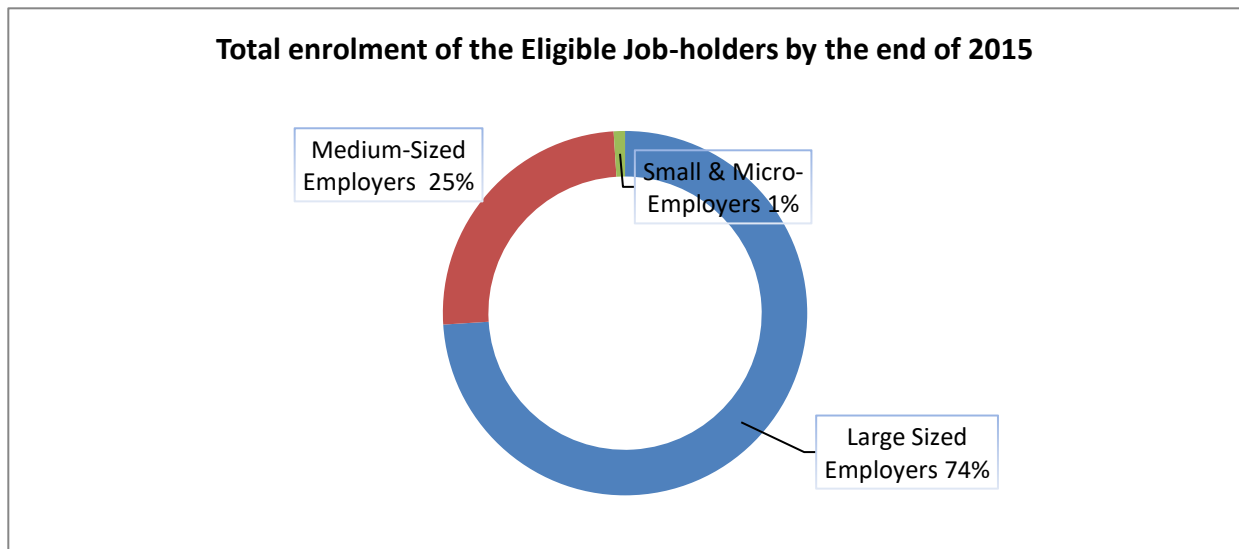
Table No.90shows increase in percent of enrolment of informal workers in the NEST

Employers	Increase in percent of enrolment since inception
Large Sized	14
Medium-Sized &Small & Micro-sized	60
Ineligible Workforce (under 22 years and above pension age)	26

Graph 51 percent increase in worker's enrolment since the inception of the scheme

Increase in percent of enrolment 2012-15

Large-Sized
Employers
14%

Medium- & Micro-
sized Employers
60%

Ineligible workers
26%
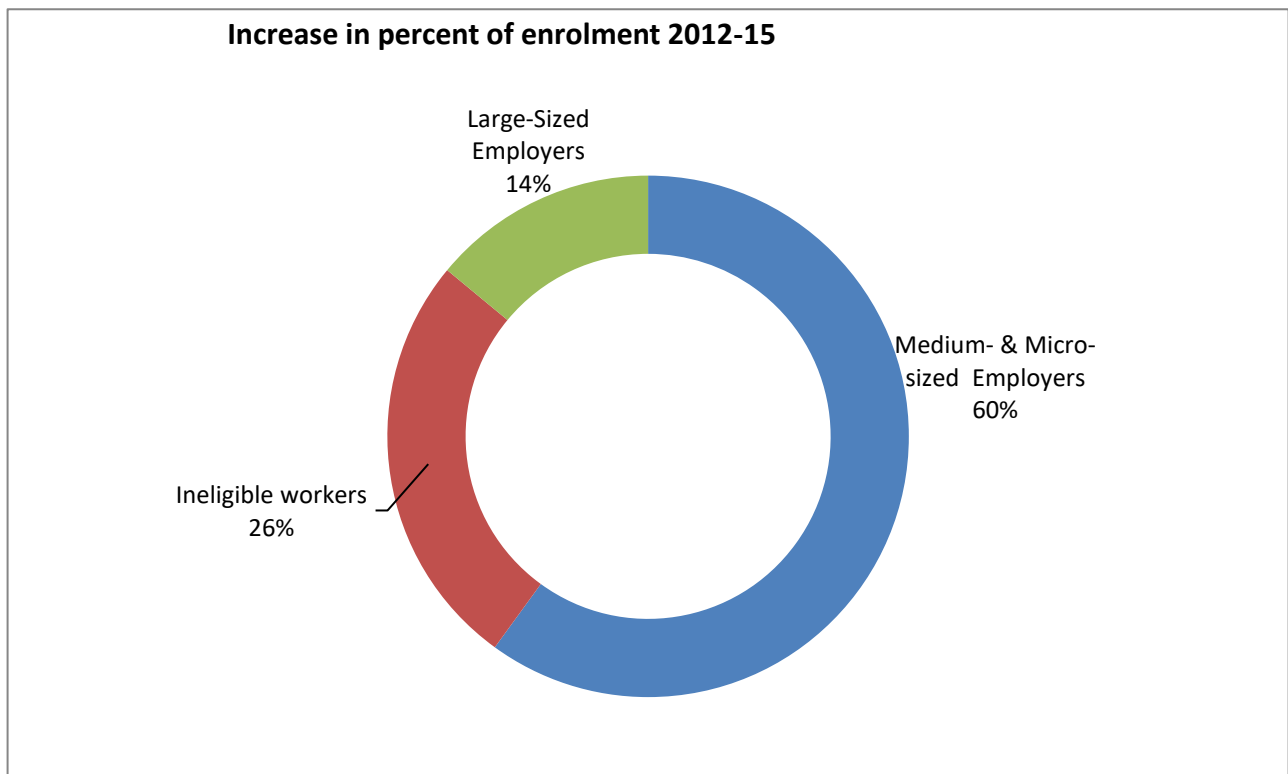
QUANTITATIVE RESEARCH ANALYSIS

The Broad Objective of the Research was to,

1. Develop a Model of Contributory Pension Scheme(CPS)of old-age income security to the unorganized sector;
2. While doing so, the idea was to develop a suitable strategy that will facilitate maximum participation in the proposed CPS model by the the unorganized sector; and
3. Assist service providersto offer CPS to the wage-seekers in unorganized sector initially through MGNREGS - a government implemented work scheme to the rural labor in India.

This obviously involved some specific tasks such as:

1. Drawing on the results of the data survey, and regional and international experiences, examining the existing pension reforms internationally i.e. in the UK and India; to propose a sustainable pension scheme that could address the needs of the unorganized sector in India; provide detailed facilities of recommended pension product scheme including specifications as to the software, accounting, reporting, yield which falls within the purview of the existing PFRDA, POPs, MGNREGS and NOAPS with Swavalambhan in place in many of the States in India;
2. Recommend a system of CPS to the unorganized sector workers with the regulatorysystem of PFRDA todeliver thé pension product scheme;
3. Recommend specific incentives for instance, 'work-place pension' to promote participation in the proposed pension schemes;
4. Create public awareness with the existing outreach of MGNREGS in the rural areas;
5. Digital public service centres like Mee-Seva Centres to provide the web-facility with simple calculations that could enable subscribers in the instant case, the wage-seekers of the MGNREGS to calculate benefits etc.; and
6. The model that should include assessment as to the benefits from the stand-point of theNational Poverty Line .

The research analysis is arranged in order to,

1. Briefly cover the existing situation of pensions to the unorganized sector workers in India;
2. Outline the broad design features that are recommended for the accumulation of contributions;
3. Consider investment strategies for larger amounts including a need for a default scheme as is existing in the CPS for the organized sector workers;
4. Discuss various ancillary benefits in conjunction with other government-sponsored schemes;
5. The Zero-Cost environment for the unorganized sector workers and the fee and others to be met from the pension fund profits by the PFRDA and POPs; and
6. The retirement outcomes and the options open to be exercised by the unorganized sector workers as members of the proposed model.
7. A comparative analysis of the predictive variables for possible inclusion in the proposed model such as those from the existing pension model in the UK and elsewhere in the world.

Research survey collected a range of quantitative and qualitative data

This research survey collected a range of quantitative and qualitative data that includes:

1. The degree to which they are actively planning towards retirement;
2. The degree of acceptability to the individual features of the proposed model;
3. The unorganized sector workers' retirement expectations in terms of the percentage of contribution from the government' side;
4. The willingness of the unorganized sector workers to contribute form the government sponsored schemes towards their retirement pots.
5. Their financial planning attributes in terms of attitudes to risk vs return factor savings;
6. The degree to which they either seek or rely on advice in taking financial decisions that is, their reliance on financial banks, SHGs or insurance companies;
7. Whether retirement planning should be considered at the earliest date in one's life and if they have not thought of retirement savings as yet then, at what age they should start an effort towards it.
8. The degree of their financial and educational levels (alternatively literacy levels) and other related life patterns;
9. Finally, the important question as to the willingness to participate in the CPS by the unorganized sector workers in India.

Process of modeling

The entire process of modeling a contributory pension scheme to the unorganized sector workers involved various combination of techniques such as,

1. Descriptive modeling ,
2. Predictive modeling and
3. Exploratory modeling .

Descriptive modeling was done using a cluster technique that involved categorical data consisting of distinct groups with multiple characteristics. In doing so, use of detailed summary statistics, parallel coordinates and cluster plots was made. Predictive modeling was done with the help of predictive analytical techniques like linear regression, decision trees and logistic regression tests. Linear regression tests allowed to find the nature and accuracy of the linearity (if any) between the response variable and the set of predictor variables and to estimate numerical predictions such as the amount of contribution to the pension pot (policy premium) or percent investment in specific pension outcomes. Decision trees on the other hand, created a hierarchy of partitions based upon a given set of rules applicable to each observation in a tree-like fashion to construct a model with the target variables such as, to buy into a CPS or not, investing in the capital markets for higher returns or not, etc. The decision at each level of the tree was used to enable building an appropriate model. Logistic regressionwas used to predict the probability of occurrence of an event by using a binary variable like yes or no, 0 or 1 etc. It was used to depict a model on the basis of binary responses that follow a non-linear trend of risk and return e.g. high-risk and high return, medium-risk and medium return or low risk and low return. Exploratory modeling involving a series of exercises was taken to include identification of target outliers or their removal if not consistent with the modeling process, investigation of different predictor variables influencing the response variable and in the initial phase of modeling at least

understanding the linearity among them. The base-line model thus created was further refined by suitably adding new variables by making comparisons with the other existing models of pension to the unorganized sector workers. Further exploration of the model was achieved by evaluating the goodness of fit or applying chi-square tests etc. Finally, the predictive analytical method further helped in building the best model of contributory pension to the unorganized sector workers in India. Conventionally speaking, in order to analyticallyvisualize the data, the graphics werecommonly used such as histograms, bar-charts, box-plots that show trends and patterns especially involving large volumes of data.

So, the entire process of modeling involved model creation, refinement and comparison to create visualizations for deeper exploration of outcomes from a large volume of the survey data. The proposed model of pension to the unorganized sector workers provides a data-base (quantitative) and predictive analysis (qualitative) for better a decision-making that should necessarily involve policy-scientists, business analysts and policy-makers for a proper fruition on the subject. The Business Intelligence Analysis in addition can provide further solutions on Hadoop clusters, SAS servers or relational data base systems.

Clubbing demand-driven pension preference with the public policy to meet the socio-economic needs

The proposed model focuses on a mechanism that needs to be modified to meet demand-driven preferences with that of public policy and socio-economic development. The central issue is to strike a balance between the social policy objective and product preference of the public. In this context, a willingness to review the existing employment guarantee scheme is required to enable the enrolled wage-seekers to contribute to their retirement pots; and also to revise and update other related development schemesin this regard.

One might want to experiment to see whether the proposed model is the best possible policy recommendation of the research; in the present instance, pensions to the unorganized sector workers. I used the statistical analyses because the solution can be found only by making use of it and also because the answer is uncertain and ambiguous. Most statistical analyses address the question as to what is the chance of that random variability to result in a larger difference than what can be observed in our experiment.

In carrying out our research, often we make a decision from the data collection and we might want to conclude that the difference is statistically significant or not. This is done in a simple manner. Before running the experiment, we opt for a threshold p-value, called <u>alpha</u> or statistical significance level. After completing the experiment, we calculate p-value and use the following logic:

1) If the p-value is less than or equal to alpha (usually set at 0.05), we conclude that the treatment had a statistically significant effect, and we reject the null-hypothesis that the treatment was effective; and

2) If the p-value is greater than the 'alpha', we conclude that the treatment did not have a statistically significant effect. In other words, we conclude that the data are consistent with the null-hypothesis that the treatment is ineffective.

Ideally, I chose a value of alpha based on the consequence of making a Type I- error concluding that a difference is statistically significant when in fact the treatment is ineffective and the difference was due to random variable. If the consequences of making a Type I error are minor, Ihad set the alpha to a higher value, so that I can get by with fewer subjects.

For the sake of testing the Hypothesis, I had divided the statistical analysis into two sections:

1) The data analysing the income level and the pension saving patterns; and
2) The data that analyses the gender and their preferences to the pension options.

The first section verifies the first part of the Hypothesis i.e.,

"Generally, the Unorganized sector workers is inclined to contribute towards their old-age income security and even for many low-income security countries like India with large informal sectors; it would seem that maintaining a basic layer of non-contributory social pensions represent an affordable option";

and the second section verifies the second part of it that is, by evaluating the choices made by each gender towards their retirement plans. In doing so, I have tried to include the marginalized sections (the socio-economically-disadvantaged and women in the unorganized sector etc.) into pension equations at par with their counterparts in organized sector i.e.,

"for ensuring inclusive growth."

Research experiment conducted in three phases

I have attempted to analyse this piece of research work using the following statistical tools in three phases of the experiment:

A) To choose a sample size and its analysis for the proposed model which includes a preliminary test for the calculation of the sample size;
B) To determine the power of a completed experiment; and
C) To choose a sample size for a future experiment on the subject.

1) The first phase of the experiment tells us about the results and analysis of the data collected and the suitability to Hypothesis-testing. It focuses on the validity of the data collected by verifying its statistical significance at a certain level of confidence interval. I had constructed a statistical hypothesis to check the results at a standard level of significance. Given under are some of the statistical tools that I had used in this research:
   a) Calculation of sample size;
   b) Transform and analyse theoretically;
   c) XY analysis at confidence level of 95% and showing significant digits up to 4 in number;
   d) Linear Regression Test:
      i) Goodness of Fit Curve;
      ii) Runs Test of Linearity; and
      iii) Normality Test of Residuals.
   e) Area under curve;
   f) Column statistics;
   g) Row means with SEM 0r SD;
   h) Computation of Correlation;
   i) Correlation matrix (computation of every pair of Y data);
   j) Computation of non-parametric spearman correlation;

k) P value two-tailed standard.
l) Fraction of total;
m) Column analyses:
   i) T-test and non-parametric tests;
   ii) One-way ANOVA and non-parametric tests;
   iii) Columns statistics;
   iv) Frequency distribution;
   v) Bland-Altman comparison;
   vi) Identify outliers;
n) Grouped analyses:
   i) Two-way ANOVA;
   ii) Row means with SD or SEM;
   iii) Multiple tests – one per row.
   iv) Contingency table analyses:
      (1) Multi-column and row contingency table
      (2) Chi-square and Fisher's Exact test;
      (3) Column statistics;
      (4) Row mean with SD or SEM;
      (5) Fraction of total.
   v) Two rows and two columns contingency table:
      (1) Fisher's exact test or chi-square test of goodness of fit;
      (2) Chi-square test of independence;
      (3) Chi-square test with Yate's corrections;
      (4) Relative risk (with 95% Ci);
      (5) Odds Ratio (with 95% Ci);
      (6) Difference of two proportions (with 95% Ci); and
      (7) Sensitivity specificity etc., with 95% Ci.
o) Parts of whole analyses:
   i) Fraction of total; and
   ii) Compare observed distribution and expected distribution.

B) In order to determine the power of a completed experiment we had conducted the following tests:

   a. To compare two paired means (paired t-test);
   b. To compare two proportions (chi-square); and
   c. To compare a mean with a hypothetical value (one sample t-test);

C) To determine a sample size for a future experiment; we had conducted the following tests:
   a. To compare two paired means (paired t-test);
   b. To compare two proportions (chi-square); and
   c. To compare a mean with a hypothetical value (one sample t-test).

A preliminary test

A Preliminary test for the calculation of the sample size using Two-Sample T-Tests Assuming Equal Variance[12] was run. A calculator was used to get the numeric results for Two-Sample T-Test Assuming Equal Variance where, the alternative Hypothesis: $\delta \neq 0$. A sample size of 172 consisting of two equal groups achieves 90.0062% power to reject the null hypothesis of equal means when the population mean difference is 2.0 with a standard deviation for both groups of 4.0 and with a significance level (alpha) of 0.050 using a two-sided two-sample equal-variance t-test. The result showed a maximum sample size of 376 (188 +188) at 0.01 statistical significance and lambda of 5. Alternatively, a sample size of 266 (133 +133) at 0.05 alpha and lambda 5 can be taken for the research.

Accordingly, I planned a study of a continuous response variable from independent control and experimental subjects with 1 control(s) per experimental subject. In a previous study the response within each subject group was normally distributed with a standard deviation of 2. If the true difference in the experimental and control means is 0.483, we will need to study <u>361</u> experimental subjects and 361 control subjects to be able to reject the null hypothesis that the population means of the experimental and control groups are equal with probability (power) <u>0.9</u>. The Type I error probability associated with this test of this null hypothesis is <u>0.05.</u>

To cross-check our analysis, I had used a GraphpadStatmate[13] calculator extensively (and where a mention of it is not made, it is implied by the style of data presented) to justify the chosen sample size and also to evaluate some of the experiments that resulted in a "not-significant" result. To start with, I had followed a prescribed formula to choose a sample size and it will be clear in the subsequent sections of the research analysis that the result holds good with the theoretical model of this Thesis.

One might ask the need to calculate the sample size? One might as well collect data and continue with the experiments until one gets the statistically significant result. Statisticians say that there is a likelihood of obtaining a "significant" result even if the null hypothesis were true at a relatively higher significance level than 5%; therefore, the sequential approach of choosing sample sizes and running checks side by side till one achieves a statistical significance is said to be invalid. Therefore, it is always advisable to calculate the sample size beforehand to avoid any errors like the Type I and II in the experiment.

Calculation of the Exact Sample Size

As can be seen from the preliminary tests carried above, many experiments were likewise carried out with fewer subjects with the expectation to detect small differences because, an under-powered study is a wasted effort for the very reason that its policy implications and recommendations are likely to go undetected. Even if, such research throws substantial light on its outcome, the study would still have only a little chance of finding a "statistically significant" effect. Therefore, it is the most prioritized method in any research plan to

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[12] PS software to calculate a power sample size downloaded from the Biostatistics software of Vanderwolt University D/ 09-07-2015 06:52:57 PM

    [13]We determined sample size using GraphPadStatMate version 2.00 for Windows, GraphPad Software, San Diego California USA, www.graphpad.com/ visited on D/25.6.2015.

first calculate an appropriate sample size. Often than not, the required sample depends on the answers to the following questions:

1) How much scatter do we expect?
2) How willing are we to risk reaching a correct conclusion?
3) How big a difference or ratios are we looking for?
4) How much statistical power do we need? Or how sure we are that our study would detect a difference, if it exists based on earlier studies on the subject?

The first question requires that we calculate the estimate of standard deviation to compute the number of subjects that we will need for our study.

The second question can be answered with our choice of statistical significance. Many social scientists choose 5% statistical significance as the optimal level and it is at this point, the probability value (p-value) is found to be less than 0.05; if we choose a smaller significance level such as 1% then, we will require a higher number of subjects.

The third and fourth questions require us to calculate the actual number of subjects I will need to detect small differences; however, this also requires a large sample size. Therefore, I have made use of Stat mate – a calculator that provides us with a table of comparison to find out the sample size, power and the effect size that I want to detect. Instead of straightaway calculating the sample size, this calculator rather answers the related question, "what information we can learn if, we use N subjects?"[14] In principle,Ihave attempted to make use of this calculator in interpreting and analysing the statistical differences as presented in the subsequent sections and also to determine the power of a completed experiment.

Earlier, I had conducted a pilot study to see whether our hypothesis holds good or not. A simple random sample was picked from Veeraghattam Mandal of Srikakulam District in the State of Andhra Pradesh, India. I wanted to see whether the respondents were willing to contribute towards their retirement years. The findings stated that they are actually willing to participate in the Contributory Pension Scheme. 73% of males and 27% of females voted for the CPS resulting in an absolute 100% preference for the CPS; with this positive note, I started off with my study.

Using a formula, I had also manually calculated an actual sample size in Exercise 2 which comes out to be 180 individuals per State. A total of 362 individuals were interviewed as part of this research survey. At the outlook, the sample allocation appears to under-achieve the allocated number of 540 for all the three States taken together; which is 32.96% (approx.. 33%) less than the allotted target. At this juncture, let me take you to the time of the collection of data; i.e., just before the bifurcation of the erstwhile Andhra Pradesh which would help explain the choice of the sample size and further to justify the achieved target as well.

This has occurred because the fieldwork could not be conducted in the State of Andhra Pradesh which was reeling under civil unrest at the time of the survey. The bifurcation of the State of Andhra Pradesh was in process and immediately thereafter, the emergence of the Telangana State has taken place. Therefore, the

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[14] This approach to sample size calculations is recommended by R. A. Parker and N. G.Berman(American Statistics 57: 166-70, 2003.

data was appropriated to both the separated States and the new emergent State of Telangana showed a deviation of 77.22% from the expected target of the State I proceeded to see if its weighted distribution for each State meets the required sample size or not. If the answer to the question was yes then the achieved sample is good for the experiment otherwise a fresh sample would be required. The following exercise explains the issue better.

Using the same method adopted by the NFHS and the ADB UK Consultants in achieving a weighted sample for each State in India, I have also attempted to construct in the same lines, the weighted distribution of the achieved sample for the selected States.

While, the data that is available in the raw database was to be found as a numeric distribution on allotted samples for each State (separately for urban and rural), for analysis purposes, the data presented in this thesis is based on weighted distribution. For each State or State group, the rural and urban data has been weighted basing on their proportionate share or contribution to the total workforce of India (as per the 2001 Census of India estimates). The achieved sample has been adjusted with the State factor to achieve the weighted sample. The weighted sample comes out to be 652.

 It is evident from the above table that the weighted sample of 652 achieves far above the allocated target of 540 i.e., by 20.74%; therefore, for the purpose of analysis the achieved sample of 362 meets the exact requirement for conducting of this research; as it outweighs the allocated sample by a figure of 112 as is reported here in the Thesis. In other words, I have over-achieved, the allocated sample target by20.74% for all the three States taken together.

In Exercise 8, a calculator[15]was used to view the trade-offs to answer some of the questions such as; how willing amI to risk reaching a correct conclusion and how large a difference in ratio amI looking at, etc. The experimental design applied here is to compare two proportions, for instance, the gender and their preferences to the pension saving patterns and the result was to be tabulated in ratios. What do I expect to find by applying the above tests? I will be comparing two groups, which I will call, 'control' and 'treated'. There are two possible outcomes, which I call "success" and "failure". I will need more subjects when the proportion success in the control group is near 0.50. Therefore, I need to estimate (based on pilot studies or previous data) the proportion of the control subjects whose outcome I expect to be "success". I apply the proportion "success" in the control group to be 0.05; the number of subjects required also depends on whether I expect the treated group to have a higher or lower proportion of success than the control group; so that the treated group will have a higher proportion of "success" than the control group.

The calculator tabulates the treatment effect for various combinations of power and sample size when we are comparing a control and treated group. The calculator displays the effect either in differences between the two groups or in ratio. I tabulated using the calculator to find the effect in ratio. As the sample size depends on the significance level I chose, i.e., I need more subjects at a smaller significance level. Most of the social scientists choose a significance level of 0.05 (a two-tailed) Standard.

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[15]Report created by GraphPadStatMate 2.00.   21-06-2015 05:38:38 PM

Test chosen: Sample size for comparing two proportions where, the expected proportion "success" in the control group = 0.5 and Significance level (alpha) = 0.05 (two-tailed) standard.

A detailed explanation for N = 362 and power = 90% was found using a calculator.

Assuming that the true relative risk is 1.24 (See the table of trade-offs); imagine out of the performed experiments, with N = 362 per group in each experiment, due to random sampling, I would not find the relative risk to be equal to 1.24 in every experiment. Instead, I would find that the relative risk would be greater than 1.24 in about half the experiments, and less than 1.24 in the other half.

In 90% (the power) of those experiments, the P value will be less than 0.05 (two-tailed) so the results will be deemed "statistically significant". In the remaining 10% of the experiments, the relative risk will be deemed "not statistically significant", so you will have made a Type II (beta) error.

Summary: A sample size of 362 has a 90% power to detect a relative risk of 1.24 with a significance level (alpha) of 0.05 (two-sided hypothesis).

In exercise 9, the ratio of the chosen sample comes to 5.4: 2.5: 1 and the total number of respondents are 362 at 95% of confidence interval and at 0.05 level of statistical significance.

In Exercise, if we look at the sample, 52% of the males had voted for the CPS as against 46% of the females. That means 49% of the total sample preferred the CPS which is nothing but the mean (average) of the two groups preferring it. That is, the % males opting the CPS plus the females preferring it divided by the number of groups in the total sample; which comes to 52 + 46 / 2 = 49%. We can infer safely from the above observation that 49% had straightaway given their preference for a CPS to the unorganized sector workers Now, let us look at the percentages of the two groups voting for both the CPS and PS. The proportions given in the two-way relative frequency table for rows shows that roughly 26% of the total sample opted for both the pension saving patterns namely, the CPS and PS. Therefore, we can safely conclude that 75% of the total sample had recommended for the contributory pension scheme to the unorganized sector workers. Likewise, we can arrive at a conclusion that 37% of the total sample wanted to increase their personal savings towards a retirement plan and only 27% of the sample chose not to respond to the questionnaire.

Therefore, my data analysis supports the hypothesis that generally the unorganized sector workers are willing to contribute towards their retirement years and it is also possible to maintain a non-contributory pension layer to them for an inclusive growth looking at their interest in saving money for their future.

Exercise No. 28 shows the difference between group mean and hypothetical mean where N = 362, 90% confidence interval and 0.05 significance level.The Test chosen was with a sample size of 362 for one-sample *t* test where, the Expected SD = 64.40756 and the Significance level (alpha) = 0.05 (two-tailed). Ihad computed a detailed explanation for N = 362 and power = 90%, assuming that the true difference between group mean and hypothetical mean is 10.99. Now imagine that you perform many experiments, with N = 362 in each experiment. Due to random sampling, you won't find that the difference between group mean and hypothetical mean equals 10.99 in every experiment. Instead, you'll find that the difference between

group mean and hypothetical mean will be greater than 10.99 in about half the experiments, and less than 10.99 in the other half.

In 90% (the power) of those experiments, the P value will be less than 0.05 (two-tailed) so the results will be deemed "statistically significant". In the remaining 10% of the experiments, the difference between group mean and hypothetical mean will be deemed "not statistically significant", so you will have made a Type II (beta) error. The sample size of 362 has a 90% power to detect a difference between group mean and hypothetical mean of 10.99 with a significance level (alpha) of 0.05 (two-tailed).

Research findings from the sample

A sample of 362 unorganized workers was selected randomly from three states of India namely, Odisha, Andhra Pradesh and Telangana for the purpose of study of their opinions, observations, knowledge about the Contributory Pension Scheme (CPS) in the country and their willingness to join such a scheme if, it were to be introduced to them. A semi-structured interviewing schedule was prepared to elicit responses relating to the currently running CPS to the organized labor and if they are willing to contribute towards a similar pension scheme and if yes, then how much should be the contribution from their side and how much do they expect from the government to contribute towards their old-age income security. The most important response to be elicited from them was whether they are willing to allow some percent of their earnings from the government payments to be routed into their retirement accounts as a contribution. The idea was to tie-up two important government schemes namely the MGNREGS and the NOAPS, so that the earnings from the MGNREGS may form a contributory pension layer for them and the NOAPS could be fortified with additional returns to them during their retirement age. The concept of Risk vs Return was also tested through the schedule to see to what extent they are prepared to take the risk for higher returns. If they are found to be ready to take a greater risk then, obviously some kind of innovation can be made to evolve a better scheme for greater certainty, longevity and returns. The innovation could bring forth a possibility of arriving at a defined collective pension benefit scheme which may enable a better risk-sharing among the members of the scheme with a least premium possible for a given year.

Table1 provides the sex of the randomly selected sample. It shows that the participation of males in the interviews was maximum as compared to the females. In Andhra Pradesh Pradesh, 69% of the male population participated as compared to 31% of the female population. Likewise, 53% and 51% in the States of Odisha and Telangana were male population and the female population was 47% and 49% respectively; showing almost equal participation in both the States.

Table 2 shows the age-category of the sample. 48.78% of the sample in Telangana was in the age-category of 15-25 years of age showing the maximum participation of the adolescent children and youth in this state in the interview process; as compared to other States where the reported strength of the persons in this age category was only 2% and 7% in Andhra Pradesh and Telangana. The sample of Odisha shows more number of persons in the age group of 36-45 with 30% falling next with 29% of Andhra Pradesh as compared to Telangana with 17.07%. In Telangana the sample shows that there was only 2.43% in the age groups of 56-85 combined together. One can see there is almost consistent percent of people participating in the age-groups from 26-35 to 66-75 in Andhra Pradesh as compared to Odisha where the percent persons participated was meagre above the age of 65; the same is true as regards Telangana where the sample shows

even lesser participation of persons above the age of 55 years. One can infer from the above table that active participation of the people was found to be the most in Andhra Pradesh   where the very aged were also found to be participating in the age group between 66-75. Even though in Odisha only 1% of the sample was found to participate however, their views were found to be very valuable.

Table 3 shows the marital status of the sample collected in the three States. Clearly, the data shows that in two of the three States, the percent of married persons is higher with almost 97% and 98% in Odisha and Andhra Pradesh respectively as compared to Telangana where there is almost equal percentage of participation by both the categories. It shows that the sample selected consists of mature and responsible persons to answer the questionnaire.

Table 4 presents the literacy level of the sample wherein the maximum literate persons were found to be from Telangana with 82.93% literate as compared to the Andhra Pradesh and Odisha regions with 41% and 45% respectively. The sample of Odisha shows that none of them had education above 10th standard; interestingly the other two samples show persons with education up to and above the Degree level.

Financial literacy[16] was found to be very low

The literacy levels of the respondents in the table suggests that there is a general lack of literacytherefore, these groups need to be given an awareness of the pension plans available for them in the existing schemes and benefits of the CPS model. I cannot go without taking notice of the fact that had the participants some kind of literacy early in their life; they would have known the beneficence of the proposed model. In other words, it seems that the responses to the questionnaire were influenced to the extent of the dependency on their families. In the lack of general awareness of the proposed beneficence of the scheme, no matter how good a proposed model be designed, it may not stand well for the benefit of these masses. Thus, for a day labourer in India with meagre resources, financial literacy probably could be said to exist if individuals had an ability to make informed judgments and take effective decisions regarding issues such as household budgeting, small savings schemes in SHGs and access to basic credit facilities and insurance products knowledge of equity markets should not be a criterion of financial literacy for such people. If literacy is taken as a function across all the segments of the unorganized work-force then, the values are found to be compressed towards the lower-end and as such, the functional literacy is a case of concern across all market segments.

In the UK, the financial literacy has been integrated into the National School Curriculum for England under the Learning and Skills Act, 2000 covering the essential aspects of financial knowledge and competency. The major Financial Banks in Scotland are found to run workshops mounting partnerships with the Scottish Centre for Financial Education. In India, through this finding it is important to evolve an education policy that should inculcate the habit of saving in the students of at least the Degree Colleges.

In this context, the Australian Securities and Investments Commission have identified four generic markers financial literacy:

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[16] According to the UK National Foundation for Education Research, Financial Literacy may be defined as," the ability to make informed judgments and to take effective decisions regarding the use and management of money."

1.   The ability of individuals to budget appropriately;
2.   The ability of individuals to identify financial products and services that meet their needs;
3.   The ability to locate reliable and independent financial advice; and
4.   The ability to avoid falling victim to abusive practices and scams.

A national survey was conducted in Australia that revealed low financial literacy levels among people whose profile bears many similarities with the average Indian worker. The similar surveys in other nations like in the UK and USA reflect only one inescapable conclusion that financial illiteracy is not unique to India alone and the remedies for the problem seem to be presently elusive. One oft-suggested approach to fixing the problem is to promote financial literacy as part of the school-curriculum so as to ensure the next generation of investors in becoming more financially erudite.In the present situation, it is advisable to overcome such a limitation by proposing a CPS policy that should allow contributions at source be paid into their retirement pots at an equal rate of 10% till such time that they begin to learn to make financial choices of their own.

Language barrier slightly eroded the efficacy of communication with the respondents

The associated issue is the language barrier that retarded the efficacy to communicate with the unorganized sector workers who appear to have competency in local languages only and an attempt to communicate with them in any other way without a translator proved totally ineffective.

The actively participating SC and ST House-holds (HHs) in MGNREGS

The research analysis tells us that there is some 40.61% of SC HHs and 44.95% of ST HHs are working as registered beneficiaries in the MGNREGS in India. A further issue of interest is to predict from the research survey data the degree to which the scheduled groups may become the members of the proposed model although, in principle, it is immaterial to gauge a person's capacity or willingness to participate in the proposed scheme; as it is envisaged to include all the active wage-seekers into its ambit through a process of compulsory enrolment. Thus the cultural barriers and prejudices may be taken care of with the inclusion of a mandatory provision of enrolment of the actively participating wage-seekers of MGNREGS irrespective of caste or creed.

In Table 5, 92% of the Odisha sample said that they are not saving for their retirement as compared to Andhra Pradesh and Telangana with 76.47% and 87.8% respectively. Saving for the rainy day does not seem to be there in their minds yet.

Table 6 shows that 100% of the Odisha sample said their savings are not CPS, as also 44.34% from the Andhra Pradesh sample and 92.68% of the Telangana.

Table 7 shows the percent of the respondents who said that they are saving enough for their retirement. It is only 38% of the Odisha who said "Yes" as compared to 44.79% and 21.95% of the Andhra Pradesh and Telangana regions respectively.

Table8 poses a question relating to whether they are willing to let the contributions may be paid at source from the government earnings and or that they would increase their personal savings towards the old-age. 64.7% of the Andhra Pradesh sample said that they are willing to contribute through their earnings from government schemes as also 46.34% and 18% of the Telangana and Odisha States. Telangana and Andhra

Pradesh almost equally responded 14.66% and 13.57% respectively to the question by stating that they would like to increase their savings. 53%,16.74% and 9.75% are the responses respectively of Odisha, Andhra Pradesh and Telangana stating that they are willing to sort out the issues by both the methods outlined in the questionnaire. Only 28% from the Odisha sample, 16.74% from the sample of Andhra Pradesh and 29.25% of the Telangana either chose not to respond or said that they do not know.

In Table 9,as expected there was more number of respondentsthat voted for banks as compared to other financial services with 80.48% from Telangana, 62.44% from Andhra Pradesh and 64% from the Odisha region. Interestingly, 29% of Odisha and 23.98% of Andhra Pradesh showed interest in saving their monies in the SHGs and the Telangana sample showed only 2.43% of interest in it. The least preference was shown to the insurance companies with 9.95%, 7% and 4.87% namely, by Andhra Pradesh, Odisha and Telangana respectively. Although conventionally, it is always safe to invest the amounts through a known financial service than letting the SHGs to handle the amount and for that matter, even the funds of the SHGs are handled by the Financial Banks. Therefore, for the purpose of our research, it is convenient to opt for known financial services like the Nationalized Banks and Insurance companies.

Table 10: To a simple question whether they were aware of a CPS in their own country to unorganized labor; only 1% from the Telangana State, 84% from Andhra Pradesh and 15% from the State of Odisha said "yes" and the rest of the sample either said "No" or "Do not know". The people of Andhra Pradesh seem to know more about CPS over the other two States.

Table 11**:** 90% of Odisha sample said that they can contribute to CPS if there were such a scheme available in India; as compared to other states, such as Andhra Pradesh with 43.43% willingness and Telangana with 48.78% which is slightly higher than that of Andhra Pradesh. Other states showed willingness even to contribute up to 20% and 30%; for instance, Telangana with 26.82% for 20% contribution and 7.31% willingness for 30% contribution is remarkably higher than Andhra Pradesh and Odisha wherein, 13.57% and 2.26% of willingness was shown by Andhra Pradesh sample for contributions of 20% and 30% respectively, as compared to Odisha with only 4% and 2% of willingness exhibited towards 20% and 30% contribution.

Table 12: To the question whether they would recommend a CPS for the unorganized labor; 97.56% of Telangana, 77.37% of the Andhra Pradesh State and 70% of the Odisha State said that it is commendable. Only 1% from the Telangana and 22.62% from Andhra Pradeshand 30% of the Odisha said "No".

Table 13: To a question as to what should be the contribution from the Government's side whether it should be equal or more than the beneficiary; 96% of Odisha, 80.54% of Andhra Pradesh and 46.34% from the Telangana said that "they do not know". Out of the rest, 46.34% from Telangana said that the contribution from the government should be more as compared to 2% and 1.35% responses from the Odisha and Andhra Pradesh samples. 18.09% from the Andhra Pradesh region said that the contribution should be equal to the contribution of the beneficiary as compared to 7.31% of Telangana and 2% of Odisha samples.

Table 14**:** Testing the concept of risk versus return: Suppose you have Rs. 1000 with you;
(a)   After one year, your Rs. 1000 may grow up to Rs. 2000, or you get back only Rs. 500.
(b)   After one year, your money may grow to Rs. 1200, or you may lose some of the money and get back Rs.800.

(c)   After one year, your money will grow to Rs. 1050, i.e., you do not lose your deposit at all.

To assess the risk versus return from the respondents, three questions as enlisted above were posed and the responses were recorded as below: 71.94% of Andhra Pradesh and 71% of Odisha said that they were ready to take the risk as outlined in the option 1 of the risk vs. return as compared to Telangana with 9.75% as they want to see their money double after one year of investment. 21.26%, 19.51% and 8% were the responses of Andhra Pradesh, Telangana and Odisha respectively for the second question. Surprisingly, 65.85% of Telangana said they do not want to loose any of their investment and are not going for the 1st and 2nd options. Only 4.87% of the Telangana State said that they do not know.

Sizing the potential CPS pension scheme in India

The size of the CPS pension scheme will be equal to the number of wage-seekers enrolled in the MGNREGS in India. Clearly, all the wage-seekers who are enrolled in the MGNREGS can make a 10% of the contributions from their wage earnings into their individual retirement pots. The crux of the issue is to include those workers who are otherwise unable to contribute in any mandated pension model. This CPS model offers a subsidised contributory scheme that allows the lowest income workers to participate who are otherwise might not be in a position to buy into the scheme and this is only possible if the government were to lower the threshold to facilitate their entry. The transaction costs of the CPS administrative architecture will be borne by the MGNREGS and PFRDA so that the question of the possible rise in its threshold value of costs might be overcome.

As the proposed scheme is purely development in its policy with no commercial orientation therefore, the GOI can consider any overriding policy interventions it may consider to be desirable. The CPS scheme also do not envisage the government to work on any major subsidies for the unorganized sector contributions, the scheme only requires the government to make contributions at par with the beneficiary's contribution which is considered to be very low, i.e., at a rate of 10% of the wage earnings. The total required funds come to around 1% of the National GDP in addition to the total amount of funds already allocated to the rural poor under MGNREGS.

Our survey also indicates that a low percentage of the workers of the unorganized sector in an employer-sponsored superannuation schemes such as the Advocates Death Benefit Scheme and in LIC coverage only reflects that the retirement planning is implicated in their existing savings plans. And in the scarcity of time-series data, it is impossible to estimate the rate of growth in either earnings or household income in any detailed way. Neither it is clear whether improvement in wage earnings will impact across age cohorts or whether significant gains will be more confined to younger, better qualified workers. In this regard, we hope that the MGNREGS would provide a better solution as regards to wage payments to especially the physically disabled workers and other enrolled wage-seekers of limited skills and abilities. The same principle under MGNREGS may apply here also in the proposed scheme to encourage the marginalised sections including the disabled ones to ensure their retention in the proposed scheme. The most important aspect of the proposed scheme is that the voluntary participation of the wage-seekers is coupled with mandatory contribution to their individual retirement pots. One of the advantages of this kind of arrangement would be that the clause of mandatory contribution to pension accounts would safeguard significant proportion of savings potential in the first half of the life-cycle of the beneficiaries who might be

otherwise obligated due to Hindu cultural imperatives with marriage obligations etc., and this necessarily should quarantine against diversion of existing savings towards wasteful expenditures.

From the analysis of the above data, it is evident that many of the workers of the unorganized sector either are not saving or have not thought of saving some amount for their old-age years due to the uncertainties of employments. Only a fraction of the total respondents have endowment policies as against their counterparts in the organized sector. That means, there is a lot of scope for cross-selling opportunities with marketing our proposed model. Instead of expecting them to cut short their expenditures, the idea of the proposed model is to route a certain percentage of their earnings from the government schemes so that an equal contribution can be made from the government's side.

An interesting point to note is that the outreach of the LIC and other private insurers is very limited with regard to pension policies to the unorganized sector workers; therefore, we are of the opinion that this sector will prove to be the best buyers of our model proposed in this Thesis.One can as well evaluate the enormous corpus of funds that builds over a period of time which can be used by the Government in various development activities or in share investments, of course, after meeting the present contingencies of running the pension scheme to the unorganized labour workers. The start-up capital is essential during the initial implementation stage of the proposed model.

And as regards those unorganized sector workers who had already bought the insurance policies could as well be persuaded to switch over to the proposed model in order to get more benefits under various government schemes; or at least, some of their proceeds from the insurance cover that they receive upon maturity should be routed into their retirement pots. If carefully handled, the threat of competition from the private companies can be salvaged. A better streamlined promotional strategy would help retain the public interest in the government-sponsored programs if something like securing their old-age income is aligned with it. The CPS model for the unorganized sector workers may have a greater appeal unlike other investment policies as the funds will be available even in times of under-employment or when the workers do not make sufficient earnings. The CPS model is flexible as to the benefits of loans etc.

Many of the unorganized sector workers do not come under the taxable range as their income falls below the poverty line. It can be seen from the data that income generally increases, with age and the reason as to why it happens so, is not clear. However, one plausible reason could be that as many younger workers are growing their businesses and even if a smaller fraction of them succeeds in ascending to the tax-paying bracket in their later years, would become a considerably good customer base for the proposed model. These groups of beneficiaries will graduate to tax-payer status as their longevity in the sector increases. When the position of these unorganized sector workers who had opted for both the CPS and PS is compared with that of the averaged position of the workers opting for only PS or CPS; we observe that with their over-propensity to save may mean that they would be prepared to overcompensate in terms of the amount of regular pension contributions that they are prepared to make under the proposed model. When we compare the high-income group with that of thee medium-and low- income groups, there seems to be a possibility of encouraging high contribution rates because of their somewhat higher average age profile. In other words, for this group average contributing periods will be shorter. This together with the fact that their incomes sporadically seem to increase should allow them to make contributions periodically in 1 or two premium.

The 10.22% of the research sample (54 million Indian Workforce) that had shown interest for personal savings are the ones who believe that their savings are not enough for making any contributions and

therefore, they intended to increase their personal savings instead of opting for any mandated pension scheme. So, one quartile of the unorganized workers sector that cannot make such contributions may be allowed to sign into their retirement accounts once they are ready with their instalment payments. One option would be to save their small amounts of money (say in Rupees 10 or so) in India Post which should act as a Point of Presence (POP) i.e., a third- party agency for the aggregation of the pension amounts and when the amount reaches the required sum to pay, the same is routed into their retirement pots. This requires a close link between the POPs and the PFRDA. And those who can make higher contributory amounts shall be encouraged to do so to achieve a reasonable income replacement rate up to a limit of Rs.4800 per annum so as to receive an equal contribution from the Government.

In consonance with the GOI objective to capture lower income workers as well as others in the scheme, effort must be made to target these groups as a key CPS target groups. These rural groups of unorganized sector workers are already enrolled in the MGNREGS programme with a guaranteed payment of minimum wages. Therefore, in terms of coverage and support, the MGNREGS shall facilitate access and the required technical support for the calculation and routing of the individual pension contributions to their retirement individual pots. It is evident that the coverage of the rural poor under the MGNREGS is almost complete; so the maintenance of the retirement accounts can be easily carried out with the help of the technical support under the scheme and the overall supervision of the PFRDA. The linkage of the Aadhar card number, the job cards under the MGNREGS with their individual retirement accounts will provide for a guaranteed wage payments duly taking care of the contributions towards their retirement pots. Those who are still left behind without having any of these cards or retirement savings account should be encouraged to start with it as early as possible. Looking at the median value of the personal savings, we can infer that the savings propensities of this group of respondents are relatively high.

Two broad potential marketsof pension for CPS

On the basis of our survey results, two broad potential markets for the CPS exist as has been benchmarked against year 2014 national poverty lines. The market segment 1 includes those respondents who have opted for the CPS and the market segment 2 that had given the choice of maintaining own personal savings account instead of participating in the proposed model. More intensive cross-selling and awareness is needed to include these masses who have shown little interest in probably, the most beneficial pension alternative to them. This research analysis is largely an attempt to consider the position of these unorganized sector workers who are unable to participate in any of the existing pension schemes whether government-sponsored or other privately run organisations; and who may be interested in supplementing mandated pension entitlements through our proposed model.

Following the procedure adopted by the ADB project, we have chosen 80% of the poverty lines benchmark for analysis purposes considering the extension of the pension saving plans upwards to 35 years with the expectation that their pension contributory capacities will increase over that long time-frame or at least the pension fund corpus may build-up to guarantee them with the pension benefits. Although, the NPS has not considered them to be eligible for a CPS for the very reason that their current contributory capacities are very low; however, they believed that a potential consumer group comprising of these workers in the unorganized sector at an appropriate point in time may emerge.[17]

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[17]Recommendation No. 4 of the ADB Project.

The NPS demarcates some 42 million audiences in 2004 that can pay the notional contributions from the rural areas of India and as much the function of the distribution of the total workforce almost accounts for 77% of the total employment. I believe that the uptake of this target group could be maximised particularly, if an attempt is made to design a mechanism that could help them to contribute towards their old-age years. The research data suggests 14.08% i.e., 77.61 million workers (those who did not respond or said 'do not know') in addition can form a potential segment of CPS; because there is every possibility that they might become the members of the proposed scheme. Givenproper training to participate in the proposed model, these people also would like to be considered for the mandated pension schemes. Therefore, this quartile of the sample should not be rejected. Our model actually aims to include these left-over and marginalised sections working in the rural areas into the 'pension safety-net'. These are the ones who often end up saying 'do not know' when a survey is conducted for their own benefit, may be due to lack of awareness or public mistrust.

Encouragingly, almost 49.72% (260.76 million workers) are the ready buyers of the CPS so the question remains as to how to convince the rest of the lot to buy aCPS pension. Our model provides for a 'gearing-up mechanism' with other government incentives, so that it would be much easier to persuade these workers to participate in the proposed model.

One of such issues has been measured to see the degree of interest expressed by the respondents in a pension scheme of the type being planned. The survey asked them as to the percent of contribution that they are prepared to make as against the government's contribution. Whether should it be 10, 20, 30 per cent or equal? The relative responses to these questions clearly delineate the position of these workers in relation to the mandated pension schemes.

Another related issue was to see the percent of the respondents who had the notional capacity to make meaningful contributions at the required rate. The high-income group that opted for CPS was found to be only 3.59% and on a weighted scale that is 25.26 million persons when projected on an all-India basis; who could make contributions unlike the rest of the CPS group of the research survey respondents.

What is interesting to note is that a very high interest was shown by the low-income group as compared to the medium- and high-income groups. It is clear that having a high-income does not necessarily equate with a high interest of participation in the proposed model; conversely, having a low-income does not necessarily equate with a low participation in the CPS. As evident elsewhere in the data, there is also a clear correlation between age and income, with income increasing steadily with age. Those who had said that they can manage their retirement years through the personal savings that they make, these amounts may be treated in the analysis as notional pension contributory capacities. The point of interest in this regard is that the amount that they intend to save suggests a possibility to evolve robust pension's contributory patterns for most of those concerned.

Sub-pension savings preferences

The other important point for sub-pension savings preferences is that "median" values are used in analysis to represent their interest within each preference group. Thus, when considering the significance of the median values it must be borne in mind that the financial situations with respect to the pension preferences of that half of the individuals above the median value are in many cases significantly above the median. For instance, in CPS group, if the data values are 100, 67, and 13; we infer that with respect to that median, i.e.,

67, most of the cases within that group will be found above this value and If we look at other aggregated values such as "means", the mean value for that group comes out to be 60 which is 7 values lesser than the mid-value (median value). Therefore, to avoid greater deviations from the mid-value, one must always prefer to follow the median-value approach in arriving at any conclusions.

Of interest in this regard is that the median values of the CPS and PS suggests that most of the respondents in both groups have the capacity to meaningfully participate in the CPS pension model due to their propensities to save money for old-age income security.

44/180 of the respondents voting for a CPS have in their minds a desire to secure income for their old-age although they are generally not willing to achieve that outcome through bank savings or equity and debt-based investments. It is not possible from the data either to assess the extent to which they can possibly save for their future.

29/180of the CPS respondents are the ones who are either receiving pension benefits or members of the Insurance companies like LIC, Sri Ram Chit Funds or Agri-Gold etc. This indicates three things of interest:

(1)   Although, the percent of unorganized labour enrolled in PPF and like savings plans are very few, the banks in this regard fare better than the India Post;
(2)   Post Offices although have a greater outreach in the rural areas as compared to the banks, most of the personal savings of the unorganized sector workers seem to be invested in India Post albeit in smaller amounts.
(3)   Tax concessions and mandatory enrolment of unorganized sector workers into the proposed scheme by their employers should help invoke a fair amount of interest in retirement savings.

The followingfeatures of the proposed scheme were taken to run a test of trend

1)   Bank linked payments;
2)   10% to 30% mutual contributions;
3)   Routing of government payments into retirement pots at a rate of 10%;
4)   Increase personal savings;
5)   Option of both 3 & 4 listed above;
6)   Flexibility of joining at any age;
7)   Risk vs. Return factor;
8)   Have an opportunity to change fund managers as and when desired;
9)   Deposit payments in variable amounts and time as per suitability; and
10) Get regular payment for rest of the life.

A Linear Regression test

A Linear Regression test was run to see the trend between the above mentioned features (Y as independent variables) with that of the dependent variable (X) i.e., the CPS responses.The method was first used to examine the relationship between the heights of fathers and sons. The two were related, of course, but the slope is less than 1.0. A tall father tended to have sons shorter than himself, a short father tended to have sons taller than himself. The height of sons regressed to the mean. The goal of linear regression was to adjust the values of slope and intercept to find the line that best predicts Y from X. That is to check the features of the model that most attracts the willingness of the respondents to buy into the scheme. More

precisely, the goal of regression was to minimize the sum of the squares of the vertical distances of the points from the line. If the scatter is Gaussian (or nearly so), the line determined by minimizing the sum-of-squares is most likely to be correct. Table 54 shows the interest of the respondents towardsvarious Y variables which are expressed in percentages. The tabular results of which shows the linear regression of the relative interests of the CPS group and the points that give goodness of fit to the curve. The linear Regression Line gives the best fit curve of the scatter as is shown in the graph.

The research survey data show the overall coverage of the unorganized workers in existing voluntary pension arrangements to be quite minimal with less than 1% of respondents indicating that planning for retirement is a major purpose of all existing savings behaviour. The research model ensures the operational schemes to conform to the objectives of the old-age income security in ways that could meet both the needs of the unorganized workers and protect future government's fiscal position. The mandatory enrolment of MGNREGS wage-seekers into a CPSshould help attract increased participation of the unorganized workers in the organized sector too and which calls for higher flexibility in terms of contribution in the long run of implementation.

The research survey indicates only 18.5 median values(50th percentile) of the total respondents who are interested in increasing personal contribution towards their retirement age rather than participating in the proposed pension model. The model therefore, provides for savings 'switches' from present savings preferences to participation in the proposed pension scheme.

All-India Estimate of the Unorganized Workforce

The predominant workforce in India comes from the agriculture sector only as can be seen from the above table with a whopping 467.97 million of workers as per the projected All-India Estimate. The 80% poverty benchmark chosen for analysis falls in line with this estimate. There is a great urgency for the Government of India to think in these lines so as to extend a life-support to them in the form of CPS that can take care of not only the present contingencies but also can secure their future needs.

One would be surprised to see that a fraction of the total unemployed respondents includes medical students who said that they are dependent upon their parent's salaries with no earnings of their own. Therefore, they said saving money is presently out of question for them. Only few of the students avail the scholarships and majority of them are forced to depend upon their parents during their study years as they do not get enough time apart from studies to earn for their living. It shows that the best of the brains in India are also suffering from acute shortage of funds. The government of India must do something to strengthen their hands so that once they are out of the medical institutions; they should be able to serve the masses.

When we look at the scenario of our legal brethren who are categorised under government jobs in the table presented above; the stringent rules of the BCI do not allow them to take up part-time jobs in any avocation that has no legal orientation in it. The result is that the unorganized workers in the legal field are in dearth of money and only the few fortunate ones are able to survive the stiff competition of the legal profession. Those who come under this classification include the para-legal workers, the part-time workers in the Courts of Civil and Criminal Judicature, the newly entered advocates into the profession etc. Our research actually recommends these professionals at the lower rung of the cadre to participate in our proposed model, so that an old-age income security is assured to them. They have a life-insurance cover however; it is not without a taint of receiving the benefit only on happening of a certain contingency.

Need for Flexibility and Innovation to provide Pension to the MGNREGS workers

The project team of ADB believed that this ambitious objective of including the unorganized sector workers into a pension model is achievable if there is a willingness to approach the task with flexibility and innovation. I believe that it is possible to include all the unorganized sector workers under MGNREGS to be brought into an umbrella cover of CPS and gradually to bring into its ambit the remaining workers in all sectors in India.

The total number of the workers covered under MGNREGS is **272.4 million** that comes to 53.65% of the total All India CPS estimate of workforce in India. That means the remaining 235.31 million are still there to be accommodated under MGNREGS in India. The Government of India has to take an action in this regard, so that these left-over proportions of the workforce should also be included in the employment guarantee scheme at the earliest. We propose first, to include **this chunk of the workforce** into the proposed CPS model so that a 'right to pension' in the form of CPS along with the 'Right to work' is guaranteed to them. Initially, the effort to open permanent retirement accounts (PRAN accounts) in the name of these wage-seekers should be initiated in order to include them for a CPS and in due course of time the remaining percent of uncovered wage-seekers should be taken into consideration. Proper linkage between the MGNREGS and PFRDA should be established in this regard.

The focus of pension reforms in India since 1995 has been in two main issues:

A) To maintain a non-contributory pension layer to the persons below poverty line; and
B) To extend mandatory contributory pension scheme to the greater part of the Indian organized workforce including a voluntary participation of the workers of the unorganized sector. The thrust has been to remove the fiscal burden associated with the unfunded liabilities in public sector mandated schemes.

Nevertheless, the proposed model helps those unorganized sector workers who are not covered under any of the mandated pensions and who appear to believe that their existing pension entitlement ae inadequate for instance, the newly recruits in legal services, the unorganized sector workers in the legal courts.

The idea of conducting this survey was to find out the interest in pension saving patterns rather than measuring the savings for retirement through this proposed model. The focus was to see whether retirement needs were implicated in their savings decisions. It seeks to arrive at an inference by measuring the range of savings behaviour. It would rather suggest their saving's motivations for designing a pension contributory model. The proposed CPS model underpins the existing lacuna in the retirement plans accessible to the unorganized sector workers in India by proposing to fix the contributions until retirement. This should preserve the contribution amount till such time as the date of maturity comes to be made available in an easy lump-sum amount.

Need for Maintaining a Non-Contributory Pension Layer

Even after taking into account all the MGNREGS wage-seekers and the potential workforce into the proposed model, there will be still 71.55% (362.76 million persons) lying below the poverty line due to their age factor and inabilities to take up manual labour work (see Table 79). This proportion of the workforce needs to be considered for the NOAPS in the form of compulsory cash transfers to be credited into their individual accounts. The proposed model is designed to enable the unorganized sector workers to buy into

the pension model with the work-place pensions brought into place for them. It is a question of policy-making that requires the GOI to seriously think in these lines for the benefit of 384.29 million unorganized sector workers who are showing ready willingness to join the proposed scheme as per the research survey estimates of this Thesis. Their contributions may not take them above the poverty line at the age of 60 years; if we look at the meagre amounts of harvested contributions in their retirement accounts; nevertheless, they will have something to fall back upon once they reach that age how small it may be. Some 52 million unorganized sector workers although, have remained content with their personal savings and said that they do not want to be enrolled in the Government sponsored scheme at all which may want them to contribute for their future. As far as this section of the society is concerned, it is clear that they can vouchsafe for the retirement years through some legitimate means however, if we pay attention towards the remaining 71 million unorganized sector workers; it is not clear how they are going to secure their retirement years without participating in the proposed scheme and without the supporting presence of the Government-sponsored EGS and CCTs.They are the ones who said, 'do not know' to the question of making contributions to the retirement accounts through wage earnings. It is again not clear whether they are interested in the scheme or not and it still remains a matter of conjecture for the researcher to come to any plausible inference regarding their preferences.

The Notional Indexed Annuity Amounts Benchmarked Against the National Poverty Line of 2014

In Table 76, the assumptions applied in the model were a maximum contributory period of 20 years, real annual investment earnings on contributions accumulations of 2.2% per annum, all contributions made through wage earnings at a rate of 3% to the retirement pot annually up to a limit of Rs.500 with an equal contribution by the employer (in the instance the MGNREGS) which makes a principal amount of Rs.1000, an annual annuity rate of Rs.61 per Rs.1000 on a single premium basis with an inflation adjustment of 3% per annum, 100% annuity of accumulations at age 60, transaction costs of Rs.25 per monthly deposit, an annual charge of Rs.20 per annum, monthly deposit for central record keeping and an annual 30 basis points fee levied by investment fund managers.

Accordingly, to find out the eventual retirement income outcomes at an age of 60 years for those who had harvested contribution amounts of Rs.10000/- per annum in their retirement pots in the intervening period between now and the age of 60 years, I have used a calculator to assess the potential outcome that would eventuate duly consideringthe transaction costs and inflation adjustments etc. An average was taken of the annuity values within each age-group for analysis purposes to see the relative position with regard to the poverty line and the results of the analysis are shown in Graph 34.The bar chart shows the age-groups and the purchasing ability through their wage-earnings a notional annuity of between 0 and 100% of the values of the 2014 national poverty lines. The bar chart includes all the unorganized sector workers who between now and age 60 years of the period could contribute to purchase a value of indexed annuity through the MGNREGS or any of the government-sponsored schemes. The average of the annuity values has been taken for each age-group for the purpose of analysis only. The bars rising above the poverty line shows the capability of the unorganized sector workers of that group to buy an annuity sufficient to remain above the poverty line, and those who are aged and have lesser number of years to contribute end up with lesser harvested contribution amounts and thus their annuities shows a fall beneath the national poverty line. The positive Y-axis indicates the percentage of the annuity outcomes that indicates the position of that group above the poverty line and the negative Y-axis values of the annuity outcomes represent the group that is likely to suffer poverty in the old-age. On the basis of the above chart, 46.4% of the total unorganized sector

workers i.e., 235.58 million workforces in the unorganized sector may be in a position to buy an annuity of a meaningful value. However, out of this proportion, those who can buy an annuity outcome equal to the notional indexed poverty line or slightly above it isonly 24.21% or 123.42 million persons working in the unorganized sector. Some 143.66 million persons in the unorganized sector will be likely to found below the poverty line as their purchased annuities may not be up to the mark by the time they reach an age of 60 years. The proposed model therefore, recommends NOAPS to this chunk of the workforce in the unorganized sector who fails to contribute for their old-age living from their meagre means. The GOI has to revise its policy of public funding in order to cover these ageing workforce in the age-group of 46 and above; who as of now, have not subscribed to any pension plan and therefore, they should be considered for a CCT.

Pension Annuities for the Harvested Amounts

Graph 35 shows the age-groups and their relative earning capacities to remain above the poverty line in the old-age. Assuming that all the age-groups are absorbed into the proposed scheme, the scenario in their old-age would be something like the graph shown above. The younger age-groups will be able to buy an annuity better than their relative age-groups. The only solution for the aged groups will be to receive compulsory cash transfers in the form of NOAPS to sustain the vigour of the old-age. The present youth must be encouraged to become the members of the CPS to take the linear trend line upwards along with them.

 It has been calculated that Rs.3,600/- per annum over 20 years period would provide retirement annuity income of approximately Rs.800/- per month at today's value based on current annuity rates.

Investment option[18]

The proposed model of CPS automatically triggers the option of a Life-cycle model (Graph 37) based asset allocation of 30/70 to age 35 changing to 70/30 at age 47 for the investors in the present case, the unorganized sector workers. The life-cycle model has a high proportion of growth assets (equities) for young ages, moving gradually to a more defensive strategy as retirement approaches. This option provides for a relatively aggressive or higher percentage of debt securities.

Life-Cycle option

This option is internationally known as a targeted, life-cycle scheme. The simplest form of this option would be an allocation containing a high component of growth (equities) assets for subscribers up to age, say 35 and their debt assets would be substituted for growth assets progressively each year so that by age, say 47 the subscriber's account would be invested in a conservative asset allocation, with a high component of debt assets. In practice, the initial divide between growth and debt assets would be determined by the age at entry and duration to the Benefit Preservation Age of individual subscribers. In this Table 80, although persons joining up to age 35 would have a scheme commencing with 70% growth assets, another person joining at age 39 would commence with equal quantities of growth (50.07%) and debt (49.93%). The construction of the life-cycle scheme asset allocation would need to be uniform across all PF providers, i.e. when PFRDA

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[18] ADB Project in India, op.cit.

has decided on a standard benchmark for allocation to growth and debt assets, all appointed PFs would be required to adopt the standard. However, there would still be room for differentiation between the products of individual PFs, in similar fashion to the option as described in the Life-Cycle option.

Table 80 illustrates the recommended model. It commences with the growth assets at 70% (69.08%) up to age 35. That allocation would be reduced by downward movements of 2.4% each year to reach 30% (30.87%) growth assets at age 47. Other models might be considered such as 90% (88.09%) growth at 33 years of age, reducing to 10% (11.86%) at age 55. A more conservative approach would be 60% at 31 years of age, reducing to 15% (14.26%) at 52 years of age. Whatever option is chosen should remain constant till the age of 60 years; the time from which the pension outcomes will be realized by the investors. Any changes at a later date should be to introduce a second (even a third) Life-Cycle option with a different benchmark, rather than alter the original.To accommodate day-to-day market movements, some latitude either side of the benchmark would be necessary. A margin of ± 3% should provide sufficient tolerance.

The investment option also provides for a "loyalty addition" so that early withdrawals may be discouraged. Under this arrangement, a portion of the government contribution equal to 10% of wage-seeker's contribution on the wages earned each year would be added to the subscriber's capital and become a guaranteed addition going forward. Such a concept of "loyalty addition" fits in well with the proposed CPS model of this research. It is recommended that the Life-Cycle option be introduced from the inception.

The research survey data supports the idea of investment in equities in the stock market in spite of the higher-associated risks; the Life-Cycle product would permit younger subscribers at least the opportunity to participate in an option with a higher proportion of equities. If proper awareness is created relating to the connection between risk and return; there is no reason to deny a high growth option to these unorganized sector workers. More aggressive options would be introduced once the proposed scheme takes off from its ground level. The permit to "switch" investment options should be given to the subscribers on application to the CRA.

Under any capital guaranteed scenario, the investment is likely to provide only marginal real rates of return over time and therefore, capital guaranteed option specifically designated as such is not recommended as a default option for low-fund investors although it should be noted that unit-linked capital guaranteed life insurance products are available in India for higher-fund investments. Therefore, it is proposed to provide a range of a high growth option of 90-100% growth / 0-10% defensive (debt).

The insurance cover is not visualized under the proposed scheme; however, if the annualized minimum contribution to qualify for insurance would need to be Rs.3,600/- of annual insurance premium were to be Rs.300/- per annum. Upon the death of the subscriber, it is proposed to allocate a lump-sum amount of the harvest to the legal heir or nominee of the option plan exercised by him. The primary purpose of the proposed scheme should be limited to the accumulation of savings, the protection of subscribers and their dependents and for the delivery of retirement outcomes till it is established and moves forward. Depending upon the harvested amounts, the service providers may add ancillary benefits as the case may be.

The need of the hour is to compulsorily enrol the younger workers first into a CPS so that they can take care of their future rather than finding themselves in a queue for NOAPS. In this way the number of prospective

NOAPS applicants can be reduced and fair justice can be done to the needy old-persons. There is also another possible way in which the problem can be handled; namely, to persuade this age-cohort who are approaching the retirement years to buy annuities of higher values up to a contribution cap of 10%. The proposed scheme has the flexibility of time to join at any age. That means, the workers in relatively higher age-cohorts can adjust their retirement outcomes on a voluntary basis. The cap of maximum limit may be relaxed as per the Law in force.

If we look at the unorganized sector workers who have said that they can sustain themselves above the poverty line at an age of 60 years by increasing personal contributions to their private savings form about 10.22% or 51.89 million persons in the unorganized sector who are earners and the ones not willing to contribute to the proposed government CPS model. Even if we discard this proportion from our calculations, there is still an urgent policy-planning needed in relation to the 383.71 million potential customers for the proposed CPS pensions. And it is expected that in addition to it, a 71.527 million persons might want to join the scheme in view of the inertia generated by the proposed scheme. These are the persons who are presently not desirous to join the scheme however;we contend that their willingness will depend more or less upon the momentum created by the proposed scheme.

Proposal for compulsory Enrolment of Unorganized Sector Workers into CPS

At this stage, I can say with conviction that the unorganized sector workers have the capability to protect their years of retirement however, what is required for them is a kind of Government assistance and proper guidance so that they can work through their productive years to ensure a secured retired life. In the present instance, the 'government assistance' means introducing a work-place pension policy to enable them to save for their future no matter how small the harvested amount may be. They should not be taken for granted as someone who would be left to receive benefits in the form of CCTs from the GOI in the coming future. Also, there is no guarantee that he may immediately get a NOAPS when he reaches the age of 65 years as we all know that every one in ten gets the benefit under NOAPS. In the contrary, they should be assisted to buy-into the life of pension that they desire to lead in their old-age. That means, the persons between the age-groups 18-45 years should be compulsorily enrolled in the work-place pensions from the date of the implementation of the proposed scheme to receive an annuity at an age of 60 years to keep them well above the poverty line. It should be noted that unless they are driven into a culture of saving for the future, they cannot remain above the poverty line in future as a result of the competitive market and inflation rates.

Proposal for a lump-sum pension payment that is smaller in amounts

Say, if a wage-seeker at an age of 45 years in 2015 seeks to join the proposed CPS, it should be borne in mind that the annuity he would receive will not be sufficient to keep him above the poverty line because the number of contribution years will still be 15 with an annual contribution of Rs.5000 plus the government's equal addition of amount; so that for a principal amount of Rs.150000 and length of annuity of 20 years; if we calculate the pension payment for him from the retirement age of 60 years i.e., from 2030 onwards, he would receive a sum equal to Rs.7500 per annum till 2050; which is far below the National Poverty Line and the Table 79 clearly illustrates this point. In such case, it is prudent to imagine him to receive the lump-sum amount rather than opting for annuity amounts. Since age is the criteria for the increase in the annuity amount; therefore, it is very essential to safe-guard the future of our youth by properly enrolling them in CPS now onwards on a war-footing, so that they may lead a secured life in the old-age and help build a

strong India. If we take care of the present generation by guiding them properly through an informed and safe approach to life; we all can rest assured for a safe future or else poverty will be seen rampant especially in rural areas.

The Diffusion of Workforce According to their Employments

The CPS workforce was screened to isolate the earning members from the unemployed persons in the survey sample (Table 74). An All-India estimate was projected to see the total percent of the population who are really capable of paying contributions into the retirement pots. These are the group of persons who are salaried and self-employed having a notional capacity to make meaningful rate of contributions. This is a smaller group of 34.77 million persons comprising of around 2.21% and who are either the subscribers of LIC or private insurance companies and who have never been the members of any contributory schemes. These workers were found to be in the employment in various sectors of the unorganized labour. They can be divided into three groups:

1. Those who are working in Government sector comprising of 3.87% of the total unorganized sector workers in India which comes to 20.3 million persons;
2. Those who are engaged in the private businesses or employments of 1.66% that is8.7 million persons; and
3. Finally those who are engaged in self-employments such as retail shops, pan-shops or grocers comprising of only 1.10% of the total estimate.

Most of these persons have shown little interest or inclination to participate in the proposed pension model and out rightly refused to become the members of the proposed scheme that too, without assigning any reason whatsoever. They did seem to possess some endowment policies of LIC and the like although at a very modest levels. They seem to nurture a kind of mistrust in these kinds of proposed schemes. If properly marketed, this proportion of the total unorganized workers may become members readily with their contribution capacities for their own good. One of the best things is that some of them possess MGNREGS job cards; so it remains only a question of time that could bring them all under a single social security cover as envisaged here.

The Litmus Test for General Employment Coverage

And if we look at the total number of workers enrolled under MGNREGS in 2014-15 in Table 75; which is equal to 272.4 million wage-seekers; we find that only 62.2 million of it actually worked at the All-India level that accounts for only 22.83% of the total enrolment for the year. The degree to which CPS is successfully introduced to the wage-seekers in MGNREGS can form a 'Litmus test' to the degree of the possible general employment coverage of these wage-seekers. In other words, the ingredient of compulsory enrolment of all the wage-seekers into the CPS may help boost their performance levels making thereby the task much easier for them to harvesting contributions into their retirement pots.

In this context, it is pertinent to mention that there is flexibility in the proposed model to contribute in two different ways:

1. Personal contributions up to a cap of 10% that can be deposited in their retirement pots through Banking or Postal services; and

2. Contributions from the MGNREGS wage-earnings at a rate of 10%. This standard contribution rate is common to all the wage-seekers in MGNREGS which shall be effected 'at source' from their wage payments.

The workers of a very low-income cohort are also showing interest in the proposed scheme

In Table 54, it is very interesting to note that within the CPS opting respondents, there are some 8% (40.6168 million) persons who form a very low-income profile group (of Rs.5K-30K annual income)and yet, there are showing immense interest in the proposed model and who also seem to be the active subscribers of insurance policies and smaller savings in the SHGs and India Post. As it is clear that the annual poverty indexed annuity value of 20K requires one person to have an earning capacity of not less than Rs.11520 per annum to sustain just above the poverty line;theresearch data delineates 15.47% of such persons (78.54 million persons) who have an earning capacity of only Rs.20K per annum who nevertheless, are willing to participate to supplement to their retirement savings in the proposed scheme. To suffice, there are 5.8% (29.45 million) persons who come within the group of Rs.5K to 20K income profile and with the productive age of 18-38 years. This group of persons should be given a priority to join the scheme at the earliest date as their savings if calculatedfrom now onwards will definitely yield good results in the future.

Saving appears to be in the minds of these workers of the unorganized sector

There is an interesting feature that these low-income unorganized sector workers seem to share with the counterparts in the high-income profilers; that is, the incidence of higher median values of insurance endowment policies. In this context, it is important to mention about the prevalence of a significant group of commission agents taking across a wide range of economic activities in the rural areas. It is not surprising to find the majority of these insurance agentsinclude teachers and lower cadre staff of the government working and this doubtless explains how these low-income profile workers of the unorganized sector are roped into such policies. What is important to note here is their conscious intention to save for their retirement years even if the amounts are smaller. It becomes obvious therefore that if the idea of CPS is properly marketed; even the marginalised sections of the society can be done a fair justice by bringing them into the pension equations hitherto denied to them.

The point in question is not whether the government teachers or the staffs are involved as commission agents in the rural areas, however, what is important to note is the degree of interest exhibited by even the poorest of the workers, those who are unable to eke out Rs.20K per annum to save for the retirement years. This should be of interest for the proposed design of the CPS for them and also for the rest of the income ranges including at the higher end of the income scale i.e. above Rs.20K. Once in the high-income end, potential contributory patterns for the relatively high-income profilers will yield significant pension values.

The overall propensity expressed by the research data respondents to save may mean that they would be prepared to overcompensate in terms of the amount of regular pension contributions they are prepared to make. It is therefore evident from their responses given through the questionnaire that 'saving for the old-age' is very much there in their minds. The prevalence of commission agents and high incidence of saving instruments in the possession of even the workers of the low-income profiles is a conclusive proof of their interest in some kind of a model that may have a pension equation inherent in it. The proposed model provides them with exactly the kind of pension model that they are looking for, i.e. the "work-place pension".As a beam of pure white light passing through a prism disperses into a spectrum of seven different

colours; likewise, if the proposed CPS model is introduced into the unorganized sector workforce, a pattern of definitive pattern of savings will result which would also help in bringing down the fiscal burden of the GOI in the long run. Applying some effort to this task is likely to reap dividends as the group have compressed incomes in the higher ranges (although less than Rs.60K) and their pension contributory capacities are high.

The other major point of interest is the presence of LIC in particular, that presently has the Lion's share of the insurance endowment policies and this observation should have implications for the PFRDA POP selection process. However, it should be mentioned here, that the outreach of these insurance companies is also limited to one million subscribers in rural areas. The possible reason for it would be the administrative and presumed compliance barriers for subscribers.

Whether the proposed CPS scheme ultimately will be able to overcome these constraints in a reasonable time-frame of a decade's length is a matter of judgment that should appear to be in prospect in the near future. In this case, making efforts to extend CPS coverage to these groups seems both an urgent and important priority. Read another way, this fraction being as small as it would appear to support the view that extending a CPS at this time might be well-received by many of this income-cohort of RS.30K-60K of persons. Indeed, the degree to which POPs can market CPS successfully to this group would be a good indicator for judging POP performance.

Since the wage payments are received by the wage-seekers under MGNREGS , in most of cases, through India Post; some lateral thinking and support may be required to facilitate the access to store pension-savings account transaction by these beneficiaries under the proposed scheme. In addition to the direct pension savings transfer method from their wage-earnings, much good may accrue if a lateral facility is created to store small amounts of personal savings in their personal accounts to be routed into their retirement pots once they reach the required minimum value of contribution for a given year. In other words, the beneficiaries for the proposed CPS model should be given an opportunity to make supplementary contributions to their CPS retirement posts.

Actively marketing the CPS to this group certainly appears worthy of interest as the government knows presently where these potential customers are to be located, which is none other than the MGNREGS wage-seekers who in the first instance should become the customer-base of the proposed scheme. The approach of offering Tier 2 account participation to this group is an appealing strategy as direct deduction from the wage-payments will be in place with the augment of the proposed scheme and the case of access to their retirement pots would not be an issue as is evident in the existing Swavalambhan scheme for the unorganized sector workers in India.

Need for a new pension policy for the unorganized sector workers

What is required is a policy that can help them to contribute for the pension without having them to squeeze-out their hard-earned savings for a purpose too remote than now; a policy that can take care of the pension requirements as they work through their productive years till the old-age; a policy that guarantees a return of equal benefit at the age of 60 years and a policy that can ensure them to plan for their future to receive a kind of pension outcome that they desire to lead in the old-age. The proposed model in addition to these features also envisages the wrapping of all the benefits that they were to receive during their life-time from the other government schemes. For instance, from the Housing scheme, the 10% contribution amount should

be added to their retirement pot i.e., if they receive an amount of Rs.75000 under INDIRAMMA housing scheme to construct a house of specified dimensions; the 10% contribution from it should go into their retirement pot; that is equal to Rs.7500.00 thus, the provision of additions into the retirement pot from all the directions in one's social life should be taken care of. Any benefit that a beneficiary receives from any source should be reflected in a 10% deposit into his retirement pot without a delay.

As per the normal conviction, the earning capacities increase with the age and the same is reflected to be true with more persons in the age-group of 38-58 years who are found to be in a relatively higher income profile of Rs.40K as compared to the other two age-groups of 18-38 and 58-78 years. Typically, a standard family consists of five members; a husband, wife and three children. Therefore, to remain above the poverty line the total earnings of the family should be Rs.60K per annum according to the National Poverty line published by the Planning commission of India. The calculation is given below:

Rupees 32 per day of earnings for a length of one year = Rs.32 * 30days *12 months

$$= Rs.11, 520 \text{ per year per individual; and}$$

For a standard family of 5 members　　　　= Rs.11, 520 * 5

$$= Rs.57, 600 + \text{other contingencies}$$

$$= Rs.60K \text{ per year.}$$

MGNREGS is the Magna Carta Employment Guarantee Scheme in India

The research data tells us that all the respondents without a single exception earn their living far below Rs.60K per year. The range of the individual earnings falls between 5K and 60K only. In other words, 507.71 million unorganized sector workers supposedly do not earn above Rs.60K per annum. And if there is only one bread-winner in a standard family of five members; an earning of Rs.60K per annum will only keep them marginally at the poverty line. Of late, the MGNREGS especially has proven to be the Magna Carta to the poor people in the rural areas guaranteeing a minimum of hundred days of rural employment of unskilled manual labour to them.

The related studies in rural economy on the decline of poverty level with the advent of MGNREGS corroborate with the findings of my research survey that explains the increase in the confidence levels of this 178.54 million persons who are now prepared to become the members of the proposed scheme. And these are the wage-seekers who are presently at the threshold of the poverty line with the earning capacity of Rs.20K per annum. It seems as if the MGNREGS is holding this fragment of the society from falling further down into the abysses of poverty.

Need for a work-place pension policy

The official data of MGNREGS for the FY2014-15 states that only 62.2 million wage-seekers have earned the wages out of the 272.4 million enrolled in the year. The data suggests that they are earning from this government-sponsored programme apart from other earnings to keep them going even inthe off-season ofwork. The premise of my argument is that the unorganized sector workers are themselves very muchsure about making contributionsthrough their MGNREGS wage-earnings; so the argument of not including them in a CPS for a want of contributory capacity overall loses its weight. The objection was allowed earlier and

they were not included in the pension calculations by the ADB research team in India in 2004. That can be overruled now in the present scenario if, a 'right to pension' is viewed as falling within the purview of 'right to life' so that it can becoupled with the 'right to work'. The interpretation of the kind must help envisage a special right to these marginalised sections in the form of a 'work-place pension' policy in order to ensure regular contributions through the wages earned. The UK's NEST scheme is a pioneer in providing pensions to the informal labour that can form a model replica in India.

The GOI can do much good by first initiating a policy that should compulsorily enrol the actively participating wage-seekers in the MGNREGS into a CPS at a contribution rate of 10% initially. In other words, the 62.2 million active MGNREGS wage-seekers as reported in the official data of the FY2014-15 should become the first buyers of the proposed scheme of CPS.

The total expenditure incurred towards making only wage-payments in the FY2014-15 was Rs.242148.2 million and at an average, the actual wages earned by a single wage-seeker comes out to be Rs.3893.00; and if the GOI first proposes a CPS to the 62.2 million actively participating wage-seekers, the estimated increase in the budget should be plus Rs.24214.46 million (Rs.2421.446 Cr). This is pretty much within the permissible range as compared to the annual labour budget sanctioned for the unorganized sector workers in India and quite appreciative to their 60% contributions to the National GDP. That comes to 9.99% (10% approx.) possible increase in the overall wage-payments under MGNREGS.

Also, it is a known fact that the GOI in view of providing social security assistance has been increasing the number of days of employment from 100 days to 300 days in specific cases. The 62.2 million persons as outlined in the analysis comprise the same chunk of the workforce (the marginalised sections of the society) who are being analysed for inclusive growth in the proposed scheme. Therefore, it is well within the reach of the GOI to consider the revision of the wage payments with the inclusion of the proposed government contribution of 10% into their retirement pots.

The ADB project team in 1994 had in the past recommended a CPS scheme to the workforce in the organized sector which only covers some 7% of the total workforce in India. They were of the opinion that the unorganized sector workers in India were not in a position to contribute the amounts towards their pension and therefore, until such time that they become capable of sustaining themselves they cannot be included in such a scheme. To reduce the fiscal burden of the GOI, they suggested a solution to introduce a CPS only to the organized sector workers and that too by negating the defined pension benefit scheme that the organized sector workers used to enjoy in the past. In case of unorganized sector workers; they said that they will be considered for the same, if they are able to contribute. My Thesis therefore, strongly argues for the cause of that 93% of the left-out workforce of India who urgently needs a policy of CPS for their old-age which can enable them to pay the premium amount through the government-sponsored wage earnings and the research survey estimates some 384 million unorganized sector workers to be willing to participate in such a scheme. Again, I stress the point that the meagreness of the harvested contribution amount is not the question, what is important is to inculcate the habit of pension-saving in the unorganized sector workers which should not be denied to them for want of the capacity to contribute. They should be given an opportunity to exercise their 'right to life' by properly including them in a pension model most suitable to their felt-needs, instead of ignoring and leaving them to their fate and is it not the responsibility of the State to secure for their social and economic needs is the issue that calls for a serious revision of the social security legislations.

In Graph 31, the CPS survey provides first of its kind of the representative data of all the unorganized sector workers being projected on a national scale and it reveals the contributory capacity of this sector to secure their future needs if and only if, a proper government support is extended to them. In other words, these workers have shown an immense willingness to make their part of contributions provided an employment is assured to them. And I opine that the MGNREGS is such unique platform which can guarantee them a 'right to work' and at the same time, provide them with the 'work-place pension' opportunity. Therefore, it is easier to expect them to contribute at a rate of 10% from the MGNREGS wage earnings by joining the proposed model of CPS. The hypothesis-testing proved to be successful with almost 75% of the total All-India workforce estimate found to be inclined to participate in the proposed scheme making it possible to re-think in the lines of the UK's NEST policy to enrol them in a CPS with a definitive contribution of 10% from their MGNREGS wage earnings.

Prediction of the percentage of the unorganized sector workers for the proposed scheme

The research survey data provides for an analysis to predict the percentage of the unorganized sector workers who would eventually become the members of the proposed model. It gives a probability value of assessment to predict the actual group of persons that can be picked up by the PFRDA in the implementation phase of the scheme. On the basis of the research data, we can categorize these groups:

1. Those who come within the age-groups of 28-48 years that allows sufficient time before retirement to accommodate a significant amount;
2. Those who appear to have strong financial capacity to make regular contributions at a meaningful value; and
3. Those low-income workers who have expressed strong interest in the proposed scheme although coming within the income-cohort of Rs.5K-20K only. They will be in a tight situation to contribute unless they are assisted through some employment guarantee scheme.

Achieving a credible result should be possible, if the active members of the MGNREGS comprising of some 62.2 million wage-seekers are taken into account to be part of the proposed CPS scheme. With the blowing wind, the workers of other economic sectors and among younger and older workers may join the proposed CPS in due course of time. The research survey data is a snapshot picture of the Indian workforce in the unorganized sector. This snapshot of the Indian workforce may assist in understanding the possible increase in the customer-base of the proposed scheme. With proper tying up with the government-run insurance schemes, there is a possibility to convert this opportunity into a new pension business. The PFRDA must be positioned well to monitor and supervise the pension savings and transactions with the help of the POPs. The diffusion of the workforce from the research survey data should take on the possible pension outcomes as proposed in the CPS scheme. The main difficulty as expressed by the ADB research team is to create a potential market in the rural areas; this should not hinder the progress of the proposed scheme as the administrative reach of the government is in position in the rural areas under the aegis of MGNREGS. The wage-seekers need to be compulsorily enrolled in the CPS scheme so that they may be able to reap the dividends in their old-age. The PFRDA and MGNREGS may provide a time-series data of the kind generated for the organized sector workers. The competition from the other private companies can be put to rest once the clause of mandatory enrolment is brought into place, this surely frustrate the efforts of those who will be vying to take benefits by enticing them to become their customers. In other words, providing

'work-place pensions' to the unorganized sector workers is not enough; what is also required is to lower the 'opt-out' rate from the proposed scheme.

The Self-Sustaining Annuity Fund Methodology

The best suitable approach is to preserve to choose a pure life-annuity which would develop the design on a 'participating' basis permitting adjustments of amounts of benefits across cohorts of groups of annuitants. The initial benefits may be determined by reference to population or aggregate mortality. The large capital could be separately analysed for the calculation of annuities from the smaller ones for the purposes of determining gains and losses, and the resulting adjustments within the selected cohorts to reflect the experience. This approach is also known as 'the self-sustaining annuity fund' methodology.

In practice, under MGNREGS in India, the wage- payments are actually calculated group-wise for the allotted work; thus the calculation of annuity for such groups of policy holders should not be a hard task to do in view of the adjustments that are being made presently within the participating groups for the resulting gains and losses. This methodology has been examined in Russian Nation for possible application to the problems associated with the conversion of retirement capital into income streams under the reforms of the National Contributory Pension System. It is awelcome fact to notice in case of India that the Insurance Regulations specify at least 90% of surplus earnings in the participating fund to be taken by share-holders. Accordingly, the rent paid for management by the participating policy-holders should reduce as the size of the participating fund grows. This has been reflected in the development of the life insurance regulations in Canada. For many years the legislation has restricted the allocation of participating fund earnings to a graduated scale that has a maximum of 10% (for the smallest funds) and a minimum of 2.5% for the largest funds. Such surplus earnings allocation rates may have been seen as desirable in the context of fostering the growth of the pension fund, in which the allocations of the surplus earnings are taken by the State. It is interesting to note that the ratios of contribution paid by the government and the wage-seekers in other countries are far greater as compared to the position in India:

Country	Government: Wage-seeker
Australia	1.5: 1.0
England	3.54: 1
India	1: 2.4

The Life-Annuity of MGNREGS Workers as Group Policy-Holders

The illustrative Tables 81 and 82 on Life-Annuities calculated for a group-policy holder on the basis of the wages earned under MGNREGS at a flat 10% rate of contribution towards pension shows that the pension annuity is directly dependent upon the percent of the work done by the wage-seekers. In other words, an increased percentage of work done by them yields more wages, which means that there is a proportionate increase in their wages with respect to the amount of work done. The following illustrations explain the same analysis further:

1. If a SSS group consisting of two house-holds of five members each working under MGNREGS earns Rs.33000/- per annum,contributes 10% of it for 10 years to yield a contribution amount of Rs.36785.70

at a growth of 2.5% annually, they will likely to receive an amount equal to Rs.3678.57/- per annum as pension annuity to be shared equitably between the two families. It is assumed here that the participating SSS group involves only two families consisting of five members each capable of earning 100% wages under MGNREGS for a given year;

2. If a SSS group consisting of two house-holds (ten members) for instance, works for half the wages for a given year, the pension contributions at a rate of 10% and with an annual growth rate of 2.5% will yield a harvested amount of Rs.18392.90 only. The resulting annuity would be Rs.1839.29 per annum to be shared between the families.

3. If a SSS group consisting of four house-holds (twenty members) works for full wages and contributes for the retirement pension at a rate of 10% annually for 10 years; the possible aggregated pension amount with a growth rate of 2.5% would be Rs.73571.50; the pay-out annuity of which would be equal to Rs.7357.15 per annum that belongs to the four house-holds of that group;

4. If a SSS group of four house-holds (twenty members) works only 50% of the allotted work, then they will receive wages of an amount equal to Rs,33000/- per annum and the resultant annuity would be equal to the sum mentioned in point 1 above; although with a difference that it would have to distributed between four households in the present case.

Table 82 clearly explains the life-annuity that a SSS group may receive on a "collective basis" for the contributions made annually through their wage-earnings under MGNREGS. The assumption is that the members of the same family work within the same group with four such families forming one SSS group of twenty members each. The number of members in a family may vary; however, for the purpose of analysis only five members per house-hold has been taken as a standard unit of a family.

Concept of 'risk vs return'

The responses to the questionnaire relating to the concept of 'risk vs return' are crucial in deciding the option most suitable to the prospective group-policy holders from the beneficiaries of the MGNREGS. Three options were put forward to elicit their choices of the plausible investment policy for them:

1. Option A provides for an investment in which the risks are borne by the insurance companies and the unexpected shocks are covered with careful government regulation on the reserves of large measure which help buffer the situation. The transaction costs are usually taken for maintaining such reserves and regulations. There is a lot of risk involved in this kind of an investment policy. If we look at the 'A' Option in the questionnaire, it says,

"suppose you *have Rs.1000/-with you and after one year your Rs.1000 may grow up to Rs.2000, or you get back only 500" which implies that there is a probability of doubling the investment or risking to lose half of it;*

2.   Option B requires the annuitants to bear the risks by allowing and possibly encouraging variable annuities whose values varies annually depending upon the chosen investment policy in terms of longevity and pension outcomes. This kind of an option encourages higher returns than that is possible under a fixed-rate annuity. Obviously, it would be difficult for the annuitants to have complete knowledge of the market prices of their investments and the companies usually take advantage of the situation. If the government chooses this kind of an option for the MGNREGS workers then, it is believed that this option would place a

large responsibility to provide for consumer information and standardizing the terms of pay-out variation to the annuitants. The Option 'B' states,

"Suppose you *have Rs.1000/- with you, after one year your money may grow to Rs.1200, or you may lose some of the money and get back Rs. 800 implying that there is a possibility of increasing the invested amount or risking to lose some of it;*

3. Option C assigns risk on the government to offer a minimum pension guarantee, sell longevity indexed bonds, or provide the annuities directly. This enables the distribution of risks through inter-generational sharing with an added liability in the form of a long-term contractual policy. Out of the three options mentioned Option C is a relatively risk-free investment. The option C states,

"Suppose you *have Rs.1000/- with you, after one year, your money will grow to Rs.1050 that is you do not lose your money at all"; implying that there will be only a marginal increase in the investment and there will be no loss of the invested amount at all.*

Exercise 60 takes the following observations into its ambit based upon the concept of 'risk vs return' as analysed above fordesigning a pension model to the unorganized sector workers in India:

1. It should be noted that the contributions of the wage-seekers alone to the pension aggregate are calculated without any other possible additions to it; however, if the government's contribution equals to theirs then, it is hoped that there will be twice as much amount available to them than what is shown inTable 82. It is recommended that the government's contribution should equal to the wage-seeker's contribution of 10% in the retirement policy.
2. As we have seen, the annuity that is calculated in Table 82 is based upon an annual growth rate of 2.5% only without the government's contribution to it; which means that if an investment like a mutual fund policy is considered for the aggregated group amount; it is likely that they may get higher returns. However the risk factor in the present instance cannot be ruled out for small term investments. The options 'a' and 'b' of the 'risk vs return' of the questionnaire were constructed to find their willingness to further risk their amount for a higher return. It was found that 64.64% of the respondents was willing to participate in government mutual funds who had opted for choice 'a' of the questionnaire and 17.4% for choice 'b'. The increased return on the investments should act as an incentive for the SSS groups to participate in the MGNREGS at full length, i.e. to work for 100% earnings.
3. Table 82 shows a pattern similar to the investment choice 'c' opted by some 17.4% respondents with least risk and almost equal returns.
4. It should be ensured to fix the number for each SSS group and maintaining the same by suitably adding new members into the groups so that contributions keep aggregating towards the retirement pot at the normal rate.

Of interest is the investments in the mutual funds expressed by the unorganized sector workforce; 17.4% of it has no opinion on the efficacy of mutual funds at all. However, the active confidence level in Mutual Funds (between 17.4% and 64.64% of workers depending upon the regional variation) is consistent with the

survey data's overall investment risk profile of the Indian workforce. This is a significant finding as with some occupational groupings (government or self-employed business people); there is more likely to be interested in investment choices involving equity investments.

What is interesting to note is at this time in general terms, India is not high-risk adverse and this has implications for the design of pension-fund investment alternatives and the way they are presented to both the existing and potential contributions. This situation implies a need for a pension reform that could take into its ambit both the government contribution in the form of subsidy or the investor's choice in a product line through a government supported work-place policy of pension.

When asked whether they are the members of any pension scheme or if they were saving enough for their retirement; only 17.9% of the total workforce indicated that the purpose of savings was related to retirement income needs. Many have said that they do not have anything left after meeting their daily expenditure and therefore, presently, planning for the old-age was not in their minds. In total workforce terms, less than 40.33% of the respondents indicated that they were actively planning for their retirement and that they are saving enough.

What the results indicate is that retirement planning certainly would be in the front of mind issue of many of the unorganized sector workers had there been a good source of income. However, the lack of sufficient funds for it seems to be the main cause of refrain by many of them. This deficit can be replenished once they are offered a policy to contribute through the work-place pensions with an equal contribution from the government or a third party contractor. Investment risk perceptions among workers show that there is a higher market confidence in national banks by many 64.91% of the total unorganized workforce as compared to the insurance companies that share a level of public confidence similar to banks and post-offices and 22.92% of the total unorganized workforce especially the female-lot showed more confidence in SHGs, which was a little over 14.36% than the insurance companies.

 The policy initiative in this respect should be seen essentially as a matter of public relations and as a part of the political process. The immediate priority is to create and extend CPS market among unorganized sector workers with wide reach across economic sectors of various denominations of income. Clearly, the POPs shall be the lead players with MGNREGS in its position in rural areas to provide minimum wages to the wage-seekers. The PFRDA should perform a supportive role in terms of creating marketing information and facilities to support the POPs in their promotional activities, and evaluating the over-all performance.

As it is a known fact that the MGNREGS is a State-owned programme sponsored by the Central Government of India; a fixed rate of contribution say 10%, should enable the equitable access for a life-time income protection to the workers registered as SSS groups under MGNREGS. In this way, a national defined contribution system should ensure some reasonable alternatives to be developed, deployed and encouraged for the benefitof these workers.

Annuitisation of the Retirement Capital

The conversion of retirement capital into income streams is dependent upon two factors that have a bearing on it through the 'mortality and form of annuity effects':

1. Firstly, a relationship between life annuity present values based on population-based mortality rates/life expectancies in the instant case the registered groups under MGNREGS and market-based mortality rates/life expectancies; and
2. The resulting impact on those relationships in varying the 'form of annuity' that modulate the present value, e.g. term-certain payment, survivor continuation etc.

A discount rate of 2.5% has been assumed throughout as an important determinant of market pricing of life annuities. It is also important to note that the transaction costs will also have an effect of dampening, especially with regard to smaller amounts of accumulated pension resources being used to purchase annuities and further it is found to be in practice, a driver of large-scale policy for minimization of the impact as mentioned earlier.

Comparative modeling

In the year 2004, the National Defined Contribution Retirement system for the organized sector employees and workers has been brought into effect shifting away from the Defined Benefit scheme and what is anticipated is a more innovative scheme for the unorganized sector workers in India. The proposed model envisages a 'group-policy' for the wage-seekers under MGNREGS with the participation of the LIC, National Banks and India Post as potential POPs and possible business partners. The group policies under MGNREGS shall be subjected to the related pricing issue and the form of pay-outstreams thereby enabling the transfer of the mortality element in the pricing process to the capital markets.

The analysis carried out elsewhere[19] shows that it would be punitive to oblige general group-savers for retirement to purchase life-annuities without any death-benefit that might otherwise affect outcomes, from the market at rates currently on effect of prospective annuities.

The effect of dampening on pricing mortality can be made by suitably varying the form of the annuity as the death-benefit in the event of death; or length-of–life continuation feature if, the annuitant survives those 'n' years of the policy at 2.4% of growth rate. A minimum pay-out period should be taken as an important factor to justify in the interests of equity across 'longevity factor' of the group-policy. Another strategy for controlling the market mortality effect would be to introduce a mandatory spouse-survivor benefit form of death-benefit. The dampening effect could be obtained by including a suitably long minimum term guarantee, likely over 20 years as shown above in the case of a single life-annuity. The government in the present instance should be prepared to be a re-insurer of the inflation risk. The investment options for the unorganized sector workers including the 'default' option shall remain the same as is available to the organized sector workers with a difference that the option shall be exercised in the case of the MGNREGS by the groups enrolled under the scheme. In any case, only a part of the investment should be driven to maintain a self-sustaining growth of the pension fund and the harvested amount should reflect at least a minimum of 10% of contribution from the government.

Pricing Life-Annuities and Inclusive Growth

The investigation in this section is to find the degree to which annuity pricing may apply to the general population with some minor adjustments.

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[19] Kumar, S. 'Mortality Variations in India', 7, Global Conference on Actuaries, New-Delhi, 2005.

The LIC, India has a range of pricing constructed on the basis of the annuitant's mortality with an idea to market the products on healthy and super-select lives. It shows a range of relative reduction from 24.1% to 27.9% for age groups between 52 and 72 of the life expectancy values based on the male experience mortality. The reason for doing so seems to be that there is little market demand for life annuities of females in India. In the present research endeavour, it is therefore;proposed to enrol the active SSS groups as group-policy holders acting as single units to answer the question of life-expectancy, gender issues and financial values. In the proposed model, groups are to be characterized as a 'super-select life' for pricing annuities. Thus the gains or losses may be shared equitably among the members of the SSS group working as one unit. In this way, the accommodation of the interests of the vulnerable groups may be taken into account which was hitherto unavailable to them. Most of the existing mandated pensions require the applicants to fulfil some pre-conditions to join the pension policies such as,

1. The payment of minimum three months of premium amount or of a considerable amount for signing into the policy; or
2. The capacity to make continuous and fixed payment of premiums of a certain amount for a given term of the policy; or
3. The age and health factors etc.

The first pre-condition requires them to invest an initial amount to become the member which may not be possible for a daily wage-seeker to buy into those pensions policies. The second pre-condition offsets their attempt to become the member of the policies by requiring them to prove their earning capacities with a regular income. Since they earn through an intermittent employments of casual nature therefore, they cannot produce a document that could enable them to participate in the mandated pension policies. The age and health factors may weigh them down especially when they are in their mid-forties.

It might seem to be a distant dream for many a vulnerable group to buy into a pension policy unless supported with some kind of government relaxations. One method to overcome this difficulty is to let them work unitedly by arranging themselves into groups to cover any of the deficiencies as mentioned above. The members of the group may 'work and buy a pension policy as a single unit' and as such receive an equitable treatment within the group. This methodology would not only influence the pension market in pricing out annuities favourable to them but also help to gain an equitable dividend through a sustainable investment policy. The question of 'inclusive growth' can be similarly answered to some extent if, this methodology is adopted in designing a pension model to the unorganized sector workers. The idea of the "work-place pensions" can be realized in its fullest measure if, the issue of inclusion of the excluded is considered with or even without government subsidies.

Defined Collective Pension Policy

The existing mandated Pension schemes do not offer a choice of greater risk sharing between the parties; they either place the risk of inflation, investment and longevity on the sponsoring employers (Defined Benefit Scheme) or the individual (Defined contribution scheme). It is therefore, legitimate to question as to who should bear the risk of the scheme. The obvious requirement is a pension arrangement that would help strike a balance between individuals and employers in shouldering the risk of work-place pensions.

The Defined Collective pensionpolicy enables the sponsoring employers (MGNREGS) to give benefit to their workers or employees (MGNREGS job-holders) with the pension outcomes without having to bear the inherent liabilities of the work-place pension arrangements. In this way, the employers can reduce their liabilities in pension arrangements. The Defined contribution pension schemes on the other hand, throw the entire liability on the individual members who actually buy into the scheme as with many purchase schemes.

As we can understand from the research survey that generally people expect the government to provide for their retirement years in the form of a secured pension outcome; even more if they are expected to contribute for their retirement years. It can be easily inferred that some 19.06% of the respondents expected the government to contribute more than or equal to their contributions into the retirement pots. The general attitude of the respondents in the research survey seems to be that they (citizens) expect the State to provide for a legitimate income security in the old-age in a somewhat contributory nature of pension arrangement with a higher return. Only 17.4% of survey was found to be risk-averse. The respondents were ready to contribute for their future; however, they (82.04% of the survey) expected higher returns on their invested amount. Not only that, 72.09% of the respondents said that they can contribute ranging from as low as 10% to as big as 30% of the wages earned by them in a given year. Obviously, to equal their contributions would place more costs on the government exchequer. To reduce such a liability on the sponsoring employer (in the instant case, the Central and State Government sponsoring the MGNREGS), it is essential to revise the thinking to accommodate the needs of the unorganized sector workers at the same time, reducing the risks on the government to provide a greater certainty to the invested amount. This requires the cost of guarantee and bearing of the risks to be borne by a third party for instance, the LIC, India or the nationalised banks or POPs which can act as a pension provider as well as the insurer. This should facilitate increasing the returns to the members by proper investment of the accumulating pension amount in the capital market by the contracting third party (POPS).

What is urgently needed is the government's intention to evolve a suitable legislation accommodating the 'Concept of Collective Benefits in Work-Place Pensions' and to give a wider meaning to the 'right to work' guaranteed under the MGNREGA.

Test-Marketing

The test-marketing of the proposed scheme before its actual implementation at the national level is required to avoid any probable risk of failure from a cold start lf implementation. The slow warming up of the process will herald much progress and therefore, it is always advisable to phase the scheme to allow the opportunity 'to learn as you go'. Since it is going to be a development scheme; its impact should have a positive effect on the coming generations. A test marketing approach will give the results in a 'live-setting which can be modified before the projection at the national level is made. Test marketing the proposed model of CPS to the unorganized sector workers would present an estimate as to delivering the pension benefits at the same time help modifying the existing administrative set-up (POPs and CRA performance in particular) as well as the MGNREGS architecture.

From the indexed table of the State factor of the relative densities of the unorganized sector workers in India; the highest densities of them are found in seven States – Andhra Pradesh, Telangana, Gujarat, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. The State of Andhra Pradesh and Telangana fared together before bifurcation fared well with maximum wage-seekers turning to work under MGNREGS and within Andhra Pradesh, the Srikakulam District had the distinction of providing maximum employment at

the national level in 2014. The GOI may test market in these two or more States to find the efficacy of the proposed pension model to the unorganized sector workers and for that purpose the State of Andhra Pradesh and Telangana with high success rates of employment provided under MGNREGS should form the Pilot projects followed by the State of Odisha with lower aggregate population and even density of workforce across the whole State.

The minimum period of test-marketing should be for a year or so; and evaluation processes in place from the onset of implementation. Necessary adjustments to policy management processes are required before extending the scheme to the wider geographical catchment. The decision can be made once this point is reached on the advisability of implementing overall at the national level or in gradual phased manner.

The role of the Trade Unions and employers in facilitating the workers in theproposed scheme should serve as a possibility to see the interest of the salaried and wage-seekers of the unorganized sector in the proposed scheme.Such a Hypothesis needs to be rested in the Pilot Project of the proposed scheme. The mandatory option of enrolling the unorganized workers by their employers and trade unions should attract many workers into the scheme.

Hypothesis holds the proposed model of Contributory Pension Scheme successfully

The Hypothesis holds good to the proposed model of CPS for the unorganized sector workers and it proves beyond doubt about their abilities to contribute to their retirement pots provided they are considered for a suitable 'work-place pension' as envisaged in the proposed model. To reiterate the lines of the Hypothesis constructed for the present research and basing on its analysis - quantitatively and qualitatively, it can be safely concluded that,
"Generally, the unorganized sector workforce is inclined to contribute towards their old-age income security and even for many low-income security countries like India with large informal sectors; it would seem that maintaining a basic layer of non-contributory social pensions represent an affordable option for ensuring inclusive growth."

Through this research I, the research scholar of the NALSAR University of Law, Hyderabad in India strongly recommend the proposed CPS scheme of pension security to the unorganized sector workers in India to provide them a kind of 'safety-net' for their future. The United Kingdom had already started the ordeal of providing pension security to the informal workers in all employment sectors by introducing work-place pensions in the Pension Act of 2008. The compulsory enrolment of all the informal workers by their employers has been seriously taken up by the GOUK and this has been successfully implemented in three phases. Firstly, the big employers were roped-in to compulsorily enrol their employees and informal workers followed by the medium-sized employers and finally the effort is on-going to cover the employments of small to minimal sizes consisting of a few informal workers. The Government of UK through the scheme called 'NEST' has achieved the targets set from time-to-time in introducing the work-place pensions to all the informal sector workers; it is to be seen how the GOI is going to embrace this ordeal and of course, it will take at least a decade or so to bring all the unorganized sector workers not only in MGNREGS alone but in all the sectors of formal and informal employments in India. The idea is to cover all the unorganized sector workers under a single umbrella-like scheme that would cater to the needs of the old-age.

The manner in which the GOI may head start would be somewhat similar to the GOUK albeit with a slight change in picking up of the immediate chunk of workforce from the MGNREGS first, followed by the big employers to compulsorily enrol all their unorganized workers into the proposed scheme and finally, to rope-in all the remaining employers to secure the lives of the unorganized sector workers in India. The incentive of tax-exemption must propel the employers of all the employments to become the members of the proposed scheme. If this kind of a scheme can work in high- to low- economies throughout the world such as in the UK, USA, New Zealand and Chile etc. where there is found to be a very high rate of voluntary enrolment by the informal workers themselves then, why it should not work in India is a question that must not remain unanswered without putting an effort in that direction.

CONCLUSION

This research work does not boast to provide a final retirement solution for the entire unorganized sector workforce in India. The research however, addresses numerous issues with particular attention to the active wage-seekers under MGNREGS in India. The research data highlights the fact that there is higher number of unorganized sector workers existing far below the National Poverty Line, irrespective of the measures used in the survey. The likelihood of this group in making any pension contribution can be visualized only if a 'work-place pension' under the aegis of MGNREGS is made available to them through a policy-revision. There are others whose income seems to be fair enough to meet their two ends meet; however, the earnings usually increase seasonally requiring them to utilize the same for other pressing needs. In addition to this, there are females in their reproductive age who for the substantial period of their life require them to nurse their family concerns. A huge 89.23% of the Indian workforce in the agricultural sector is engaged in casual labour with unreliable income stream. Although, this scenario is not unique to India alone as it can be seen rampant everywhere in the world.

In spite of the hurdles mentioned above, it should be acknowledged that savings of any denomination is better than having none and the proposed model provides an opportunity to save money even in smaller amounts in one's own retirement pot. This method of pension contribution is distinct from other policies that require larger amount of capital for investment. If the envisaged payroll-account transfers for the unorganized sector workers is facilitated and the Points of Presence (POPs) brought into place for an automatic transfer of minimum value of contributions into their individual retirement pots; the savings will start to grow quickly. India thus, can make substantial progress if the 'mandated collective system' of pension prevalent in the UK the(NEST) is taken up for the cause of the millions of the unorganized sector workforce on a sustainable basis in India. Thus, an OASIS (Old-Age System of Sustainable Income Security) may help the poorest of the poor to tide over the vigours of the old age.

LIST OF RECOMMENDATIONS

Recommendation 1 To compulsorily enroll all the wage-seekers of MGNREGS into the proposed 'work-place government-assisted contributory pension scheme'; followed by the big employers to enrol on a compulsory-basis all their informal workers into the scheme and in the third phase to cover all the remaining employers to include the names of their informal workers in the proposed scheme.

Recommendation 2 The Pension Fund Regulatory and Development Authority (PFRDA) should work in coordination with the MGNREGS expertise to form a management information platform based on Central Records Keeping Agency.

Recommendation 3 For the purpose of pension disbursements the pension provider for NOAPS should be the preferred coordinator with the PFRDA and MGNREGS.

Recommendation 4 The GOI should consider the option that would produce zero transaction cost environment for point of presence POPs by considering the India Post as the potential pension provider and by basing POP profit margins on shares of the pension fund profits.

Recommendation 5 The scheme in the initial phase at least should have a seed-capital. The POPs as a service agreement condition should form the business relationships with the third party intermediaries in the CPS among lower income unorganized sector workers.

Recommendation 6 The commissioned agents of LIC and other private companies should not be engaged in the CPS and the India Post should be positioned to provide the services.

Recommendation 7 The PFRDA should consider facilitating monitoring and evaluation requirements in co-ordination with the National Data Survey (NDS) for developing time series data for all related purposes.

Recommendation 8 Each member of the CPS should be provided with a permanent retirement account number with a facility to withdraw amounts as is prevalent under other GPF like government schemes.

Recommendation 9 The routing of 3-10% rate of wage earnings of the workers of MGNREGS into the retirement accounts should be facilitated at source by the MGNREGS forum. The records-keeping should be updated by the PFRDA at regular intervals. The initial mandatory contribution rate of 3% should be raised up to a maximum of 10% under the proposed scheme.

Recommendation 10 The basic rules pertaining to the organized sector workers must apply to the unorganized sector workers, including the benefits that must accrue in such a long-term investment. The one-time lump-sum should be paid only in circumstances where instalments would produce lower amounts.

Recommendation 11 Since only 12.25% (62.2 million out of 507.71 million workforce) of the unorganized sector workers are actively working under MGNREGS in India; therefore, efforts must be made to include the remaining uncovered wage-seekers so that they can avail the benefit under the proposed scheme.

Recommendation 12 The comprehensive CPS model envisages the merger of all development schemes to provide for the fixed 10% rate of contribution towards the retirement accounts, that is to say that a beneficiary who is to receive public funds for instance, under the Housing scheme must allow 10% of that fund to aggregate into his retirement pot. In other words, whatever government assistance a beneficiary receives should include a pension equation apart from his contribution through MGNREGS or other earnings.

Recommendation 13 The CPS model also embraces all the employers in the government and other private sectors to voluntarily participate by enrolling their employees and unorganized workers of any size to avail tax-exemption benefit. Gradually, the enrolment of all the unorganized workers into the CPSmodel should be made mandatory in the lines of the National Employment Savings Trust(NEST) of England which should

provide a kind of Blue-print to include all the informal sector workers under one comprehensive old-age income security scheme.

Recommendation 14 This Thesis recommends that the CPS architecture and pension aggregator tools be test marketed in a selected State or States prior to full national implementation of the CPS scheme. On the basis CPS survey results the two States that appeal most for test marketing purposes are Andhra Pradesh and Telangana.

Recommendation15 Each member of the household should be guaranteed with a minimum of 100 days of employment under MGNREGS so that they can contribute enough savings towards their retirement instead of providing just 100 days to the Household.

Recommendation 17 On the basis of theresearch survey, the three States that appeal the most for test-marketing the proposed scheme are Andhra-Pradesh, Telangana and Odisha.

Recommendation 18 The evaluating test-marketing tools and the administrative set-up should be activated in the States where the 'test-drive' is to be performed; even if that needs an attempt to review policy settings.

Recommendation 19 The priorities for the various activities of the POPs and PFRDA are set annually on a consultative basis and the costs is met from the pension fund profits at a level to be determined by the PFRDA.

Recommendation 20 It is important to promote financial literacy as a part of schools-curriculum especially the retirement planning projects at an early age.**Recommendation 21 T**he Life-Cycle option is proposed for the wage-seekers of the MGNREGS who become the members of the proposed CPS model under which asset allocation would be growth assets totalling 70% and debt assets 30% up to age 35, with growth assets then reducing each year to reach 30% at an age of 47 and thereafter till 60years of retirement age.

Recommendation 22 The permit to "switch" investment option should be given to the subscribers.

Recommendation 25 TheFinancial incentive to encourage massive participation in the form of CPS in India should be considered similar at**theearliest.**

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