

Why we set reserves?

Actuarial Background

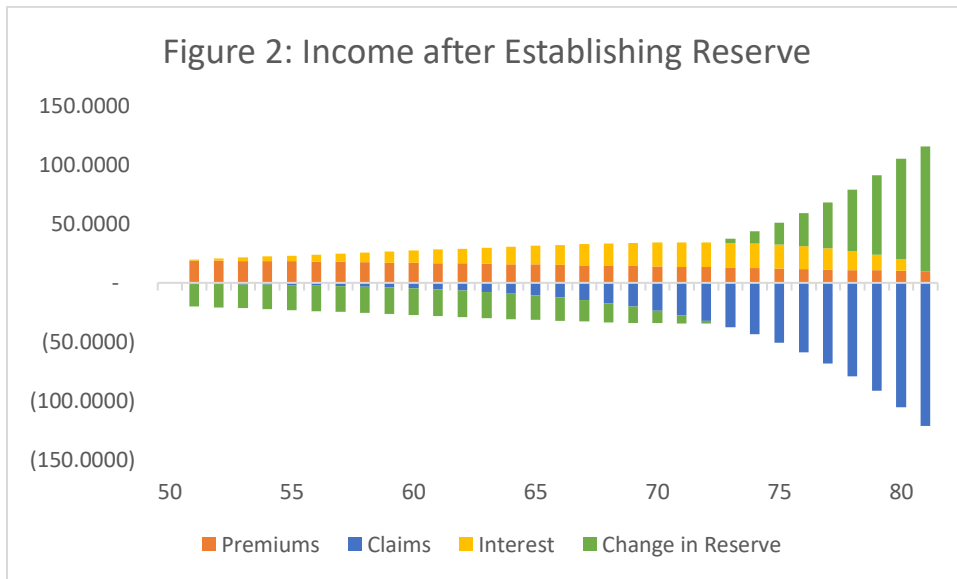
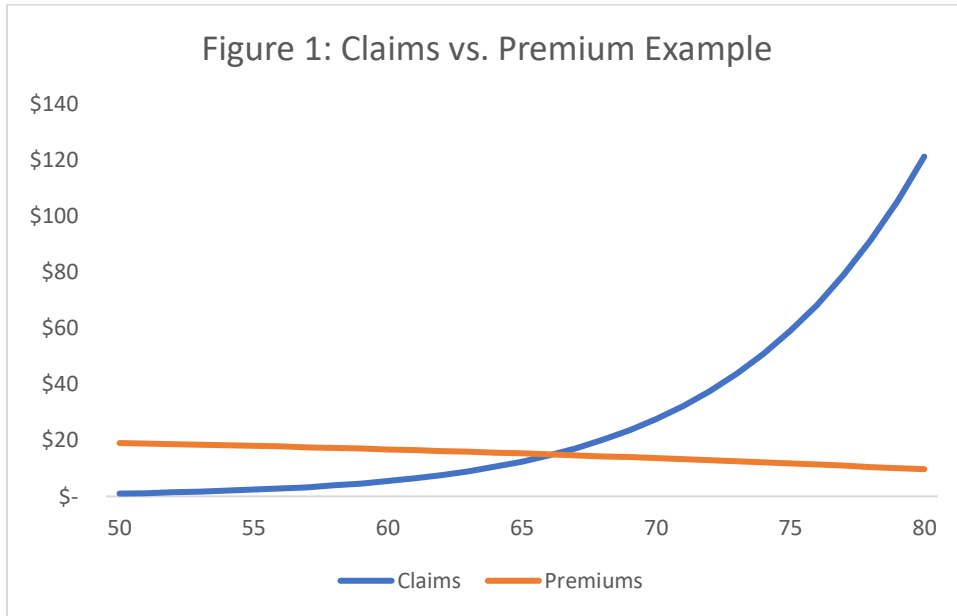
Setting reserves and calculating premiums that insurance companies need to charge are an actuary's bread and butter. These jobs are interrelated in that they help institutions stay solvent (a fancy word for "keep their doors open for business"). The main focus of this paper will be former, setting reserves. The purpose of setting reserves is to set aside funds today so that they can use these reserves to pay out claims in the future. In practice, reserves tend to be conservative so that companies can withstand potentially adverse future scenarios. These conservative margins are referred to "provisions for adverse deviations" (often called "PADs"). On the balance sheet, reserves are a liability because they represent the present value of future net obligations stemming from an insurance contract. On the other side of the balance sheet, reserves are backed by assets which earn interest. The premiums from a contract get invested into said assets. Regulatory bodies scrutinize the reserves held by insurers in order to ensure solvency.

The size of reserves will depend on the type of insurance contract. For long term contracts, the reserves will grow over time with premium payments. An example of such a contract would be long term care insurance. Long term care insurance provides benefits to policyholders when the policyholder becomes physically or cognitively impaired. Physical impairment is typically deemed to have occurred when a person can no longer perform the activities of daily living ("ADLs") without substantial assistance. Cognitive impairment is deemed to occur upon diagnosis of a neurodegenerative disease such as Alzheimer's' disease. Both impairments become more common with age. Because long term care charges a level premium, premiums will often be significantly higher than the expected costs at beginning of the policy. However, that changes as the policyholder ages. In later years, premiums are expected to be less than claims. Without a reserve there would be a disconnect between profits. Profits would be high initially but substantial losses would occur in the later years of the policy. Thus, to fix this disconnect, a reserve is established while premiums are higher than claims. Below Figure 1¹, highlights this disconnect. Figure 2 builds on Figure 1 as it illustrates the projected gain (loss) when a reserve is established.

As can be seen in figure 1, at the beginning of the policy, the premiums exceed claims which leads to gains if the no reserves are established. After the policyholder turns 65, the expected claims begin to exceed the expected premiums. Reserves allow companies to better handle the dynamics of long-term risks as well as smoothing out the earnings pattern. This can be seen in figure 2. When premiums exceed claims, reserves must be built up in order to pre-fund future claims. These reserves earn interest and after age 70, the reserves begin to be released to pay

¹ Assumptions: Issue Age 50, Active terminations 1% in year 1 and increases by 5% each year, incidence = 0.1% in year 1 and increases by 20% each year. Claim cost assumed to be \$1,000 (simplified). Premiums of 19.01 calculated based on the net level premium method at 5% interest.

claims. In this example, the projected gain is 0 for each year in the projection. This is because the projection assumes that the claims will pay out exactly as the assumptions dictate and the premium does not include provisions for profit. In practice reserves will have built in conservatism to withstand “moderately adverse” future environments (ASOP #5, ASOP #42), a core actuarial principle in setting reserves. In addition, premiums will be increased to allow insurance company to expect profits if the insurance company is a for-profit company.



In contrast to long term contracts, short term contracts typically hold lower reserves. In short term contracts the contract is renewable and the premium may be updated each year based on the profitability of the contract. The premiums charged are meant to cover the expected claims cost each contract year. For example, health insurance premium rates tend to vary each year based on attained age and will generally increase. The underlying assumption is that older workers will

incur more claims and therefore will need to be charged a larger premium. In addition, healthcare costs generally increase each year which must be factored into pricing.

In general, reserves are calculated as the present value of expected claims and expenses less the present value of expected premiums. To simplify this formula, it can be helpful to think of the formula as the present value of outflows (cash flows payable) less the present value of inflows (cash flows receivable). The difference represents the value of payments that future premiums cannot be expected to cover. These pieces are based on probability weighted cash flows. They are valued today based on the time value of money. These estimates will become more accurate when they are estimated for a group of policies as opposed to individual policies because of the law of large numbers. These probabilistic weight cash flows are subsequently discounted at a rate of interest that the insurance company can expect to earn on its investments. Below is a list of key assumptions needed to project cash flows and reserves.

- Plan provisions – the contractual features of the plan will determine how much benefits are paid to policyholders.
- Persistency – the probability that a policyholder will continue to pay premiums after a given period of time. Persistency has two components; lapse and mortality.
 - o Lapse – the probability that a person will stop paying premiums and effectively cancel their policy.
 - o Mortality – rate at which people die by a given a time period.
- Morbidity – Relates to the frequency that someone will have a health-related claim. This area is much more subjective than mortality because it is not a binary event. Morbidity can consist of the probability someone will go on claim (called “incidence”) or the probability that they will stay on claim (called “claim terminations rates”). In addition, for health insurance policies the severity of a claim should be considered (in general, someone who claims because of a broken leg will have higher healthcare costs than someone making a claim for their annual physical).
- Interest rates – the projected interest rates that a company will earn on its investments. Based on economic environment, monetary policy, company reinvestment strategy (i.e., what types of assets the company invests in) and other factors.
- Regulatory – As stated before, regulators scrutinize a company’s reserve methodology. In the US insurance is regulated by state insurance boards.
- Future trends – perhaps unfavorable events could lead to additional reserves being established to protect against uncertainty. For example, company’s may have increased their reserves right after the start of the Covid-19 pandemic in order to protect themselves against the pandemic’s uncertain impacts.

Why You Should Care?

Now, we will move on to why you should care about reserves. Reserving is a framework for planning for the future. This generally applies at a higher level. It would be excessive for households to establish reserves for the various payments that they are obligated to make based on actuarial probabilities. However, pre-funding for large payments based on simpler models

will reduce the pain those payments bring when they come due. Further, when analyzing the current debt debate, one can observe the problem through an actuarial lens. Taxes should be thought of as premiums and the payments that the government disburses as claims. Essentially taxes are the price of keeping the government functioning.

The debt stands at \$31 trillion as of this writing. In addition, each year the deficit is negative. I do not believe this is sustainable. A negative budget deficit indicates that the US is spending more money than it collects from taxes and other revenues. To cover this shortfall the government must borrow. The cost of borrowing is low when interest rates are low as they have been since the financial crisis. However, interest rates have been increasing recently, which means future borrowing will be more expensive. The debt can be thought of as a point in time estimate (comparable to the figures on a balance sheet) and the budget deficit can be thought of as cumulative change in a period time (comparable to figures on an income statement). To add some data points on the current US financial situation, the 2021 US financial report calculated the deficit at \$2.8 trillion (Department of the Treasury, 2022). This means government spending needed to be reduced by \$2.8 trillion or taxes raised by \$2.8 trillion in 2021, to break even. The 2023 projected deficit is lower at a spry \$1.2 trillion likely driven in part by reduced Covid-related spending (Office of Management and Budget, 2022). Further, in 2021, 12.7% of the \$2.8 trillion deficit was for interest (Department of the Treasury, 2022).

I am not going to argue that all debt is bad, it can be a necessary mechanism to fund projects. In addition, when the return on investment is higher than the cost of the debt, you are in an arbitrage situation. For example, if you borrow borrows \$100 at 2% interest each year but earn 5% each year, you will be able to finance the interest payments solely with the dividends from the investment and have some benefit left over. Further, the US is one of the most credit-worthy governments in the world and very few believe it will default on its debt which is why lenders continue to lend to us. However, even for the most creditworthy institutions and countries, deficits in perpetuity are not sustainable.

Moving back to reserves. The US does not collect enough taxes (aka premiums) for the amount of expenses it incurs. Alternatively, if you are more conservative, the argument is that government spending is too high. Pulling either one of these levers, raising taxes or reductions in spending, will improve the deficit. When considering the aging population, one should become worried. When considering the aging population in the US, there will be strain on US finances. For example, Medicare and Social Security represent roughly 2.2 trillion of the 5.7 trillion projected 2023 costs payable by the federal government (Office of Management and Budget, 2022). This proportion will likely increase as the baby boomers continue to retire. Social Security is funded by payroll taxes which are used to fund a trust fund (aka a reserve). The payroll taxes, the interest earned on the trust funds and withdrawals from the trust fund are used to pay Social Security benefits and expenses. As I have discussed in prior papers, the Social Security trust fund is inadequately funded and projected to run out of funds in 2035 (SSBT, 2022). There are not enough payroll taxes coming in to support the retiring baby boomers (alternatively one could look at it as there are too many benefits being paid out). Medicare part A functions similarly to Social Security. Both the Social Security and the Medicare part A trust

funds are projected to be insolvent within the next 15 years. Other portions of Medicare, part B, part D and Medicare Advantage are mostly financed with general revenues and premiums from the elderly.

The reason I am discussing Social Security and Medicare is policymakers could have addressed these programs' shaky finances years ago. It was no secret that the retiring baby boomers would present problems for the US when they retired. The 1990 Social Security Trustees' report made explicit mention of this generation's size when the Trustees stated "the number of persons born in the two decades after World War II, rapid growth is expected in the aged population after the turn of the century" (SSBT, 1990). If the US had raised payroll taxes previously when it realized the future costs the baby boomer demographic would present to these programs, these programs would be on better financial footing today by easing the cost over time. However, they did nothing and the costs for the current generations is now much higher than it would have been. Policymakers sat around and ignored insolvency concerns raised by the Social Security Board of Trustees and the Medicare Board of Trustees because they were busy devoting funds to wars or focused on winning the culture wars. Today, the baby boomers are retiring which leaves a smaller amount of workers who will have to share the cost of shoring up these programs. This lesson is the fundamental message as to why we establish reserves for future costs. Reserves ease the future costs as well as protecting institutions from rainy days ("moderately adverse scenarios" in actuarial speak). By inadequately funding itself, the US has fundamentally shifted the cost to future generations. So, when our politicians finally act it will be cuts to spending or tax hikes. My advice to you the reader is; do not just blame the current politicians or the baby boomers, learn from the United States' previous financial mismanagement. However, I cannot deny that many of today's politicians have been serving for quite some time and may have contributed to the past US financial mismanagement.

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