



Subject : Life Insurance – PPP

Actuarial Valuation & Risk

Introduction

- We know that during the early years of a policy the premium received by an insurance company surpasses the required amount due to the Level Annual Premium system. Thus there is collective excess, corresponding to the premiums of all the policies. This excess then constitutes a funds pool, which enables the company to, settle claims and meet deficit during years when the premium is not sufficient. It now becomes essential to determine whether the premium accumulated is on the same lines as the calculated premium. This enables the company in determining its solvency. Thus the process by which the value of all the existing policies is ascertained is called **valuation**.
- It is also called valuation of liabilities of the insurance company. And since the process of valuation is taken up by an 'actuary' by applying actuarial principles it is termed as **actuarial valuation**.
- The premium charged on policies covers the expenses incurred by a company. The pool of funds formed as a result of premium balance accumulated after deducting the expenses is called **Life Fund**.

Method of Valuation

Valuation of liabilities is the process of arriving at the value of policies existent on the day of valuation.

There are different methods of valuation:

1. Prospective method
2. Net premium method of valuation
3. Modified net premium method of valuation
4. Gross premium method of valuation
5. Gross premium method for with-profits policies
6. Retrospective method

Prospective Method

- When this method is used the prospective value of a policy at any time will be equal to the excess premium accumulated, as long as the business growth is anticipated as per the basis on which the premium was computed. Valuation also determines the adequacy of the life fund, because in a given situation the life fund is never sufficient, it is either in excess or will fall short of the requirement.

The formula applied to calculate valuation using prospective method is:

$$t_x^v = XA_{x+t} - P_x a_{x+t}$$

where,

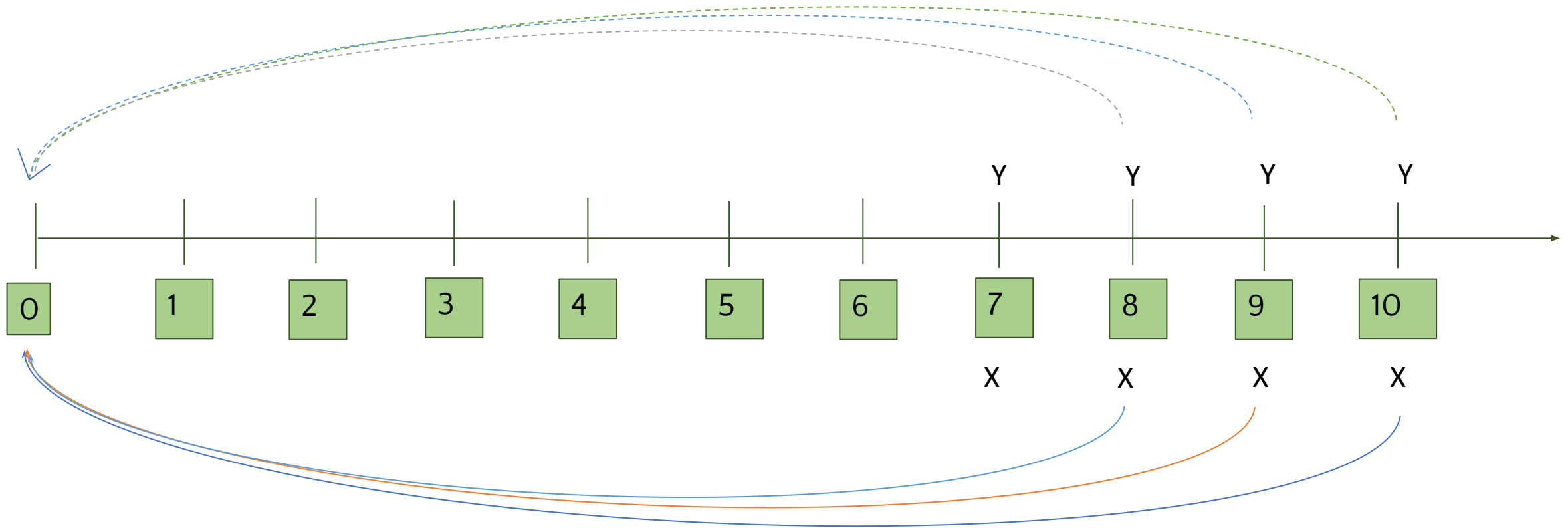
t is the duration elapsed since the date of commencement of the policy, it is reckoned in integral number of years.

x is the age as in during the latest birthday or next birthday as per the practice of the office.

T is obtained by calculating the difference between the calendar year of valuation and calendar year of commencement of the policy. But adjustment has to be made with regard to the month of valuation and the month in which the policy begins.

x + t is the valuation age. It is calculated by adding the duration elapsed (t) to the age (x).

In other words this method evaluates the current value of future premiums and the current value of future claims at a particular date. It can be more simplistically understood as:



X = Premiums received annually

Y = Sum assured or any benefits and expenses paid

The expected present value of the future outgo less the expected present value of the future income

Prospective Method

Valuation surplus = (Life Fund + Present value of future premiums) – Present value of future claims.

There is **valuation deficit** if the present value of future claims is more than the sum of life fund and present value of future premiums. Life insurance companies employ this method of valuation as for the purpose of calculation it considers the existent trends in interest, mortality and expenses, while it determines the present values of future premiums and benefits.

Net Premium Method of Valuation

- The premiums charged by insurers are always inclusive of the expense loadings in addition to the net premium. And usually, the actual expense incurred is covered in the premiums, while the expense loading is kept to meet any eventuality in the future. Therefore it is sufficient to consider net valuation for the purpose of valuation.
- The net premium method of valuation is based on the following considerations: For determining the factors required to calculate the value of the insured sum or any additional bonuses declared previously, true mortality tables and true interest rates should be used.
- Similarly true mortality tables and true interest rates should be used for determining factors required for the calculation of future premiums.
- According to this method of valuation, the valuation of a particular policy starts with zero on the day the policy comes into force. And with the life of the policy the value grows till the assured sum is reached, along with the declared bonuses.

Net Premium Method of Valuation

- We know that although the office premium for each policy is fixed and known at any of valuation there can be a change in the office premiums as on different dates the office premiums of policies in force will be based on different scales. But this is not the case with the net premium, which has
- only one value for a particular age at entry in case of whole life assurance and for each age of entry and original term in case of endowment assurance. The difference in value between the office premium and the net premium is termed as valuation loadings.
- If the valuation loadings are not utilised for expenses or contingencies, then they add on to the assets of the company and become a source of disposable surplus. Thus, there will be a surplus at the end of each year if mortality, interest and expenses do not deviate from the assumptions made for valuation. But if the insurance company intends to give bonus in the reversionary form, then the surplus accumulated after successive valuations will cause a reduction in reversionary bonuses. But if the life insurance company intends to follow the reversionary bonus method on a regular basis for the distribution of surplus, then it should reduce the valuation rate of interest to a rate less than what is currently earned by the life fund.

Modified Net Premium Method

- In this method the net premium value of the policy is reduced and brought to a new value, which is called the modified net premium. The deductions are made from the premium of the first year and the reserve formed as a result is termed as full net premium reserve. This implies that the net premium of the first year is set aside for expenses of that year and in doing so the entire modified net premium reserve becomes nil. But at the end of the term both the policy values become equal because the deduction from the net policy value gradually decreases. This modified net premium method is suited for a prospective method of valuation as it takes into account a higher value of premium, so that deductions can be made from the benefits to be availed, but finally arrives at a low-priced policy.

Gross Premium Method

In this method of valuation, the entire premium or the office premium is considered. The part of the premium that remains after the percentage for expenses is set aside is employed for arriving at the policy values.

The percentage of the premium, which is set aside for the expenses in the end, will correspond to what total expenses bear to total premiums. The expenses for which amount is set aside is chiefly calculated as the expenditure during the first year, which is heavy and not likely to be incurred again.

This kind of overall estimation of the expenditure works on the assumption that the proportion of new business to old business in the coming years will be the same as on the date of valuation

Gross Premium Method

For instance, if the insurance company intends to expand due to which the insurer had been writing a higher proportion of new business in comparison to the old business during valuation. In this case, there is a possibility that after some time the actual proportion of new business to old business is less than that assumed during valuation. Thus, when such a situation arises, to arrive at the premium for valuation, it is better to use a lower expense ratio. Once the percentage set aside for the first-year expenses is removed, the extra expenses are to be met through renewal premium income. The expense ratio derived from the renewal premium income is called renewal expenses ratio, which is nothing but the renewal expenses. It is essential for high priced businesses written by the insurance company that the amount set aside from the office premium to meet expenses is higher than the renewal ratio. However, insurers carry out an analysis of the expense and designate it between the 'initial' and 'renewal' cost of business. And according to the premiums of initial and renewal, cost ratio for new business, renewal servicing and claims (renewal cost ratio) are determined. In this method of valuation there is a considerable margin between the interest and mortality assumptions made during valuation and the actual experience. The mortality rate adopted for valuation is much higher than what would happen in future. With respect to the life fund, the yield earned on the life fund is lower than the rate of interest employed.

Gross Premium Method

A serious fault with this form of valuation is that it overestimates the liability of the insurer, thereby reducing the share of the policy owners (in the form of bonus) from the surplus. It also makes it difficult to ascertain the kind of bonus the fund would support in the coming years.

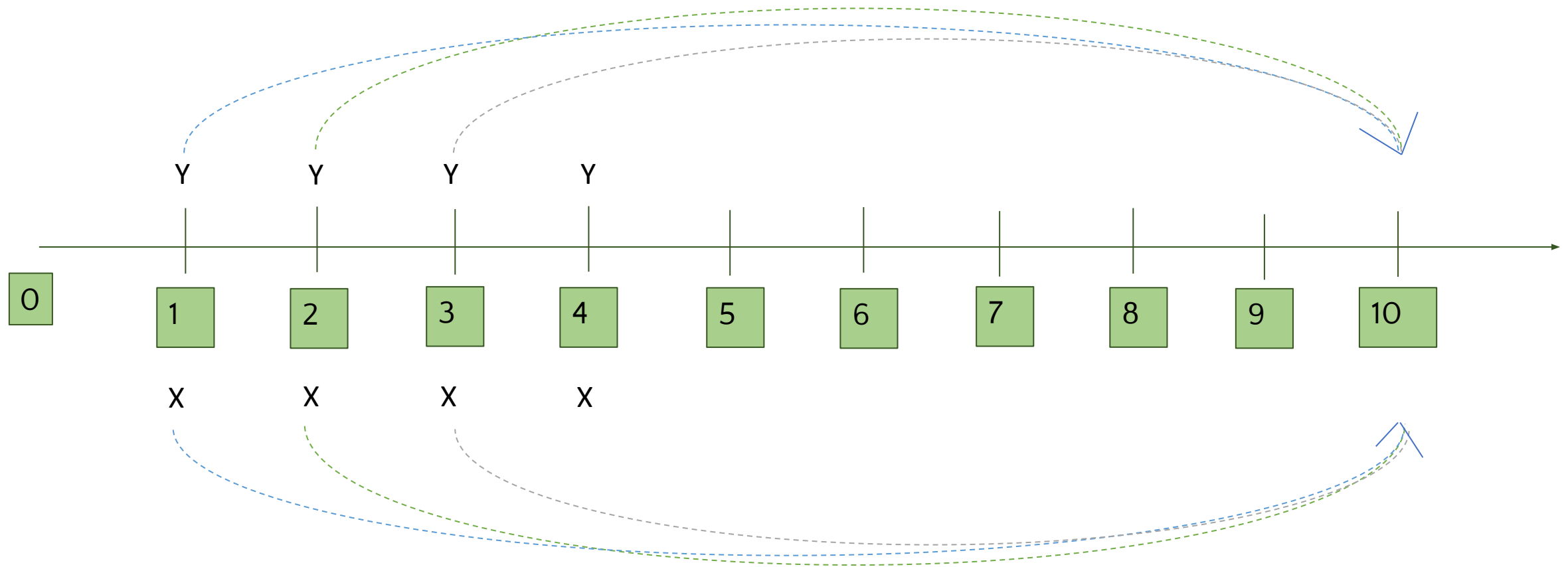
Gross Premium Method For With – Profit Policies

In the method of valuation we discussed above (gross premium method) a part of the office premium is thrown off to meet expenses. Likewise in a situation of expansion of business a percentage higher than the renewal expense ratio, but lower than the ratio of total expenses to total premiums is suitable. But such a case is not applicable for With-Profit policies and is only for without profit office premiums. This is because the with-profit office premiums in addition to expenses also contain bonus loadings. Thus in the case of with-profit office premiums a larger percentage has to be thrown off at the time of valuation to meet future bonuses. This can be better explained with the help of an example. Let us assume that 15% is set aside from a without profits office premium for future expenses. But for a with profit policy the insurer will have to set aside at least 20% or more for expenses and bonuses. And this will also depend on the rate at which the future bonuses are to be declared for the policyholders.

Net Premium	Gross Premium
is the prospective reserve, where we make no allowance for future expenses	the premium required to meet all the costs under an insurance contract, and is the premium that the policyholder pays.
expected present value (PV) of an insurance policy's benefits minus the expected PV of future premiums.	expected present value (PV) of an insurance policy's benefits plus expected value of expenses minus the expected PV of future premiums.

Retrospective Method of Valuation

A retrospective method is employed to determine the policy values of all the existing policies. The excess of the existing life fund after meeting the value of all the policies is called valuation surplus. There is a valuation deficit if the life fund falls short of the total policy values.



X = Premiums received annually

Y = Sum assured or any benefits and expenses paid

The accumulated value allowing for interest and survivorship of the premiums received to date less the accumulated value allowing for interest and survivorship of the benefits and expenses paid to date

Surplus & Its Distribution

- In life insurance the word 'surplus' signifies an estimated profit. This is because the calculation of profit in insurance business is slightly different from other businesses. We all know that normally profit is the excess over the cost price of a product. Thus in regular businesses, the difference between the cost price and the selling price decides the profit made or loss incurred. But it is not the same in the case of an insurance business. Profit in insurance business is a result of margin kept on the basis adopted for the calculation of premium with regard to mortality, expenses, interest and other factors like surrender and lapse. Profits are also made when the actual earning is more than the projected value at the time of premium calculations.
- Likewise if the actual experience of the insurer is the same as the projected value at the time of premium calculations then the difference between the liability of the insurer and the life fund is considered as profit achieved on the basis of margin provided while calculating premium.

Surplus & Its Distribution

- Going back to a situation when the actual experience is better than the projected, the profit achieved is not only due to the margin kept during valuation of premiums but is also the profit arising as a result of favourable experience up to the time of valuation. This situation may arise when the life fund, which is an accumulation of the excess premiums after settling the claims for that year. As a result of favourable circumstances claims are few, so the expenses are reduced, hence the **outgo** from the company is less. In an insurance business the actual profit cannot be determined, as the company is to meet future liabilities and has to receive premiums in future. Furthermore the excess of assets that remains after settling current liabilities cannot be termed as 'profit' as it will be required to meet the liabilities in future. Thus it is very difficult for a life insurance company to declare the profit made at the end of a year. It is possible to declare profits only if the company closes its new business procurement operations, after which it should have met the liabilities to the last policy. After this the funds left with the company can be considered as profit.

Nature of Surplus

- Surplus is accumulated when there is a favourable deviation from the projected value with respect to mortality savings, excess interest and loading savings. That is, when the actual experience overshoots the assumptions made during valuation, which are very conservative estimates.
In life insurance there are five sources of surplus:
- **Surplus from investment earnings:** Life insurance policies are long term contracts, thus it becomes essential for the insurance company to maintain a conservative rate of interest, so that there is a steady income as long as the policy is in force. The interest rates are often conservative. For example if the insurance company bases the reserves expecting to earn 4% but actually earns 7% then there is an excess of 3%, which should go to the policyholders.

Nature of Surplus

- **Surplus from mortality:** Usually the rate of mortality considered during reserve calculations is much higher than what exists on ground. This is because insurers employ conservative methods thereby retaining a broad margin to meet any eventuality. Usually the projected mortality is higher than the experienced, thus the surplus after settling all mortality claims is considered a gain.
- Two factors required for the calculation of mortality surplus are expected death strain and actual death strain.
- Death strain = $(S - V)$, in this equation S is the sum insured, and V is the policy value.
- Now if we consider a situation where all the policies are of the age x , and if Q_x is the evaluation rate of mortality and q_x is the actual rate of mortality,
- $Q_x (S - V)$, represents the expected death strain; and
- $q_x (S - V)$, represents the actual death strain
- Thus mortality surplus is the difference between the expected death strain and the actual death strain. Mathematically, mortality surplus = $(Q_x - q_x) (S - V)$

Nature of Surplus

- **Surplus from Loading:** If an insurance company has to do well then the gross premium earned by the company should be sufficient to meet not only the regular expenses but any unforeseen expenditure also. Thus loading on policies is inclusive of policyholders' dividend and gains from other sources.
- **Surplus from surrenders:** The surplus gain as a result of the difference between the policy reserves released due to surrender and the surrender values permitted is called surrender surplus. This form of surplus also represents the amount that was originally taken from the surplus to replenish the reserves. In reality, this surplus is on paper i.e. it is the repayment of borrowed surplus, in a situation when the asset share is below the surrender value of the policy. But there is a gain when the assets share is far greater than the surrender value of the policy. These gains are often channelised for expenses incurred while distributing the divisible surplus to the policyholders.

Nature of Surplus

- **Distribution of surplus**
- At the end of a year's business the insurance company determines the surplus accumulated in addition to the surplus carried on from the previous years. After such a calculation, the company decides the percentage of surplus, which has to be retained as contingency fund, and also the percentage that should be distributed to policy owners. The amount set aside for distribution as dividend to policy owners is called

Nature of Surplus

- **Divisible surplus.**
- The percentage to be set aside for distribution is decided by the trustees or directors of the insurance company. Once the divisible surplus is decided it is no more a surplus but a liability for the insurer. There are certain basic norms that an insurance company has to abide with, while determining the divisible surplus. They are as follows:
- **Equity:** The distribution of surplus should be fair and proportionate, that is the policies contributing more to the surplus should be given a better share.
- **Flexibility:** The divisible surplus should be flexible according to the situation.
- **Simplicity:** The method employed in ascertaining the divisible surplus should be simple and uncomplicated for easy understanding by the shareholders. The process should also be transparent.
- **Consistency:** The dividend provided to policyholders should exhibit consistency, for, the sales force and the policyholders do not appreciate wide fluctuations in dividend.

Method for Distribution of Divisible Surplus

- **Contribution Method:** This is also called as fair distribution, but is an impractical method of surplus distribution. According to this method distribution is directly based on the contribution of the policies to the surplus accumulated from basic sources like interest, expenses, mortality etc.
- **Simple Reversionary Method:** In this method the bonus is paid in addition to the sum insured, when the event for which insurance is provided occurs, that is death during the term of the policy, or on maturity of the policy. Therefore it is termed as reversionary. It is a popular method as it allows the insurer to retain the surplus enabling him to earn interests on it. It also gives an incentive to policyholders to maintain their policies. Furthermore it is a very simple procedure.
- **Compound Reversionary Bonus System:** This method is also reversionary as the one discussed above. But the incentives provided to the policyholder by this method are better. In this process the bonus addition of each year is of an increasing nature, and the rate that is given is a percentage of the sum insured and the bonuses added during the maturing years of the policy.
- **Bonus in Cash:** In this method the bonus announced is paid in the form of cash to the policyholders.

Method for Distribution of Divisible Surplus

- **Bonus in Reduction of Premium:** In this method the bonus is reduced from the premium payable by the policyholders to the company. But after a certain period there will be no premium to reduce from, so the company will have to change its way of distributing surplus. There is another disadvantage of this method; it reduces the profit acquiring capacity of the company due to loss of premium income and due to depletion of funds, as the surplus is distributed as cash.
- **Tontine Bonus:** In this process the bonus is distributed after a specific period to the survivors among the policyholders. To avail this kind of bonus, the policyholder should be alive on the date when the bonus is announced. In this method the distribution of divisible surplus is deferred to a future date, and for the first few years of the policy it is not considered eligible to participate in profit sharing. New entrants favour this method, as it enables them to conserve their resources and also removes the need to distribute surplus in early stages.
- **Interim Bonus:** In this the bonuses are announced on the basis of valuation of all the policies at the date of valuation. If some policies result in claim (in case of death) or maturity before the next valuation then they are not eligible for that bonus, as by then they will not be part of the company.

Method for Distribution of Divisible Surplus

- **Interim Bonus:** In this the bonuses are announced on the basis of valuation of all the policies at the date of valuation. If some policies result in claim (in case of death) or maturity before the next valuation then they are not eligible for that bonus, as by then they will not be part of the company records, but an interim bonus according to the previous valuation is provided.
- **Guaranteed Bonus:** This method is applicable for without profit policies, which are not entitled to surplus of actuarial valuation. In this process there is guaranteed addition of bonus at a fixed rate for every year, to the sum assured, as long as the policy is in force.
- **Final Additional Bonus:** This is an extra bonus paid by the company to policyholders apart from the usual annual bonus. This is generally paid to policies lasting for long durations, and due to the contribution made by these policies to the surplus. Considering the period for which the premium under a policy was received the company may decide to pay an additional bonus to the policyholder in case of claim or maturity of the policy. Life insurance Corporation of India was following this process, provided the policies were in force at the time of claim or maturity, along with prior payment of 15 years premium.

Method for Distribution of Divisible Surplus

- **Frequency of Distribution**
- In many countries it is a statutory requirement to pay dividend annually, due on all participating policies. However there are certain policies on which dividends are paid only after the passage of the stipulated time like, 5, 10 and 20 years etc. This is called deferred dividend.
- Policyholders are not entitled to the annual dividend if they fail to pay the premium within the stipulated time frame. The lost dividend is paid to policyholders who had been regularly paying the premium during the deferred dividend period.