

# GPV Workshop: Economic Assumptions for Discounted Cash Flow valuation

Teoh Seng Hong, FIAA  
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# Introduction

## ■ Very pleased to be here!

## ■ Myself

- Teoh Seng Hong
- Chief Actuary of AXA in Indonesia
- Previously held Chief/Appointed/Certified Actuary positions in AIA in Singapore and Thailand.
- Current Fellow of the Institute of Actuaries of Australia since 1994.
- When working in New Zealand (8 years) and Thailand (5 years), was also Fellow of NZ Society of Actuaries and Certified Actuary of Thailand.
- Lived and worked as Actuary in 7 countries (Australia, New Zealand, Thailand, Singapore, Hong Kong, Malaysia and Indonesia) with 3 employers (AMP, AIA, AXA).

# Introduction & Rules

## ■ Interactive Workshop Session

- Please participate!
- Questions based.
- Don't be afraid to make mistakes!

## ■ A little bit of Competition!

- Form 2 teams.
- Team A on my left; Team B on my right.

## ■ Simple Rules

- Each team will take turns to answer a question on GPV. (the assumption is that participants already know about GPV from past PAI seminars! So, all participants are ready for "Actuarial Exams" on GPV Economic Assumptions!)
- The answers are simple Yes/No, or True/False answers.
- I will ask "Who thinks the answer is True, please raise your hands". I will then ask "Who thinks the answer is False, please raise your hands".
- If there are more hands raised as True, then, the team is regarded as having state it is "True".
- If the correct answer is True, then, the team wins a point. If the correct answer is false, then, team gets zero points.
- There will be up to 50 questions depending on how much time we got.
- The winning team will be the one with the most points by the time we run out of time!

# Rules and Disclaimer

- **Participate and compete fairly!**
  - Please respect each other.
  - Before counting the hands, please be silent and do not “taunt” the other team with false answers.
  - No consultations before counting of hands.
  - Everyone should raise their hands independently.
- **If you disagree with the answers that I've given, or need clarification, do raise your hands and ask!**
  - This is the point of this workshop, which is meant to be interactive.
  - But please be mindful of the limited time.
  - We can only spend roughly 2 minutes per question (assuming 2 hour slot).
- **DISCLAIMER: Please note that the views and answers expressed here are purely my own personal and professional views, and does not necessarily represent the views of my Employer, nor PAI, nor MOF.**
- **Let's Get Started!**

# Question 1 (Team A) – GPV Formulae Background

Consider a 10 year Endowment policy:

**Question.** *True or False?*

**GPV Reserve =  $A - B$  where**

- ***A = Present Value of Projected Future Policy Inflows, and***
- ***B = Present Value of Projected Future Policy Outflows.***

## Question 2 (Team B) – GPV Formulae Background

***Question. True or False?***

***The international best practice methodology to calculate GPV reserve is to use Commutation Functions in the latest version of Excel, not older versions of Excel.***

# Question 3 (Team A) – GPV Formulae Background

## ***Question. True or False?***

***The definition of “Projected Future Policy Inflows” should include both Projected Future Premiums as well as Projected Future Investment earnings earned, using an appropriate investment return assumption.***

## Question 4 (Team B) – GPV Formulae Background

**Question. True or False?**

**To project Future Premiums at all future durations, the actuary should take into account all policy decrements - mortality, TPD (if full payment terminates policy and affects future premium receipts), critical illness incidence (if full payment terminates policy), policy lapses, surrenders, maturity and any other decrements or factors that could impact the future pattern and receipt of policy premiums in the future.**

# Question 5 – GPV Formulae Background

**Question. Yes or No?**

*An endowment product was originally designed to provide a 5% automatic premium increase and automatic SA increases each year.*

*Should the projected premium and benefits allow for the automatic increase each year – Yes / No?*

# Question 6 – GPV Formulae Background

## **Question. Include or Exclude?**

*(Overheard Conversation between Actuary and Actuarial Student)*

**Actuary:** Please explain the items included in the GPV Future Projected Outflows.

**Actuarial Student:** I've modelled Death Benefits, Surrender Benefits, Maturity Benefits, Management Expenses and Distribution Expenses.

**Actuary:** Why didn't you model Profit Tax as well since isn't this a cash outflow? Shouldn't profit tax be part of the outflow as well to be prudent?

**What do you think? - Should profit tax be included or excluded from the Future Projected Outflows? Include / Exclude?**

## Question 7 – GPV Reserve Results

**Question. True or False?**

***Assuming a higher interest rate in GPV calculations gives higher GPV reserve results.***

## Question 8 – GPV Reserve Results

**Question. True or False?**

*The initial GPV reserve results should always be a positive number, since when a company sells a life insurance policy, there should always be a future liability to the policyholder as long as the policy remains in-force, and hence reserves. So, if the initial calculated number is negative, this means there is always an error.*

**True or False?**

## Question 9 – GPV Reserve Results

***Question. True or False?***

***When the initial GPV reserve calculated for a policy is negative, the international best practice methodology is to always set that number to zero for reserving purposes.***

# Question 10 – GPV Economic Assumption Scope

***Question. True or False?***

***To calculate GPV for 10 year endowment policy, the only economic assumptions needed are the Risk free interest rate/s.***

# Question 11 – GPV Economic Assumption Scope

**Question. True or False?**

*To calculate GPV for a 10 year non-participating endowment policy, between the 2 following economic assumptions - investment “earnings” rate assumption vs investment “discount” rate assumption - only the latter is needed and the former not needed.*

*(For clarity, “earnings” rate is used to accumulate the assets and net cashflows with interest, whereas “discount” rate is used to “present value” the future projected cashflows.)*

**True / False?**

# Question 12 – GPV Economic Assumption Scope

**Question. True or False?**

**To calculate GPV for a 10 year participating endowment policy (with bonuses and policyholder dividends), between the 2 following economic assumptions - investment “earnings” rate assumption vs investment “discount” rate assumption - only the latter is needed and the former not needed.**

**(For clarity, “earnings” rate is used to accumulate the assets and net cashflows with interest, whereas “discount” rate is used to “present value” the future projected cashflows.)**

**True / False?**

# Question 13 – GPV Economic Assumption Scope

**Question. True or False?**

*To calculate GPV for a simple 10 year endowment policy with level Sum Assured and level regular premium, since future premiums and benefits are level, there is no need to make any inflation assumptions in the GPV calculations.*

# Question 14 – GPV Economic Assumption: Importance

***Question. True or False?***

***As there is no need to project future investment income in calculating GPV reserves, therefore, economic assumptions are usually less important than non-economic assumptions in Indonesia.***

# Question 15 – GPV Economic Assumption Importance

**Question. True or False?**

***It is impossible and can never happen, that 1% change in interest rates can double the GPV reserve of a 10 year Regular Premium Endowment contract.***

## Question 16 – GPV Discount Rates

### ***Question. True or False?***

***When a company provides guaranteed benefits - such as a 10 year non-participating Endowment with a guaranteed maturity value where there is “no risk” (i.e. “risk free”) to the policyholder of receiving a reduced maturity amount for example – the international “best practice” standards and an appropriate and prudent asset-liability matching policy would suggest that the company should invest in similar “risk free” assets (such as government bonds), if everything else is equal.***

## Question 17 – GPV Discount Rates

**Question. True or False?**

*A company has a clearly written and Board approved Investment Policy which requires the Investment Manager to invest the assets backing its non-participating Endowment policy liabilities in a balanced mix of investment assets which includes 20% Term Deposits, 40% Government Bonds and 40% Equities. The Investment Manager adheres to this practice impeccably. This strong discipline and very consistent past practice suggests that the Company Actuary must always use the portfolio weighted expected returns (which assumes 20% TD, 40% Gov Bonds, 40% Equities) to discount its future GPV liabilities.*

## Question 18 – GPV Discount Rates

***Question. True or False?***

***The Expected Returns of Risk Free assets are always lower than Expected Returns from Risky Assets in rational markets.***

## Question 19 – GPV Discount Rates

***Question. True or False?***

***An asset portfolio that invests in a mix of Term Deposits, Bonds and Equities should always have higher long term expected returns than a portfolio comprising only of Government bonds.***

## Question 20 – GPV Discount Rates

**Question. True or False?**

*In performing GPV-related calculations, the international “best practice” standards to determine the GPV discount rates is to always allow for some risk margins (or “PAD”, or Provision for Adverse Deviation), since valuation assumptions should be more prudent than pricing assumptions.*

# Question 21 – GPV Discount Rates

## Question. True or False?

*Assuming the inputs in blue in the table below are correct – is the methodology to calculate the “Portfolio Weighted Expected Returns” below correct? Note that below is simply the “sumproduct” of the Mix (in column [1]) and the Expected Returns (in column [2]) for each asset type.*

Asset Type	Mix [1]	Exp Ret [2]	[3] = [1]x[2]
Term Deposits	20%	5%	1.0%
Government Bonds	40%	7.50%	3.0%
Equities	40%	10%	4.0%
Portfolio weighted Expected Returns			8.0%

## Question 22 – GPV Discount Rates

**Question. True or False?**

*The company invests in a balanced mix of assets (Term Deposits, Bonds, Equities) to back its Participating Endowment policy liabilities, and so, it should only use the Portfolio Weighted Expected Returns to discount its future GPV liabilities.*

## Question 23 – GPV Discount Rates

### **Question. True or False?**

*In theory, the Best Estimate assumption is the assumption where there is a 50:50 chance that the actual experience will turn out lower or higher than the Best Estimate assumption. Therefore, if there are 2 different “time-horizons” for the same economic assumption (e.g. 1 year vs 10 years government bond yields), there could be 2 different “Best Estimate” assumptions, both of which are equally valid.*

## Question 24 – GPV Discount Rates

**Question. Yes or No?**

*Assume that the Expected Returns shown in Column [2] are “Long Term Best Estimate” rates for the asset types. To calculate the “Long Term Best Estimate Portfolio weighted Expected Returns”, should the Asset Mix always be based on last year end’s Actual Asset Mix?*

Asset Type	Mix [1]	Exp Ret [2]	[3] = [1]x[2]
Term Deposits	20%	5%	1.0%
Government Bonds	40%	7.50%	3.0%
Equities	40%	10%	4.0%
Portfolio weighted Expected Returns			8.0%

## Question 25 – GPV Discount Rates

***Question. True or False?***

***In setting the long term best estimate portfolio weighted expected returns, the company should base its decision on its own actual historical experience of it's own actual investment portfolio.***

## Question 26 – GPV Discount Rates

**Question. Yes or No?**

*A company's historical equity returns consistently underperformed the equity market returns over the past 5 years. In studying the past data, the Actuary noted that the losses were due to stocks that were largely unheard of (not large cap stocks) which were sold when the prices were lower than when they were bought. As the new Appointed Actuary just became aware of this under-performance, his first decision is to use a lower equity expected return assumption. Is this decision always correct?*

## Question 27 – GPV Discount Rates

### **Question. True or False?**

*The key economic assumptions to perform a GPV valuation for a typical life insurance company are:*

- **Risk free rates to value its Non participating life insurance liabilities**
- **Best estimate portfolio weighted expected returns to value its Participating liabilities (and Risk Free rates for guaranteed benefits).**
- **Inflation assumption to project future per policy expenses of the company.**

## Question 28 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*If the Asset Value was based on amortized value, and the GPV valuation used the risk free yield curve on the same valuation date, the current low market interest rates may sometimes cause unnecessary technical insolvency.*

## Question 29 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*If the Asset Value was based on amortized value, and the GPV valuation used the risk free yield curve on the same valuation date, a temporarily high market interest rates can cause “windfall gain” that might not really be there.*

# Question 30 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*If Assets are marked to market, when interest rates fall, the company solvency position always improves because according to the CIO, the market value of bonds always rises when interest rates fall.*

# Question 31 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*If Assets and Liabilities are both “marked to market”, and the Asset duration is substantially shorter than Liability duration (which can be typical for life insurance companies), the company is in a perfectly good financial position.*

## Question 32 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*Today, for Solvency/RBC reporting, the industry is currently using an Amortized Value basis for Government Bonds. It has been argued that the new GPV valuation will always be better than NLP valuation to determine solvency/RBC position because in past industry presentations, the presenters have showed that GPV reserves can be expected to be higher than NLP reserves, and since these reserves are higher, it should always be more prudent to use GPV than NLP reserves.*

## Question 33 – GPV Economic Assumptions & Solvency

**Question. True or False?**

*In theory, GPV valuation must always be updated regularly to be in line with Market value of assets for all public reporting such as Solvency/RBC reporting (if the results are made available publicly) and all public financial reporting. Otherwise, the solvency and financial results will not be consistent.*

## Question 34 – GPV Risk Free Rates

**Question. True or False?**

*For returns on liquid assets such as the Indonesian government bond yield curve, it is generally considered more accurate and safer to get Risk Free Rates from professional investment sources such as Bloomberg.*

## Question 35 – GPV Risk Free Rates

**Question. True or False?**

**To set the Risk Free rate assumption, you must always use the 10 year Government Bond rate, because it is the most liquid and most popular benchmark duration compared to other durations.**

## Question 36 – GPV Risk Free Rates

**Question. True or False?**

*A company has a disproportionately large (say 60%) cash outflow expected in 12 months time. Is it always appropriate for the company to use the 10 year Government Bond rate to value its GPV liabilities?*

## Question 37 – GPV Risk Free Rates

**Question. True or False?**

*In the context of Government Bond valuation, the “Yield to Maturity” rate is the single interest rate that equates the Purchase Price of the Bond with the Present value of all future coupons and proceeds of the bond.*

## Question 38 – GPV Risk Free Rates

**Question. True or False?**

***In the context of Government Bond valuation, the “Spot Rate” at Duration “n”, is the equivalent zero coupon yield for that specific duration.***

## Question 39 – GPV Risk Free Rates

**Question. True or False?**

*A company intends to use the Risk Free Yield Curve to value its GPV liabilities, because it has cash outflows that is reasonably spread across all durations. Is it correct to use the Yield to Maturity yield curve that is commonly found in reputable, professional sources such as Bloomberg?*

## Question 40 – GPV Risk Free Rates

***Question. True or False?***

***A professional source like Bloomberg does not provide the Spot yield curve for Indonesian government bonds because there is no zero coupon bonds in Indonesia.***

## Question 41 – GPV Risk Free Rates

***Question. True or False?***

***To derive the risk free yield curve to use in GPV calculations, you should almost never apply PAD or any other adjustment, unless there are very strong justifications to do so and you would only do so after serious consultations with relevant experts and authorities.***

## Question 42 – GPV Risk Free Rates

**Question. Yes or No?**

*You plan to use the Risk Free yield curve to calculate your GPV liabilities, and found that there was a “kink” at duration 9 rates, compared with duration 8 and 10 years. Therefore you decide to “smooth” the yield curve to remove the “kink”. Is this adjustment necessary for year end IFRS reporting? – Yes / No?*

## Question 43 – GPV Risk Free Rates

### ***Question. Net or Gross?***

***In Indonesia, coupons on Indonesian Government bonds attracts Final Withholding Tax rate of 15%. This tax is unavoidable, and must be paid. Therefore, should GPV discount rate assumes a Net or Gross of WHT?***

## Question 44 – GPV Risk Free Rates

**Question. True or False?**

*In setting the risk free rate assumption for GPV purposes, if you have very strong views and strong belief that interest rates will rise in the future (and it has in fact risen as you predicted), you are allowed to assume a higher interest rate than what the actual market rates was at the time of valuation. True / False?*

## Question 45 – GPV Inflation Rate

**Question. Yes or No?**

*A company actuary decided not to set any inflation assumption for GPV valuation. The justification is because his company expense experience study showed that over the past 3 years (2009 to 2011 period), his company expenses have been progressively lower and therefore, he argued that there was deflation (and not inflation) for his company. Is his justification correct?*

## Question 46 – GPV Inflation Rate

***Question. True or False?***

***Each company must use only its own inflation experience to set its future inflation assumptions.***

## Question 47 – GPV Inflation Rate

***Question. True or False?***

***Last year's inflation rate was 3.8%. Is it always appropriate to assume 3.8% as the future inflation rate?***

# Question 48 – GPV Inflation Rate

## ***Question. True or False?***

***At the start of 2010, the Actuary received the following data for CPI experience and has calculated the following averages:***

Year	2005	2006	2007	2008	2009
CPI	17.1%	6.6%	6.6%	11.1%	2.8%
1) Latest Year					2.8%
2) 3 Year Average					6.8%
3) 5 Year Average					8.8%

***As a result, the company assumed a long term CPI assumption of 7.5%.***

***Subsequently, a year later, the Actuary received data that 2010 CPI rate fell to 7.0%. The Actuary recalculated the past averages with the following results:***

## Question 48 (2) – GPV Inflation Rate

Year	2005	2006	2007	2008	2009	2010
CPI	17.1%	6.6%	6.6%	11.1%	2.8%	7.0%
1) Latest Year					2.8%	7.0%
2) 3 Year Average					6.8%	7.0%
3) 5 Year Average					8.8%	6.8%

*The company then decided to set the long term inflation rate assumption to 5.5%, just a small 2% reduction from prior year's assumption of 7.5%. In theory, is this an appropriate way to set the inflation rate assumption for GPV? Yes / No?*

## Question 49 – GPV Inflation Rate

**Question. Yes or No?**

**Q. In the previous example, the company decided to keep the long term CPI assumption unchanged at 7.5%, even though the averages pointed to 7.0%. The company justified that last year's 2010 inflation of 7.0% is close to its current long term assumption of 7.5%, that the difference of 0.5% is small. Another reason is that the experience has spiked from 2.8% to 7.0%, and so, since the company didn't know what the future will hold, so, it wanted to hold its assumption of 7.5% for one more year, until further experience emerges. If you were the regulator, would you consider approving continued use of 7.5% as long term inflation assumption? Yes / No?**

# Question 50 – GPV Inflation Rate

**Q. One year later, the following additional data emerges.**

Year	2005	2006	2007	2008	2009	2010	2011
CPI	17.1%	6.6%	6.6%	11.1%	2.8%	7.0%	3.8%
1) Latest Year					2.8%	7.0%	3.8%
2) 3 Year Average					6.8%	7.0%	4.5%
3) 5 Year Average					8.8%	6.8%	6.3%

**The Actuary decided to lower the inflation assumption by 1% to 6.5% (from 7.5% previous year), since the 3 and 5year averages have come down.**

**However, we note 6.5% is higher than 6.3% (5 year average).**

**The Actuary justified this on the basis that this is a long term assumption which should only change gradually, and the assumption is still prudent (higher inflation results in higher GPV reserves). The Actuary also state that if 2012 CPI remained low, then, it will bring this down further.**

**If you were the regulator, would you consider approving the assumption of 6.5%? - Yes / No?**

# Answer 15

**Question. True or False?**

**It is impossible and can never happen, that 1% change in interest rates can double the GPV reserve of a 10 year Regular Premium Endowment contract.**

**Answer: False. GPV reserves can more than double with just 1% change in interest rates at certain durations when it is close to zero. Remember that GPV reserves can be negative initially, so, it must cross zero before it becomes large positive in the future. During the cross over is the sensitive duration. E.g. \$3 rising to nearly \$15 at policy year 2.**

