TRAIT ANALYSIS OF INVESTMENT PACKAGES AS EOQ BY USING COMPUTATIONAL TECHNIQUE: A CASE STUDY OF INSURANCE COMPANIES

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Abstract: *In this paper, an attempt has been made to analyze the traits (availability, demand, security and growth) of investment packages as EOQ with regard to three important insurance companies of India. Computing technique developed on the basis of σ – score, multiple correlation and regression have been employed to numerically demonstrate the model.*

Keywords: *investment package, multiple correlation and regression, σ – score, traits.*

1. INTRODUCTION

Investment packages offered by various insurance of finance companies can be treated as inventory items because it embodies market values (it can be sold and bought as materialistic items) with the security and growth vide (Acoff *et al.* al.,1968). Availability of insurance plan is vital for all countries. The security of the fund is of particular concern for any insurance company like LIC, ICICI and Bajaj Allianz etc. as in (Marquis and Long, 2001) using a 1993 survey of over 22,000 private employers in 10 U.S. states, found that changes in insurance price affect decisions to offer insurance, and that the share of employers offering insurance rose a mere 2.5% if insurance premium fell by 40%.

This relative lack of sensitivity of coverage to a large decrease in premium may mean that smaller employers resort to complex and highly ingenious ways of financing the increasingly costly health care coverage of their employees. They included co-insurance and also considered the provisions under Section 105 of the U.S. Tax Code that allows employers to create Medical Expense Reimbursement Plans (MERP) and write off the cost of Medi-gap insurance, co-payments for office visits and medications, return trip mileage for doctor's office visits, hearing aids and braces.

Under state's Children's Health Insurance Program (CHIP) for minor dependents of eligible single parents and the parents obtaining a single plan through the employer; and the small employer granting economic incentives to Medicare-eligible employees to declare Medicare as the primary medical care insurance. The insurance plans like medical insurance, money insurance, vehicle insurance etc play most important role to manoeuvre human life .Since each and every person wants to insure and secure his life from the forth coming risks. Risk can have several economic meanings such as risk describe the possibility of harmful event occurring or being induced. Such event may cause substantial damage. Second, risk refers to the variation, variance or volatility of economic indicators such as exchange rates or future investment returns. These movements may induce costs to some economic factors. In (Mark, 2003), discussed that cyber insurance provider potential source of risk to accurately predict insurance premiums and deductibles because no historical data available on cyber insurance policies and security violations, insurance providers find it difficult.

In (White-Means, Okunade, and Stafford, 1993) there is new thought about the evidence of differences in the job-lock behaviours for women and men could signal differences in the implications for job mobility, medical insurance coverage, the health care system's access policy designs, and the resulting gender-specific health outcomes.

Researchers Monheit and Cooper (1994), and Gruber, and Madrian (1994) used a voluntary job-switch dummy variable is the dependent variable, and proposed to use a continuous variable as the dependent variable to capture job-lock behaviour of workers. Dummy variables by nature constrain the informational contents of data. Therefore, although "voluntary job switch" could be a proxy of job-lock, this phenomenon could be alternatively captured using a continuous measure, such as the tenure of workers on a job.

Our novel measure, being continuous, would enable computation of marginal effects with respect to continuous independent variables, such as, years of education or number of children living at home. A worker may elect to continue work at his/her current employment with a longer rather than a shorter duration of tenure (resulting from frequent job switches), if indeed that particular worker has to satisfy the waiting period to qualify for health insurance, or more importantly when pre-existing health conditions are excluded from insurance coverage in a new job. In other words, medical care benefits are the least portable among employer-subsidized benefits in the worker's compensation package. Sullivan and Nozaki (1984) and Hui Sam (2008) employed the multiple regression analysis (MRA) for developing energy prediction equations from the results of building energy simulation.

For minimizing the number of simulations to generate the data a randomized approach to MRA is proposed. Several researchers, as in Benjamin, Guttery and Sirmans (2004), focused on the case study to the basics of real estate

appraisal and multiple regression analysis, and also include the market comparison technique as well as advantage and disadvantages of using multiple regression analysis.

In (Sander *et al.* 1993) provided the data for deriving algebraic expressions using multiple regression analysis, a set of simulation results is usually generated by varying the input parameters of building energy simulation.

Higher proportion of women tend to participate in health insurance, life insurance, retirement plans, and maternity (paternity) leave than men, has been elaborated as in Okunade and Wunnava (2002).

Using the logistic multiple regression method, in Lee (2005), the spatial relationship between landslide-occurrence location and landslide-related factors was calculated. A statistical program was used and calculated the correlation of landslide to each factor.

As we know that trade-off refers to the different types of expenditure by both the private sector and governments. Such butter versus guns decisions include the trade-offs between different types above.

Security driven improvements may even facilitate trade in the long run. Additional investments in secure facilities and modern technologies can reduce transaction costs. Security cost pressures could potentially induce reforms in trade-related institutions and infrastructure with beneficial effects on trade and growth. Better trade facilitation due to deregulation of trade-related sectors, harmonization of customs services and coordination across countries would increase trade among 75 countries by 377 billion USD (World Bank 2003).

Analysis of public policy choices in the security economy from an economic perspective and discussed the role of public goods for national and global security and identifies the importance of the first and second-order indirect effects of insecurity on economic activity, which include the behavioral responses of agents and the government to security measures (Bruck,2004). While in the United States the government required insurance firms to offer terror insurance, in Germany for instance the government helped subsidise a monopolist public private partnership re-re-insurer to cover potential terror risks.

The US scheme has suffered from insurance firms offering the obligatory terror insurance but doing so at premiums that are unattractive to most firms. Thus the insurers fulfil their legal obligations without incurring risky and potentially unprofitable terror risks discussed as in Kunreuther, Wolgast and Ruprecht (2002).

Therefore, this may represent an instance where public intervention and even subsidies are necessary for maintaining some market forces, rather than using regulation. World Bank elaborated that security regulations imply shifting economic resources between actors, including between sellers and buyers and between private and public agents. The existence of such a burden will reduce the efficiency of the market and hence growth. Regulation may be more targeted, thus reducing unnecessary security measures. Security measures have been discussed as in (World Bank 2004) and find new ways to communicate, to produce and to deliver goods. Security measures may deter or identify criminals thus reducing the exposure to risks and hence making the measures superfluous in the long-term. This may be true. It is, however, not clear if these developments will actually occur. A key policy focus should thus be the monitoring of security spending, the security situation, the security policies and their effects on the economy to adjust measures over time as appropriate.

Overall, security spending and security measures do have strong effects. It is less clear that these effects significantly restrict growth, trade and other economic activities. However, security policies appear to have a differential impact, depending on the nature of the economy. In the long-term, there operate strong forces which will alleviate the negative economic effects of security policies. In Hobijn, (2003), it is open to empirical analysis if and how soon the negative effects of insecurity will wear off in the long-term. Increases in efficiency may be obtained by better regulation and implementation.

In the context of the analysis of the impact of social security systems on saving and growth, the different treatment of population growth in the neoclassical and Classical models leads to a fundamental difference in the predicted growth path. Long-run equilibrium growth rate is determined completely by the capitalist saving function, sometimes called the Cambridge equation and second version of the Pasinetti Paradox: changes in workers' saving affect the level, but not the growth rate, of capital in the long run. Applied to social security, this result implies that an unfunded system relying on payroll taxes reduces workers' lifetime wealth and saving, creating level effects on the capital stock without affecting its long-run growth rate. His model is offered as an analytical framework for the review of current topics in fiscal policy, in particular identifying the social security reserve fund as a potential vehicle for generating capital accumulation and effecting a progressive redistribution of wealth vide for example Marglin (1984), and Michl and Foley, (2004).

In Kunreuther, and Heal, (2003) pointed out that on the demand side, people tend to under-estimate the risks of natural disasters or terrorist attacks when it comes to making insurance decisions. This "it-will not- happen-in-my-backyard" mentality represents another obstacle for developing an insurance market for disastrous events.

In this paper, a real case study of investment packages as EOQ has been conducted and their demand has been analyzed and computed with respect to their traits such as availability, security and growth.

Stratified random sampling approach has been employed to collect the data from various strata of population under consideration. Analysis and computing of the data has been carried out on the basis of psychological statistics, $\sigma -$ score, multiple correlation and regression techniques.

2. NOTATIONS

In this paper the following notations are used throughout the paper:

D = $\sigma-$score of demand

A = σ−score of availability

G = σ−score of growth

S = σ− score of security

σ_1 = Standard deviation of σ −score of demand

σ_2 = Standard deviation of σ −score of availability

σ_3 = Standard deviation of σ − score of growth

σ_4 = Standard deviation of σ − score of security

rgs = Correlation between growth and security

rda = Correlation between demand and availability

rds = Correlation between demand and security

3. DESCRIPTION OF THE MODEL

For the measurement of psychological data which are rather abstract in nature as compared with physical or biological characteristics. For scaling of the psychological data various devices, many of them based upon the use of the normal probability curve, have been used. Psychological scale is an interval scale and not a ratio scale since there is no absolute zero point. In this case, a number test items, say n, all designed to test the same trait, and are administered to a large group of individuals who are selected at random out of those for those whom final test is intended. We can find the proportion *i p* for the *i*th item (i = 1, 2, 3…n) successfully, i.e.

$$p_i = \frac{\text{Number of individuals answering } i\text{th item correctly}}{\text{Number of individuals}}$$

In the construction of the scale we assume that the trait (availability, demand and security, growth) being measured is distributed normally about some mean μ = 0 and standard deviation σ. Under the group provides a better scale, known as σ scale. Here the minimum ability to answer this item correctly under the assumption that the ability is distributed normally $N(0, \sigma^2)$. If *pi* is the proportion of the individuals answering *i*th item successfully then its difficulty value is given by σz_i where z_i is determined from the following relation:

$$P(Z > zi) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{\frac{-t^2}{2}} dt = pi \qquad (1)$$

$i = 1,2,...,n$ and where $Z \sim N(0,1)$

Let us suppose that the observation of the trait say X is N (0,1). Suppose that the individuals with trait values in the interval ($x_1 - x_2$) are given a rating A by the customers. The scale value corresponding to this rating A is defined to be the average trait value of all these individuals and is accordingly given by the formula:

$$\text{Scale value} = \frac{\int_{x_1}^{x_2} u\phi(u)du}{\int_{x_1}^{x_2} \phi(u)du} = \frac{\left| -\frac{1}{\sqrt{2\pi}} e^{-u^2/2} \right|_{x_1}^{x_2}}{\Phi(x_2) - \Phi(x_1)} =$$

$$= \frac{\phi(x_1) - \phi(x_2)}{\Phi(x_2) - \Phi(x_1)} \qquad (2)$$

The numerical score for rating is now obtained by shifting the origin in the scale value to -3.0 as an arbitrary origin, multiplying each σ -value so obtained by 10 and rounding them to the nearest integer. We get the score of each trait (availability, demand, security, growth) for different grades.

We find out mean, standard deviation of each variable trait from its corresponding scores and also correlations between pair of variables. After that we compute multiple correlation coefficient of the demand which is associated with availability, security and growth. Let us consider a distribution involving random variable demand, availability and security, growth.

Then the regression of demand (D) on availability (A), security (S) and growth (G) is:

$$D = a + b12.34\ A + b13.24S + b14.23\ G \qquad (3)$$

Without loss of generality, we can assume the variables D, A and S, G have been measured from their respective means, so that:

$$E(D) = E(A) = E(S) = E(G) = 0 \qquad (4)$$

Put these values in above equation we get,

$$D = b12.34\ A + b13.24S + b14.23\ G \qquad (5)$$

The coefficients $b_{12.34}$, $b_{13.24}$ and $b_{14.23}$ are known as the partial regression coefficients of D on A and D on S and D on G respectively, $e_{1.234} = b_{12.34} A + b_{13.24} S + b_{14.23} G$ is called the estimate of *D* as given by the regression equation (5) and the quantity:

$D1.234 = D - b12.34\ A - b13.24S - b14.23G$ is called the error of estimate or residual.

We apply the least square principle for knowing the value of b's which is given as:

$$b_{12.34} = \frac{-\sigma_1 \omega_{12}}{\sigma_2 \omega_{11}} \text{ and}$$

$$b_{13.24} = \frac{-\sigma_1 \omega_{13}}{\sigma_3 \omega_{11}} \text{ and}$$

$$b_{14.23} = \frac{-\sigma_1 \omega_{14}}{\sigma_4 \omega_{11}} \text{ ; where}$$

$$\omega = \begin{vmatrix} 1 & r_{da} & r_{ds} & r_{dg} \\ r_{ad} & 1 & r_{as} & r_{ag} \\ r_{sd} & r_{sa} & 1 & r_{sg} \\ r_{gd} & r_{ga} & r_{gs} & 1 \end{vmatrix}$$

$$\omega_{11} = \begin{vmatrix} 1 & r_{as} & r_{ag} \\ r_{sa} & 1 & r_{sg} \\ r_{ga} & r_{gs} & 1 \end{vmatrix} \quad \omega_{12} = \begin{vmatrix} r_{ad} & r_{as} & r_{ag} \\ r_{sd} & 1 & r_{sg} \\ r_{dg} & r_{ds} & 1 \end{vmatrix}$$

$$\omega_{13} = \begin{vmatrix} r_{ad} & 1 & r_{ag} \\ r_{sd} & r_{sa} & r_{sg} \\ r_{gd} & r_{ga} & 1 \end{vmatrix} \quad \omega_{14} = \begin{vmatrix} r_{ad} & 1 & r_{as} \\ r_{sd} & 1 & r_{sg} \\ r_{gd} & r_{ga} & r_{gs} \end{vmatrix}$$

where: $r_{da} = r_{ad}$, $r_{ds} = r_{sd}$ and $r_{dg} = r_{gd}$ are the correlation coefficients of demand with availability, security and growth respectively. Similarly, other correlation coefficients $r_{as} = r_{sa}$, $r_{ag} = r_{ga}$ and $r_{sg} = r_{gs}$ are the correlation coefficients between various traits are defined.

Hence the regression equation of demand is given as

$$(D - \bar{D}) \times \frac{\omega_{11}}{\sigma_1} + (A - \bar{A}) \times \frac{\omega_{12}}{\sigma_2} + (S - \bar{S}) \times \frac{\omega_{13}}{\sigma_3} + (G - \bar{G}) \times \frac{\omega_{14}}{\sigma_4} = 0$$

where D, A, S, G are the sigma-score of demand, availability and security, growth respectively and $\bar{D}$, $\bar{A}$ and $\bar{S}$, $\bar{G}$ are the mean of the σ − scores of D, A and S, G respectively.

In the notation subscripts before the dot are known as primary subscripts and those after the dot are called the secondary subscripts. The order of the regression coefficient is determined by the number of secondary subscripts are written is immaterial but the order of the primary subscripts is important.

The sensitivity analysis has been done with the help of computer programming in C^{++} language.

4. COMPUTING ALGORITHM

The following computing algorithm has been developed to compute all the necessary steps:

Step 1: begin

Step 2: input all variables for computation of sigma-score

Step 3: input all variables necessary for computation of correlation matrix

Step 4: input holding cost, setup cost (ordering cost) of different investment packages

Step 5: compute sigma-scores of D, A, S and G

Step 6: compute mean of sigma-scores of D, A, S and G

Step 7: compute standard deviations of D, A, S and G

Step 8: compute the regression equation of demand for various companies

Step 9: compute the EOQ of different insurance packages

Step 10: end.

5. SAMPLING OF DATA COMPUTATION OF MODEL PARAMETERS

Random samples were taken out in the stratified populations of various districts of Uttar Pradesh a largest province of India. This case study based on large sampling (more than 500 size of the sample) keeping in a view adequate represents of the population. Sampling units are randomly selected across the whole population. Though it is very difficult to gauge the psychological standing of investors, a sound and widely used scientific technique computing based on sigma statistics, multiple correlation and regression analysis has been rigorously used. For each company, we use separate data sheet and information for entering their choice according to sampling units' experience and knowledge.

After getting all the data based on above indices, we get the sigma score for traits (availability, demand, security and growth). The sigma-score of traits for LIC, ICICI and Bajaj Allianz are shown in the table (1), table (2) and table (3)

respectively. Difficulty score of any trait or sigma score of trait increases then the trait value will decrease i.e. if the difficulty scores of demand increases then the demand value will decrease. In similar manner, the difficulty score of availability decreases then the available quantity will increase, and the difficulty score of the growth decreases it means the growth of the fund will increase. While collecting the data through interview, three insurance companies operating in India i.e. LIC, ICICI and Bajaj Allianz are targeted to study. Four important traits such as availability, demand, security and growth have been associated with investment of each company and each trait has got five options or choices to be responded by each respondent. These choices include very-high, high, medium, low and very-low. Any one choice is supposed to be answer by each respondent. The following computation tables are given as follows:

Computation for LIC

Table 1.

Traits	Scores				Mean	S.D.
Demand	56	4	14	16	24.5	22. 942
Availability	48	13	19	18	25.5	11.786
Security	52	6	22	24	26	16.462
Growth	47	13	25	15	27	15.885

rda	*rds*	*rdg*	*Rd.asg*
			1.0
0.9960			
	0.9790		
		0.955	

D = 56.208 -0.71972 **G** – 1. 2134 **S** – 1.3751 **A**

Computation for ICICI

Table 2.

Traits	Scores				Mean	S.D.
Demand	11	14	18	17	15	13.162
Availability	44	27	19	19	27.25	11.786
Security	48	13	15	18	23.5	16.462
Growth	47	12	13	17	23.5	15.885

rda	*rds*	*rdg*	*Rd.asg*
			0.99864
0.9371			
	0.9008		
		0.9399	

D = 33.211-0.52272 **S**+ 0.27417 **A**- 0.57015 **G**

Computation for Bajaj Allianz

Table 3.

Traits	Scores				Mean	S.D.
Demand	43	15	16	18	22.5	22.94
Availability	38	24	18	21	25.2	8.928
Security	32	23	17	20	22.6	5.683
Growth	49	11	13	19	22	15.29

D = 39.14 + 0.33410 **S** + 0.26336**G** -1.30**A**

6. QUANTITY

The investment package is treated as the inventory and according to the assumption of simple inventory model without shortage with deterministic demand D. There will be a cost through a advertisement the package till its purchase C_h and a contrary cost which is invested on luring the customers towards itself is denoted as Co;

For equilibrium,

Carrying Cost = Ordering Cost

$$C_h = \frac{Q}{2} = Co\frac{D}{Q} \Leftrightarrow Q^* = \sqrt{\frac{2DCh}{Co}}$$

$$EOQ_{LIC} = \sqrt{\frac{2(56.208 - 0.71972G - 1.2134S - 1.3751A)Ch}{Co}}$$

$$EOQ_{ICICI} = \sqrt{\frac{2(33.211 - 0.52272S + 0.27417A - 0.57015G)Ch}{Co}}$$

$$EOQ_{BajajAllainz} = \sqrt{\frac{2(39.14 + 0.33410S + 0.26336G - 1.3025A)Ch}{Co}}$$

The following computation tables are given for EOQ of three insurance companies:

Computation of EOQ for LIC, ICICI and Bajaj Allianz for given security and growth S = 20 and G = 10

Table 4

Availability	LIC-Demand	ICICI-Demand	Baja Allianz-Demand
20	2.1776	22.064199	21.6998
15	4.1163	21.16765	28.9181
10	10.991	19.796801	35.430599

LIC-EOQ	ICICI-EOQ	Baja EOQ
1.47566	4.6977	4.658133
2.028867	4.600832	5.377555
4.060505	5.44933	7.290123

Computation of EOQ for LIC, ICICI and Bajaj Allianz for given availability and growth A = 15 and G = 20

Table 5.

Security	LIC-Demand	ICICI-Demand	Bajaj-Allianz Demand
8	11.4799	21.7387	27.5425
12	6.6263	19.647909	28.8789
15	2.9861	18.077975	29.88126

LIC-EOQ	ICICI-EOQ	Bajaj- EOQ
3.3882	4.662488	5.248095
2.57416	4.432596	5.373909
1.728034	4.252029	5.46637

Remarks:
(i) When σ − score of security increases then the σ − score of LIC-demand and ICICI-demand will decrease but σ − Score Bajaj-Allianz demand will increase.
(ii) When σ − score of security increases then the σ − score of LIC-package and ICICI- package decrease but the σ − score of Bajaj Allianz-package will increase.

Computation of EOQ for LIC, ICICI and Bajaj Allianz for given availability and security A = 15, and S = 15
Table 6

Growth	LIC-Demand	ICICI-Demand	Bajaj-AllianzDemand
20	2.9861	18.07975	29.88126
15	6.5847	20.9305	28.5644
10	10.1833	23.78125	27.247601

LIC-EOQ	ICICI-EOQ	Bajaj-EOQ
1.728034	4.252029	5.46637
2.566067	4.574968	5.344567
3.1911280	4.876602	5.219023

Remarks:
(i) When the σ -score of growth decreases then the σ – score of the LIC package demands as well as ICICI - package demand will increase but Bajaj-Allianz package demand will decrease.
So it is obvious that σ -score of EOQ of LIC package and ICICI-package will increase but σ -score of Bajaj –Allianz package will decrease.

7. OBSERVATIONS AND CONCLUSIONS

• From table (4) we can say that if only availability of investment packages are increased by each insurance company then demand of ICICI would increase but demand of LIC & Bajaj Allianz would decrease.
• From table (5), we observed that if only security of the money is increased by each company then Bajaj Allianz demand would increase, but LIC & ICICI – demand decrease.
• From table (6), it is clear that if only growth of the money is increased by each company then demand of the Bajaj Allianz would increase but the demand of LIC and ICICI investment packages decreases.
The above illustration shows that indices related to traits of LIC in the public domain are higher than ICICI and Bajaj Allianz. Moreover, traits indices related to ICICI are higher than Bajaj Allianz and Bajaj Allianz has lowest traits-indices in the market.
Through this work, we have attempted to show that growth and security have been targeted to have optimal trade off.
And, these are key factors for the investments by the customers in the market. Availability of schemes also affects the demand of investments for various investment companies.
It has been observed that business and professional classes while investing their money are more tempted the growth of the fund as compare to security of the same. In another words, we can say that professionals have more capacity to afford the risk and the hence they also tend to gain in their final pay off.

Similarly, middle class having low traditional education often considers security of the fund at top. So for as LIC is concerned, It has maximum demand among the customers because of high security, expected growth and availability of the schemes. Reason may be long established monopoly of the corporation in the field of the investment.

Here it is very interesting to note that about 15% sampling units reported to the interviewer, while the process of sampling, that they have no yet heard the name of Bajaj Allianz and about 5% to 10% sampling units are not well acquainted to ICICI organization. These reasons are because of low education index among customers in the society and least interactive exposer with cross sectional groups of the society. This kind of case studies can easily contribute to the decision making in investment sector as a scientific foundation.

This study further reveals that what is the amount of multiple correlation among various traits (demand, availability, security and growth), and multiple regression among them facilitating the system of comparison for various traits.

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