The effect of retirement taxation rules on the value of guaranteed lifetime withdrawal benefits

Eric Ulm

SEF WORKING PAPER 8/2018

The Working Paper series is published by the School of Economics and Finance to provide staff and research students the opportunity to expose their research to a wider audience. The opinions and views expressed in these papers are not necessarily reflective of views held by the school. Comments and feedback from readers would be welcomed by the author(s).

Further enquiries to:

The Administrator
School of Economics and Finance
Victoria University of Wellington
P O Box 600
Wellington 6140
New Zealand

Phone: +64 4 463 5353
Email: alice.fong@vuw.ac.nz

Working Paper 8/2018
ISSN 2230-259X (Print)
ISSN 2230-2603 (Online)

The Effect of Retirement Taxation Rules on the Value of Guaranteed Lifetime Withdrawal Benefits

Eric R. Ulm[1]
Victoria University of Wellington

Abstract

We examine the value of GLWB options embedded in variable annuities in two different tax regimes. The New Zealand system taxes investment income when it is earned whereas the system in the US defers taxes on annuity investment income until it is paid out. We examine the effects of these tax differences on the charges collected by the issuer as well as on the value of the contract to the policyholder. We find that the issuer's charges are typically lower (higher) in the NZ tax regime when the expected fund earnings are low (high) or the fund volatility is high (low). On the other hand, the value to the policyholder is always lower in the NZ tax regime due to the earlier tax payments. We also find that the value of the GLWB in the NZ tax regime is nearly always below the value of an ordinary payout annuity with the same tax rules.

Keywords: GLWB, Variable Annuities, Retirement, Taxation.

[1]Associate Professor, School of Economics and Finance
Victoria University of Wellington
Phone: New Zealand 04-463-5233 ext 7515
International: 64-4-463-5233 ext 7515
E-mail: Eric.Ulm@vuw.ac.nz

1. Introduction

Providing sufficient income in retirement is one of the principal problems faced by individuals. In response to this need, insurance and financial companies have provided a large variety of useful and innovative products. Among these products are Guaranteed Lifetime Withdrawal Benefit (GLWB) riders attached to variable annuity products. These contracts allow customers to withdraw a fixed percentage of their benefit base regardless of whether their investment fund has enough money in it to sustain the withdrawal at that time. The customer chooses the date at which the withdrawals will begin. The guaranteed withdrawal percentage goes up with age so delaying initiation of the withdrawals will provide a larger annual income.

At the commencement of the contract, the benefit base is equal to the premiums paid. In many current contracts, the benefit base has a “step-up” or “ratchet” feature. In these riders, the benefit base may move upwards on the policy anniversary if the investment returns have caused the fund to increase. Most contracts allow for step-ups only before benefits commence, but contracts exist that allow step-ups even after benefits have commenced. A good description of the contracts and market can be found in Drinkwater et al (2013). They find typical fees of 233 bp, most frequently charged as a percentage of the benefit base.

These contracts provide policyholders with several advantages relative to traditional annuity products. The most important is added liquidity. Standard annuity contracts do not allow policyholders to withdraw funds from the reserve since this would result in serious anti-selection issues as unhealthy policyholders withdraw rather than continue periodic payments. GLWB riders, however, allow partial or full withdrawal of

the remaining funds if the fund balance remains above zero. When this option is exercised, the benefit base and associated guaranteed withdrawals are adjusted proportionately. If the policyholder dies with a positive fund balance, the account is paid to a beneficiary as a death benefit. This additional feature provides policyholders with liquidity in the case of adverse health shocks and additional medical expenses. It also allows the policyholder to provide a death benefit to dependents.

In the United States, the tax-deferred status of the investment income in the funds supporting these riders is a major complication. For example, see Moenig and Bauer (2015), for the impact of taxes on the closely related GMWB riders. Investors in the US can fund the GLWB variable annuity with pre-tax funds and will defer taxes on the investment income until it is realized through withdrawals. Withdrawals are taxed as ordinary income. This includes all withdrawals, both those that are supported by the fund and those which are made after the fund value has dropped to zero.

In New Zealand, however, the thought behind retirement tax policy is noticeably different. There is in general no tax deferral of either retirement contributions or investment income. A GLWB would be funded with post-tax funds. The investment income would be taxed when earned and decrease the fund as a result. The withdrawals, however, would be tax free until they exceeded the benefit base (or were no longer supported by the fund) at which point the withdrawals would become taxable as income. A good discussion of the rationale behind the differing tax treatment in New Zealand and the effect on annuity products can be found in several papers by St. John (2003, 2007a, 2007b, 2009)

This difference in tax treatment has a significant effect on the risk-return profile of the funds underlying the GLWB. This effects both the desirability of the contract to retirees and the fees charged on a risk-neutral basis by the issuer.

2. The Model of GLWBs in Different Tax Regimes

We model a representative variable annuity product in the New Zealand marketplace. An individual who chooses to begin his withdrawals at age 65 will receive a guaranteed right to withdrawal 5% of the strike value per year for life, regardless of the fund performance. If the individual chooses to wait until age 66, the guaranteed withdrawal rate will rise to 5.1% and will increase at 0.1% per year until reaching 7.5% at age 90. The strike value is set to the initial fund amount at the initiation of the contract and has a ratchet feature so that the strike at later ages is set to the maximum fund amount on a policy anniversary.

The fund is required to be invested conservatively, which we model as a base scenario volatility of 14%. If the fund has a positive balance, fees and withdrawals are deducted from the fund fortnightly. If the fund has a zero balance, guaranteed withdrawals are paid directly by the company. An individual can withdraw a positive fund balance at any time with a proportional reduction in the strike value. We model this conservatively as a death benefit with no extra (non-guaranteed) withdrawals prior to death. In agreement with Huang et al (2014), we typically find no benefit to delaying initiation of withdrawals under any tax regime.

Under US tax treatment, the Variable Annuity with a GLWB will be purchased with pre-tax funds. The internal buildup of the funds will not be taxed until withdrawn. The Guaranteed Withdrawals are taxed as income starting from the first dollar withdrawn, and the fund paid out as a death benefit is also fully subject to taxes.

Under NZ tax treatment, the Variable Annuity with GLWB will be purchased with post-tax funds. The internal investment returns, both gains and losses, are taxed as income when they occur. The fund paid out as a death benefit is not taxed. The Guaranteed Withdrawals are also not taxed until the fund drops to zero, at which point the withdrawals are taxed as income.

The value of the GLWB is determined using risk-neutral option pricing methods. This approach assumes the value is being calculated from the perspective of a seller who is able to diversify the mortality risk and hedge the remaining market risk in a complete market. A description of this approach can be found in Bauer et al (2008). This approach has been used extensively in the valuation of options in Variable Annuities. A good overview can be found in the references in Table 1 in Bauer et al (2017).

We use a trinomial lattice with two-week time steps. The lattice has two stages. In the first stage, the probabilities of an up, middle and down move are calibrated so that the fund grows at the risk-free rate and has the appropriate volatility. The second stage removes taxes, withdrawals and fees from the fund. Once the fund drops to zero, the value is treated as annuity. The values are discounted through the lattice at the risk-free rate. In both regimes, the fees are a percentage of the strike (not the fund) and are set so that the risk-neutral value of the option to the company is zero, assuming the company can create a hedge in a complete market.

The base scenario is a risk free rate of 3%, a volatility of 14% (i.e. conservative investments) and a tax rate of 28% (the NZ tax rate on Portfolio Investment Entities). These rates will be assumed in the analysis unless different parameter values are stated explicitly. We performed sensitivity analysis as well, allowing the risk-free rate to vary between 0.0% and 5.0% in steps of 0.5%, the volatility to vary between 0% and 30% in steps of 1% and the tax rate to vary between 0% and 28% in steps of 2%. Mortality follows the 1994 GAM male table with values shown in Table 1. We choose a starting account value and starting strike value of $1000 in the analysis that follows.

3. Analysis of Results

The most obvious difference between the two tax regimes is that contracts in the NZ tax regime are always less valuable to the policyholder than contracts in the US tax regime. This is due to taxes being collected earlier in NZ and therefore being discounted less heavily. Since the total value is $1000 and the company value is set to $0, the policyholder value must be smaller in the NZ regime if the present value of taxes is larger.

The value to US policyholders is straightforward to compute. It can be shown that the US tax regime is equivalent to one where the government owns a share of the contract equal to the tax rate τ and the policyholder owns an untaxed share of the contract equal to $1-\tau$. The value to the US policyholder is therefore $\$1000(1-\tau)$. The value to a NZ policyholder is always less than $\$1000(1-\tau)$.

3.1 Comparison of Risk Neutral GLWB Prices

We begin by examining the BP charges required to break even in the two tax regimes. This matters from the perspective of the issuer since a lower fee requirement would make the product sell more easily. Because the policyholder effectively owns a untaxed share of the contract, the US BP charges can be computed by ignoring taxes entirely. Charges are therefore independent of taxes and equal to 84.48 basis points in the base scenario.

There are two competing forces at work in the NZ tax regime. First, the earnings of the fund are reduced by the tax rate. This makes the option more likely to go into the money and increases the charges relative to the corresponding US case. Second, the volatility of the fund is reduced since high returns are taxed away and low returns receive a tax credit against income. This decreases the option value and decreases the charges relative to the corresponding US case. The first effect dominates at high values of the risk-free rate and low values of volatility. The second effect dominates when the risk-free rates is low or the volatility high.

The interplay of these effects can be seen in Figures 1 and 2. Figure 1 plots the BP charges vs. the risk-free rate for the US and NZ tax regimes. The charges in the NZ tax regime are seen to be lower than US charges when the risk-free rate is low and higher than US charges when the risk-free rate is high. Both sets of charges decrease as the risk-free rate increases as the option is less likely to be in the money when its expected return is larger.

Figure 2 plots the BP charges vs. volatility for both regimes. The charges in the NZ tax regime are seen to be higher than US charges when the volatility is low and lower than US charges when the volatility is high. Both sets of charges decrease as the risk-free rate increases as the option is less likely to be in the money when its expected return is larger. The two curves cross at a volatility of about 17%. Interestingly, this crossing point appears to be independent of the tax rate, as can be seen in Figure 3 where all the NZ curves cross at 17% when the risk-free rate is 3%.

The independence of crossing point and tax rate remains roughly true for all values of the risk-free rate between 0% and 5%. Figure 4 shows the crossing point volatility where the US and NZ charges are equal as a function of risk-free rate.

The NZ basis point charges are equal to those in the US tax regime when taxes are zero and are roughly linear in the tax rate. This can be seen in Figure 5 which plots both NZ and US charges vs. tax rate in the base scenario. It turns out that the fees charged are quite stable with tax rate for a given volatility level as shown in Figure 6.

3.2 Comparison of Risk Neutral GLWB Policyholder Values

We now look at the policies from the perspective of the policyholder. The value of the GLWB is always lower in NZ than in the US tax regime due to the earlier collection of taxes. In one sense, this implies that a NZ GLWB is less attractive than US GLWB. However, this is not the most relevant comparison since the option of purchasing a US GLWB is not available to a NZ tax resident. His nearest substitute is a conventional payout annuity so that is the comparison that will be made in the following analysis.

We calculate the expected present value of the annuity in both tax regimes. In the US, we make the same assumptions for the annuity as we did for the GLWB. The annuity is bought with pre-tax funds, investment earnings are not taxed, and payouts are taxed when received. The payout rate is set to the actuarially fair value. This results in a value of $\$1000(1-\tau)$ to the policyholder, for the same reason as in the GLWB case. If the products are priced at zero profit, the value of the GLWB and the annuity will be the same in the US tax regime.

In NZ, we assume that investment income is taxed, but the annuity is received tax-free. There are complications arising from differences in individual and corporate investment tax rates. Details can be found in St. John (2009). We are not modelling those issues in order to isolate the effect of tax regime by itself. Again, we set the payout rate to the actuarially fair value including the effect of taxes.

We find that annuities are typically worth more than GLWB contracts to policyholders in the NZ regime. In other words, the government takes a larger share of the expected present value of the initial investment in GLWB contracts relative to annuity contracts. This occurs because the government treats GLWB contracts as individual accounts and taxes both investment income and payments that exceed the initial investment plus returns. On the other hand, the government does not tax annuity payments that exceed the initial investment, treating the fund as a pooled investment. The loss to the policyholder increases with the volatility of the fund, as shown in Figure 7. The value to the policyholder is surprisingly stable with respect to changes in the volatility of the fund, as shown in Figure 8.

US annuity and GLWB values are independent of the risk-free rate. Payouts are larger in high interest rate environments, but are discounted more to compensate. New Zealand annuity values fall with interest rates, since taxation occurs earlier and the effect of this is more pronounced at higher rates. NZ GLWB values rise and then fall with rates. This is due to the interplay between growth rates, discount rates and fees charged since the payout rate is independent of the interest rate for a GLWB. These features are shown in Figure 9.

The annuity and GLWB values fall roughly linearly with the tax rate. For the US annuity values the decline is exactly linear. The NZ values decline slightly more rapidly at low tax rates and less rapidly at high ones. The relationship between values and tax rate are shown in Figure 10.

4. Conclusions

The differing tax treatment of Guaranteed Lifetime Withdrawal Benefits in countries with tax-deferred and non-tax deferred retirement schemes has a significant effect on the value of these products in these markets. If risk-neutral pricing is used and consumers behave as though they are in a complete market, a GLWB and a payout annuity will be equally valuable to a policyholder in a tax-deferred environment.

However, the GLWB will be less valuable than a payout annuity in this risk-neutral setting if the tax regime doesn't allow for deferral of taxes. The fees charged for the product will be lower with tax deferral when expected returns are high and will be higher with tax deferral when expected returns are low. While this analysis suggests that

GLWB products are not valuable in non-tax deferred environments, it assumes a complete market environment for the policyholder. It remains possible that an analysis in a utility framework that takes liquidity into account may change this conclusion.

Table 1. 1994 GAM male table.

age	q_x	age	q_x	age	q_x	age	q_x
0	0.00651	30	0.000801	60	0.007976	90	0.152931
1	0.000592	31	0.000821	61	0.008986	91	0.16726
2	0.0004	32	0.000839	62	0.010147	92	0.182281
3	0.000332	33	0.000848	63	0.011471	93	0.198392
4	0.000259	34	0.000849	64	0.01294	94	0.2157
5	0.000237	35	0.000851	65	0.014535	95	0.233606
6	0.000227	36	0.000862	66	0.016239	96	0.25151
7	0.000217	37	0.000891	67	0.018034	97	0.268815
8	0.000201	38	0.000939	68	0.019859	98	0.285277
9	0.000194	39	0.000999	69	0.021729	99	0.301298
10	0.000197	40	0.001072	70	0.02373	100	0.317238
11	0.000208	41	0.001156	71	0.025951	101	0.333461
12	0.000226	42	0.001252	72	0.028481	102	0.35033
13	0.000255	43	0.001352	73	0.031201	103	0.368452
14	0.000297	44	0.001458	74	0.034051	104	0.387855
15	0.000345	45	0.001578	75	0.037211	105	0.407224
16	0.000391	46	0.001722	76	0.040858	106	0.425599
17	0.00043	47	0.001899	77	0.045171	107	0.441935
18	0.00046	48	0.002102	78	0.050211	108	0.457553
19	0.000484	49	0.002326	79	0.055861	109	0.47315
20	0.000507	50	0.002579	80	0.062027	110	0.486745
21	0.00053	51	0.002872	81	0.068615	111	0.496356
22	0.000556	52	0.003213	82	0.075532	112	0.5
23	0.000589	53	0.003584	83	0.08251	113	0.5
24	0.000624	54	0.003979	84	0.089613	114	0.5
25	0.000661	55	0.004425	85	0.09724	115	0.5
26	0.000696	56	0.004949	86	0.105792	116	0.5
27	0.000727	57	0.005581	87	0.115671	117	0.5
28	0.000754	58	0.0063	88	0.12698	118	0.5
29	0.000779	59	0.00709	89	0.139452	119	1

Figure 1: BP charges vs. Risk-Free Rate in US and NZ Tax Regimes.

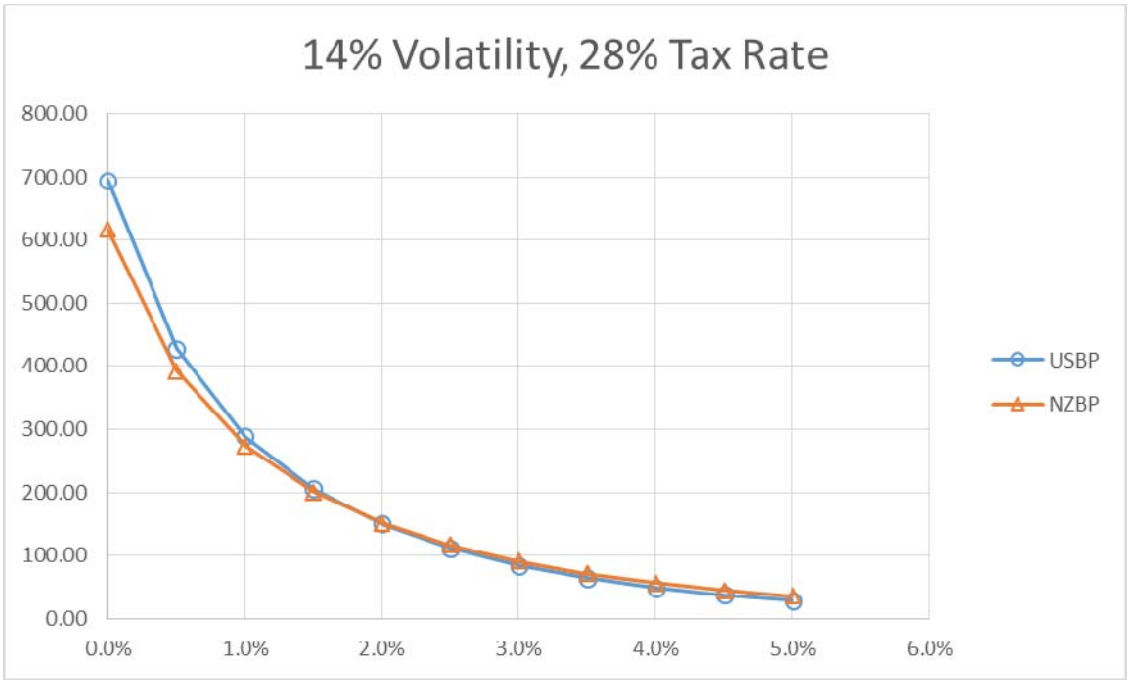


Figure 2. BP charges vs. Volatility in US and NZ Tax Regimes.

Figure 3. BP charges vs. Volatility in the NZ Tax Regime for various tax rates.

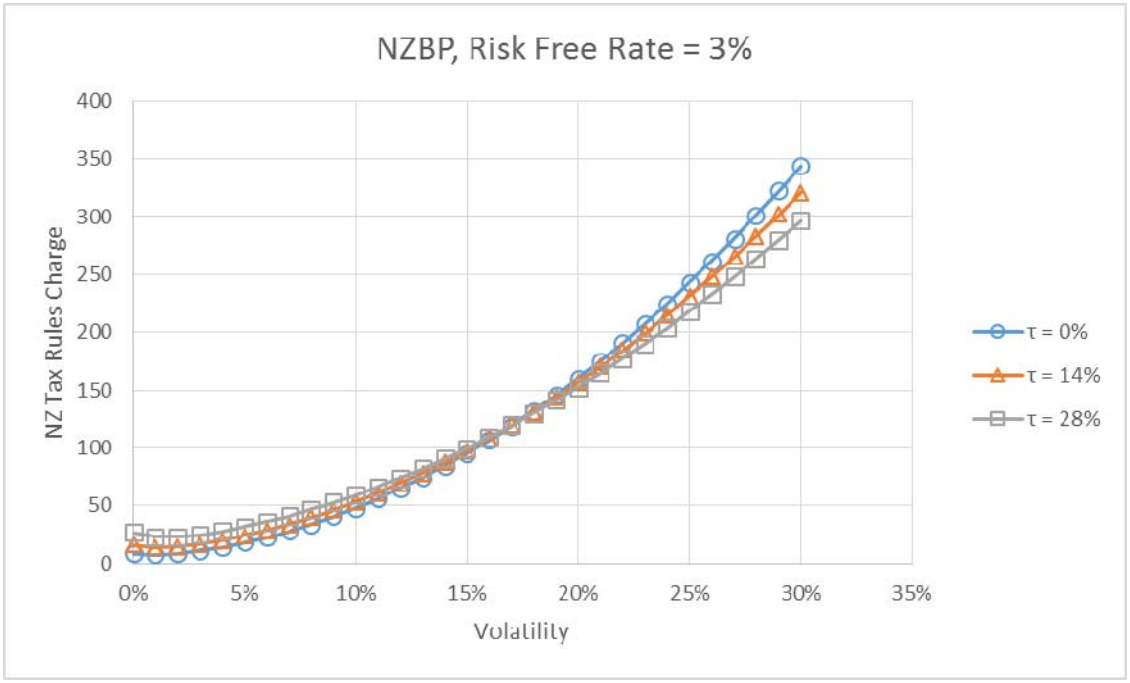


Figure 4. Crossing Points where NZ and US GLWB Charges are Roughly Equal.

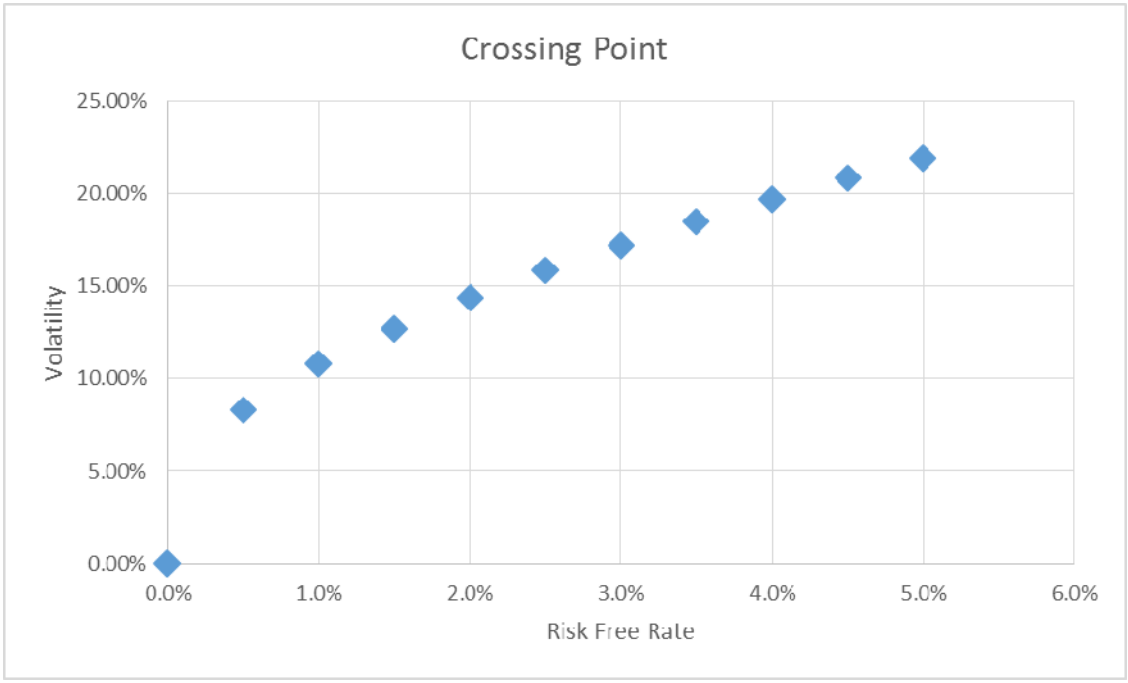


Figure 5. BP charges vs. Tax Rate.

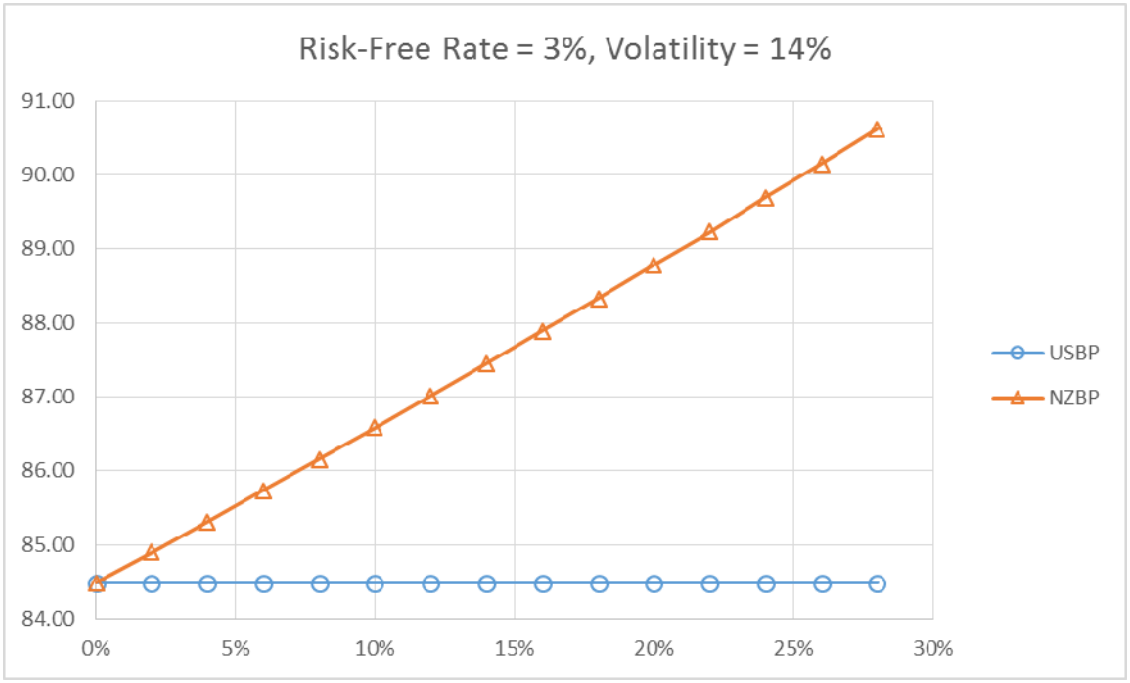


Figure 6. NZ BP Charges vs. Tax Rate for Various Volatilities.

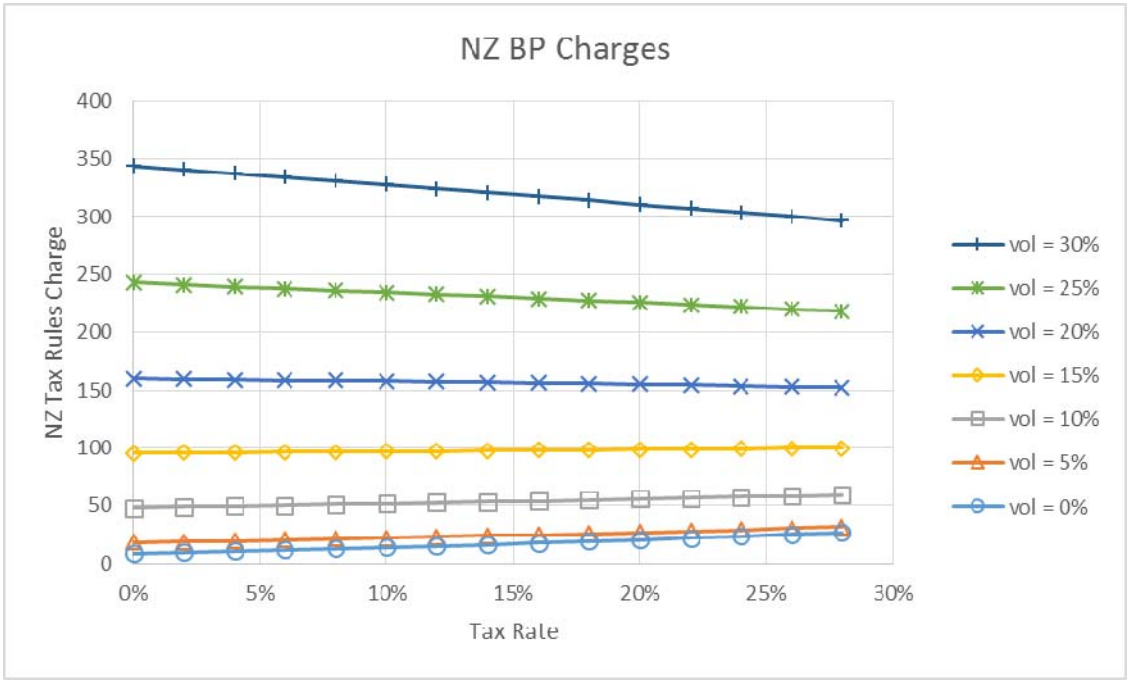


Figure 7. Policy Values vs. Volatility

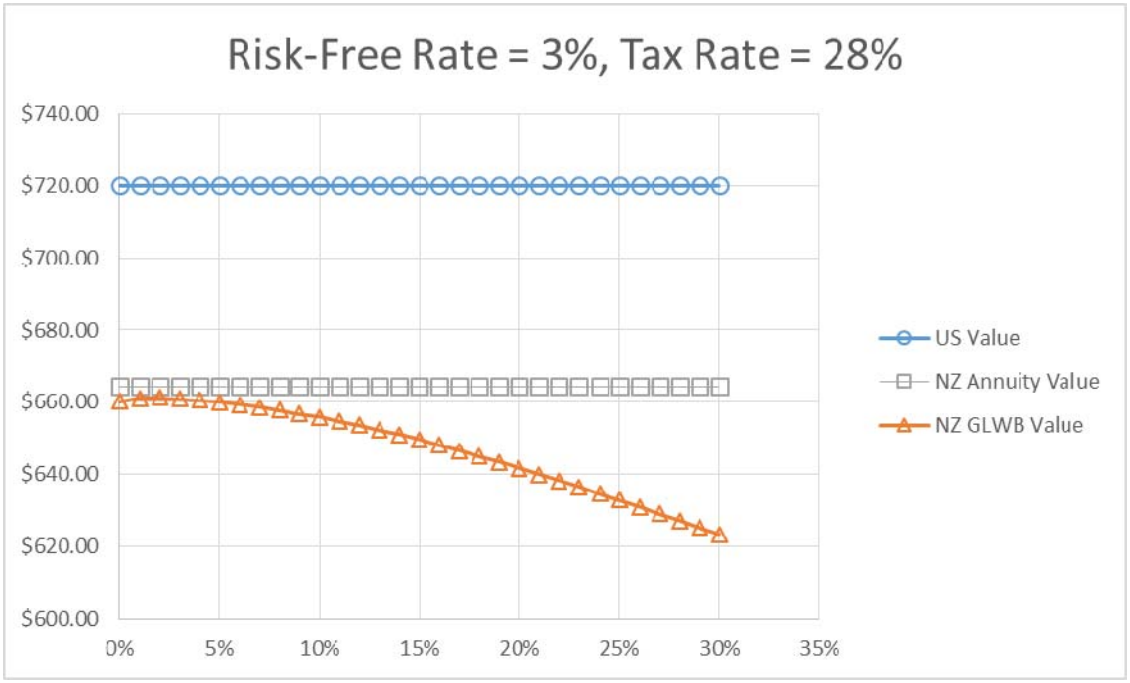


Figure 8. NZ GLWB Values vs. Volatility for Different Tax Rates.

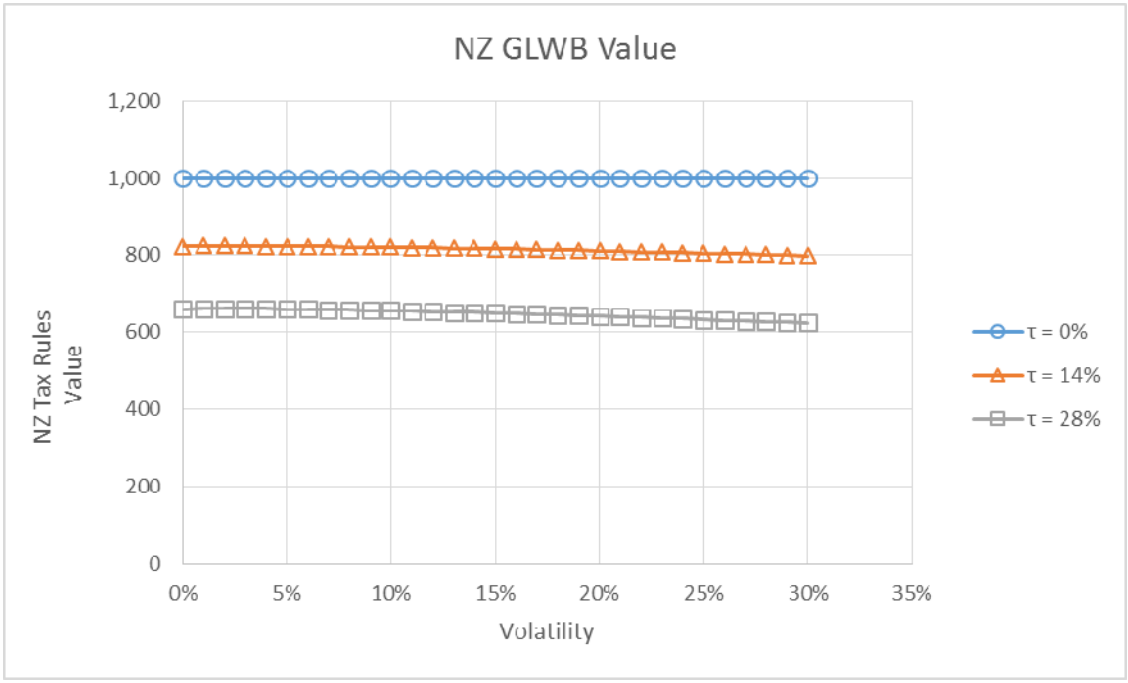


Figure 9. Policy Values vs. Risk-Free Rate

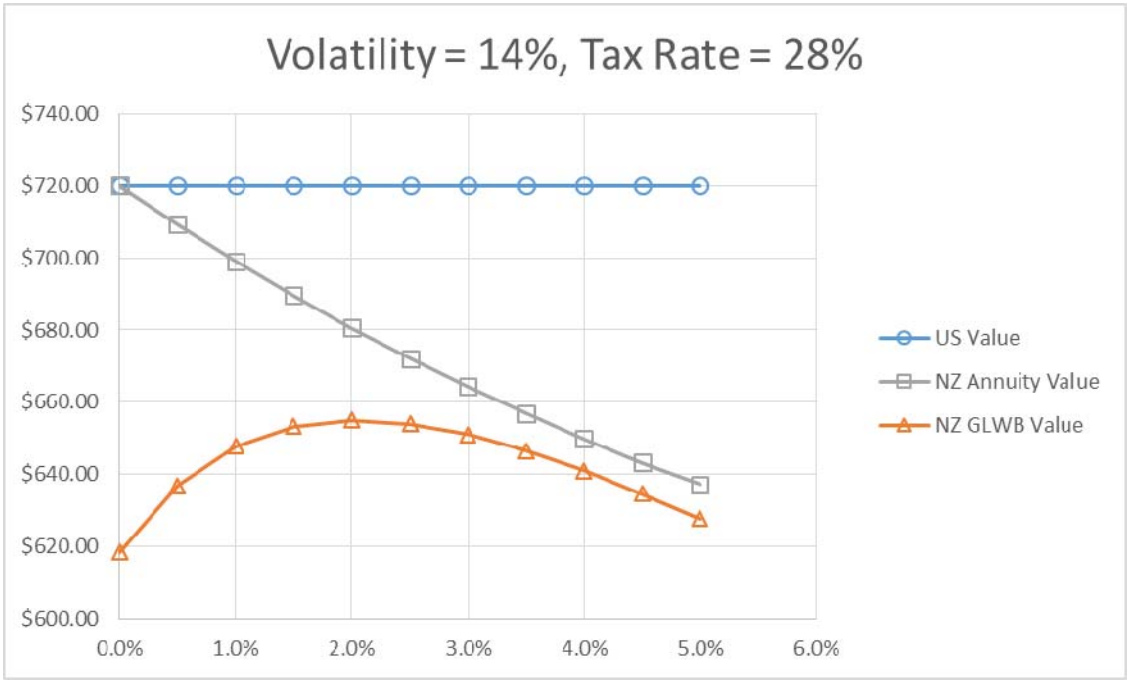
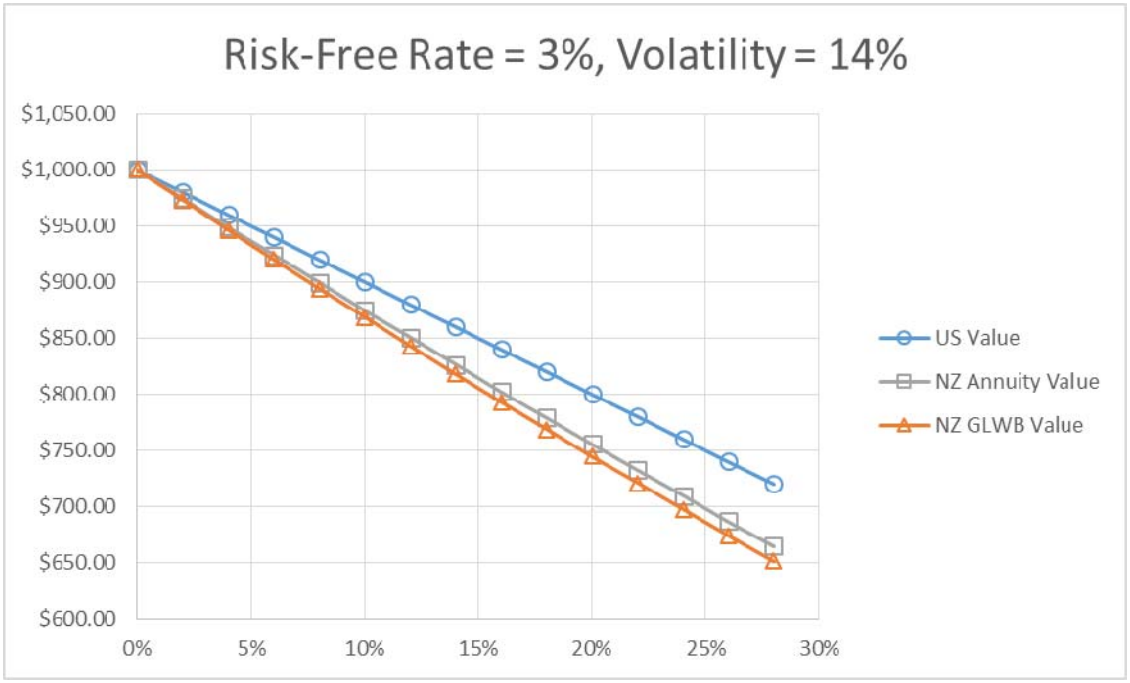


Figure 10. Policy Values vs. Tax Rate



References:

Bauer, D., Kling, A., and Russ, J. (2008), “A Universal Pricing Framework for Guaranteed Minimum Benefits in Variable Annuities”, *ASTIN Bulletin* 38(2):621-651.

Bauer, D., Gao, J., Moenig, T., Ulm, E.R. and Zhu, N. (2017), “Policyholder Exercise Behavior in Life Insurance: The State of Affairs”, *North American Actuarial Journal* 21(4):485-501

Drinkwater, M., Iqbal, J. and Montminy, J. (2013), “Variable Annuity Guaranteed Living Benefits Utilization”, SOA and LIMRA study. Online at: https://www.soa.org/Files/Research/Exp-Study/research-var-ann-a-joint-study.pdf

Huang, H., Milevsky, M. and Salisbury, T. (2014) "Optimal Initiation of a GLWB in a Variable Annuity: No Arbitrage Approach." *Insurance: Mathematics and Economics* 56: 102-111.

Moenig, T. and Bauer, D. (2015), “Revisiting the Risk-Neutral Approach to Optimal Policyholder Behavior: A Study of Withdrawal Guarantees in Variable Annuities”, *Review of Finance* 20(2):759-794.

St. John, S. (2003), “The Role of Annuities in the New Zealand Retirement Incomes Policy Mix”, Periodic Report Group, Online at: http://www.geocities.com/Wellesley/Garden/9441/SusanStJohn/20038prg.pdf

St. John, S. (2007a), "Farewell to Tax Neutrality: The Implications for an Aging Population", *The Economic and Labour Relations Review* 18(1): 27-52

St. John, S. (2007b), "New Zealand's Experiment in Tax Neutrality for Retirement Saving", *The Geneva Papers on Risk and Insurance-Issues and Practice* 32(4): 532-552.

St John, S. (2009). “The Annuities Market in New Zealand”, *Retirement Policy and Research Centre.*


TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON