



NatEquity, Inc. National Equity Access For Senior Homeowners

NatEquity Knowledge Base

Why is NatEquity's Valuation Methodology Unique and
How Does It Add Value?

1 EXECUTIVE SUMMARY

What is the Valuation Methodology

NatEquity's net present value (NPV) of predictable future portfolio cash flows methodology was first presented to the SEC in 2009 and published in a peer reviewed paper in 2011. The methodology uses 250-year-old Bayesian Inference to prove the hypothesis that NatEquity's Longevity Cost Calculator (LCC) is more accurate at predicting the trajectory of morbidity and mortality than medical records commercial life expectancy estimates. Large population Society of Actuaries tables are not accurate at the individual level, thus not included. The LCC is proven to be more than 96% accurate on an individual level in predicting morbidity and mortality. To reprove the accuracy using Bayesian Inference, after fewer than 70 deaths in any asset class, the LCC achieves that same 96% confidence interval.

For any mortality dependent class of assets or liabilities this means that a lower discount rate can be used to NPV "predictable" future portfolio cash flows – thus accreting portfolio balance sheet value and current book income. Combined with downside contract cash flow protections this means NatEquity knows how much cash flow will be collected and when it will be collected.

Origins and History

In 1980, the U.S. Government assembled a group of medical and applied math specialists to develop a questionnaire to assess seniors in an upcoming study called the National Long-Term Care Survey (NLTCS). The group spent a year deciding upon the makeup of the question set to evaluate medical, activity of daily living (ADL), cognitive and lifestyle characteristics of seniors aged 65 and older. This assessment surveyed, at random, 32,000 Social Security recipient seniors every five years for 20-years. These consecutive assessments of the same individuals were stored in computer databases.

After the third consecutive assessment, the actuary/demographer on the team, Eric Stallard from Duke University's Medical School, noticed some patterns in the consecutive assessment data sets. Stallard embarked on a 10-year process of developing algorithms to isolate patterns in the more than 30 million co-dependent variables in each data set. Individual snapshot data sets then had to be reconciled to changing data from consecutive 5-year interval data for each individual studied. In total 20,000 individuals were tracked until death in three or more consecutive data sets to validate the trajectory of those changes. The algorithm set in the model is more than 96% accurate in predicting the trajectory of morbidity and mortality in single individuals aged 65 and older. The data sets were de-identified in 2005.

Stallard first presented his peer reviewed findings at a conference in 2005. The material was again peer reviewed and published in 2007ⁱ. In 2008 Stallard was presented with the Edward Lew Award, given annually to one actuary worldwide for work in computer modeling. In 2009, Life Settlement Financial, LLC (LSF)ⁱⁱ, (NatEquity's CEO, Peter Mazonas, was at the time Managing Member of LSF), contracted with Stallard to be a consultant. Later Mazonas diagramed the Stallard work, and in conjunction with Stallard and contractors converted the Stallard published materials into computer code and validated a web-based replica of the model and named it the Longevity Cost Calculator (LCC). The LCC was combined into the fair valuation methodology Mazonas was invited to present to the SEC in November of 2009. Most recently in 2014 and again in 2017 and 2021, the original study accuracy has been replicated in peer reviewed published journal articles, to accurately predict the trajectory toward death of persons with Alzheimer's Disease^{iiiiv} Mazonas and Stallard are pursuing National Institutes of Health grants to advance the model.

Value Added, Part 1 – Superior Control of Portfolio Tail Risk

A NatEquity value added is using the Bayesian Inference Valuation Methodology to accurately price and value longevity dependent products for seniors. Knowing when you are going to collect the proceeds of an asset or liability contract allows the manager to control portfolio tail risk. The higher degree of accuracy in predicting contract maturity means that the few contracts that fall outside of the expected maturity date range have a negligible effect on the expected internal rate of return (IRR) for a portfolio. This ability to accurately predict portfolio contract maturities is a key component in securing a rating for securitizations.

Value Added, Part 2 – Contract Safeguards to Know How Much Will be Collected

NatEquity's founder has spent 35-years designing shared appreciation reverse mortgage products to isolate markets and home price appreciation (HPA) characteristics that allow the portfolio manager to know with certainty how much will be collect on all but a few maturing contracts. Predetermining acceptable portfolio rates of return allows NatEquity to cap cumulative compound HPA at 4% in selected markets with 37-years of high consistent HPA. The excess above 4% on NatEquity's share of home value is held in reserve to cover any shortfalls at time of future sale. This contractual HPA reserve is also available to support periodic contract and portfolio valuations required for GAAP and SEC fair value reporting.

Value Added, Part 3 – Accretive Portfolio Values

In 2014, accounting rules worldwide implemented changes to how assets and liabilities are valued for audited financial statements. These fair value changes, initially begun in the 1990s, require that assets be "Marked-to-Fair Value" and no longer carried at cost on financial statements. This is easy for stocks and bonds; assets classified Level 1, where the daily traded value is published. Level 2 assets and liabilities rely upon observable market-based inputs other than Level 1 quoted prices or unobservable inputs that are corroborated by market data. All real estate and mortgages are classified as Level 3. Most difficult are Level 3 assets where the value is dependent upon an "unknowable" future event, moveout or death dependent future cash flows. This is where the LCC's predictive abilities incorporate in NatEquity's valuation methodology yields value^v. The ability to use Bayesian Inference to have statistical confidence in predicting future portfolio cash flows allows NatEquity, under mark-to-fair value GAAP rules, to use a lower discount rate to arrive at the net present value (NPV) of future cash flows – the measure of value. This means NatEquity's proprietary jumbo reverse mortgage portfolios accrete

substantial additional annual book profits and cumulative balance sheet value. This predictability is added leverage to supplement portfolio reserves required by rating agencies. Over time in individual portfolios this accredited value normalizes.

Value Added, Part 4 – First Mover Barrier to Entry

Community bankers successfully lobbied to delay implementation of ASC§ 825 Mark-to-Fair value GAAP rules until 2020 when the audit principle became effective for mortgages and real estate assets. By 2022, the proprietary reverse mortgage industry had not come into compliance with GAAP NPV of future cash flows methodology. On company, Reverse Mortgage Funding, went into bankruptcy when their out of compliance HECM loans came out from under the protection of the Government guarantee and had to be marked to fair value. This caused their bank to make a capital call they could not support. Today no company offers private reverse mortgages.

NatEquity's unique combination of product design and valuation methodology presents a barrier to entry for all others into this market. Some home equity investment option products have lent to seniors. SEC Rule 2a-5, summarized below, means that any holder of these products must comply with Level 3 mark-to-fair value rules when valuing contracts presented on audited financial statements.

On December 3, 2020, the SEC issued Rule 2a-5^{vi}, indicating "Net Present Value" (their emphasis) is the correct method to be consistently applied to determine the discounted NPV of future portfolio cash flows. The SEC gave a year's notice of enforcement by having the 210-page rule apply to financial period after December 31, 2022, later delayed again until year-end 2023. They also made it clear this rule and related enforcement applies to both reporting entities Boards and their independent auditors. Non-compliance renders third party auditors at risk of SEC sanction. The issuing entity's Board must certify and thus take responsibility for the valuation. In support of this rule and at the request of the International Financial Reporting Standards (IFRS) Board, the AICPA, FASB and PCOB worked together to reaffirm GAAP/IFRS auditing standards to clarify methodology and curb non-compliant audits.

2 LONGEVITY COST CALCULATOR (LCC) - MODEL DETAIL

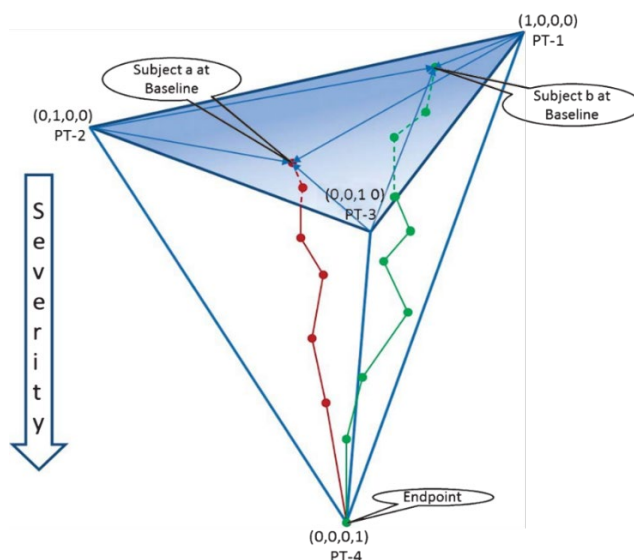
To deal with the more than 30 million codependent variable large data sets Stallard employed the Grade of Membership (GoM) model KG Manton^{vii} and MA Woodbury and Stallard had developed at Duke's Center for Demographic Studies. The GoM model does this by estimating, using maximum likelihood principles, two types of parameters. One describes the probability that a person who is exactly like one of the K analytically defined types has a particular response on a given variable. The second describes each individual's degree of membership in each of the K types. This "partial" membership score reflects the logic of the fuzzy partitions (rather than of discrete groups) that are employed in the analyses. This predictive modeling is an application of the Bayes Theorem where a hypothesis is backed by strong evidence over time. Once the algorithms are developed and validated, they can be applied to single data sets. By modifying the probability structure of the basic model, the procedure can be applied to a number of different types of data and analytic problems, as evidenced in the Alzheimer's work.

Each GoM state is described in relation to an inquiry, ideal individuals "Pure Type" score totaling 1.0. GoM scores are not crisp, they are "fuzz". Except for rare pure type individuals, an individual's score is a blend of scores from GoM categories 1-3, where a pure type 1.0 GoM 4 score occurs at death

(endpoint). GoM scores however are not probabilistic of membership – instead are grades of membership.

The GoM score categories are defined below:

1. GoM I – Generally healthy with lowest level of impairments.
2. GoM II – Poorest subjective health, largest number of medical conditions, non-institutionalized, low mortality. These are persons who will usually outlive both longevity table mortality and mortality or life expectancy derived from medical records only commercial life expectancy underwriters.
3. GoM III – High mortality rates, few medical conditions, few impairments relatively good subjective health. These are persons with activity of daily living and cognitive impairments typically not recorded on their medical records.
4. GoM IV – High mortality rates, high levels of physical and cognitive disability and institutionalization.

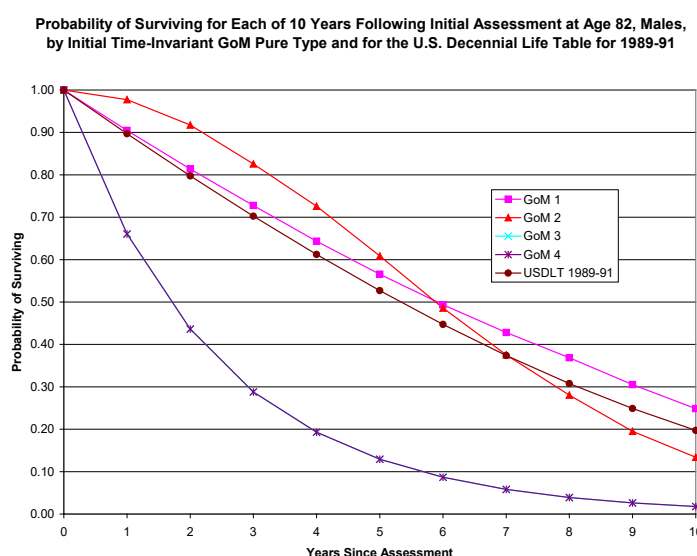


GoM 1 (also referred to as “Pure Type I” or “PT I” in the above drawing, with Roman numerals designating the rank ordering of the states by health status; we use the shorter GoM 1–4 reference throughout this document) refers to the healthiest component of the population. GoM scores 2–4 captures a range of health problems that occur at different ages, with progressive and graded transitions from GoM 2 to GoM 3 and 4. GoM 2 scores refer to people who have numerous medical problems, but few, if any ADL or other functional problems, or cognitive impairment. Persons with initial strong scores (i.e., close to 1.0, or 100%) on GoM 2 will live longer than traditional LE providers estimate; although this changes at older ages where these persons transition to strong scores on GoM 4. Persons with strong scores on GoM 3 have minor medical problems, but mild/moderate cognitive impairments, usually not indicated in their medical records, although this also changes at older ages where these persons transition to strong scores on GoM 4. Strong scores on GoM 4 identify people who have more serious medical problems, combined with serious ADL and/or cognitive impairments, usually not indicated in their medical records. People with initial strong scores on GoM 3 and GoM 4 will have shorter LE’s than those issued by traditional LE underwriters.

Recall that the LE is the area under the relevant survival curve for the person or population for which the LE is being calculated. Thus, differences in LE between persons or groups of persons are best understood by examining the associated survival curves. This is illustrated in the following graph (Fig. 1) which plots the survival curves for males assessed at age 82 (i.e., age at last birthday is 82) for the next 10 years following the assessment, with a separate curve shown for each of the four time-invariant GoM pure types and also for comparison the survival curve from the U.S. Decennial Life Table (USDLT) for 1989-91.

Whether the USDLT or Society of Actuaries Variable Basic Tables (VBT) are used for comparisons makes little difference because the LCC is not table based. The changes in the VBT tables from 2001 through 2014 extrapolate an extension of the tail of mortality tail with a corresponding adjustment to early mortalities.

Figure 1



By age 82, the GoM 3 and GoM 4 curves have merged.

According to the USDLT, the male LE at age 82 is 6.2 years. This value is less than the LEs of 6.9 and 6.3 years for GoM 1 and 2, but is substantially higher than the LEs of 2.5 years each for GoM 3 and 4 (the values are the same because an initial GoM 3 “converts” to GoM 4 prior to age 82).

Importantly, given that both the survival curve and its slope are used to price contracts, it is important to accurately estimate these quantities. Armed with this knowledge, an underwriter can accurately price each contract and the valuation team can accurately value the NPV of future portfolio cash flows. This predictability of future cash flows puts NatEquity in a unique market position.

On the above graph, you will note that an initial GoM 2 has approximately a 16% greater likelihood of surviving through years 1 through 5 until the lines converge at the year 6, near the 6.2 year LE. On the other hand, an initial GoM 3 or 4 has approximately a 75% lower likelihood of surviving through years 1 through 5, with corresponding reductions for persons who have initial *fractional* scores on GoM 3 or 4, with complementary *fractional* scores on GoM 1 and/or 2. The sum of all fractional scores must equal 1.0 (100%), with the scores for any given individual derived from his/her answers to the 76 questions on the application form.

Below are a table (Table 1) and two graphs (Figs. 3–4) reproduced from the 2007 *NAAJ* paper. Table 1 shows the predicted probability of death within each year contrasted to the observed death of individuals in the assessment population. These are shown in age brackets by the 5-year age groups (age at start of each 1-year follow-up) used for model estimation as well as the total over age of the observed vs predicted mortality for males and females.

Table 1
Probabilities of Death within One Year in Four Pure-Type GoM Model, Adjusted for Declines in Vitality, by Sex and Attained Age at Time of Exposure

| Exposure Age | No. of Person-Years at Risk ¹ | Annual Probability by Type | | | | Observed Probability | Predicted Probability |
|--------------|--|----------------------------|-------|-------|-------|----------------------|-----------------------|
| | | I | II | III | IV | | |
| Males | | | | | | | |
| 65–69 | 20,323 | 0.000 | 0.000 | 0.132 | 0.138 | 0.031 | 0.032 |
| 70–74 | 38,255 | 0.002 | 0.005 | 0.194 | 0.246 | 0.043 | 0.044 |
| 75–79 | 31,291 | 0.038 | 0.013 | 0.319 | 0.319 | 0.067 | 0.067 |
| 80–84 | 19,170 | 0.095 | 0.023 | 0.340 | 0.340 | 0.105 | 0.106 |
| 85–89 | 8,117 | 0.127 | 0.202 | 0.330 | 0.330 | 0.154 | 0.155 |
| 90–94 | 2,728 | 0.198 | 0.323 | 0.323 | 0.323 | 0.228 | 0.229 |
| 95–99 | 793 | 0.226 | 0.434 | 0.434 | 0.434 | 0.301 | 0.301 |
| 100–104 | 155 | 0.372 | 0.528 | 0.528 | 0.528 | 0.400 | 0.401 |
| Total | 120,832 | 0.041 | 0.033 | 0.253 | 0.271 | 0.071 | 0.072 |
| Females | | | | | | | |
| 65–69 | 25,424 | 0.000 | 0.000 | 0.081 | 0.140 | 0.017 | 0.017 |
| 70–74 | 52,008 | 0.001 | 0.003 | 0.108 | 0.223 | 0.027 | 0.027 |
| 75–79 | 48,498 | 0.018 | 0.003 | 0.249 | 0.249 | 0.043 | 0.043 |
| 80–84 | 35,563 | 0.059 | 0.005 | 0.267 | 0.267 | 0.070 | 0.070 |
| 85–89 | 20,404 | 0.089 | 0.110 | 0.271 | 0.271 | 0.115 | 0.115 |
| 90–94 | 9,577 | 0.127 | 0.272 | 0.272 | 0.272 | 0.183 | 0.184 |
| 95–99 | 3,804 | 0.168 | 0.388 | 0.388 | 0.388 | 0.264 | 0.264 |
| 100–104 | 992 | 0.274 | 0.499 | 0.499 | 0.499 | 0.325 | 0.324 |
| Total | 196,270 | 0.036 | 0.037 | 0.201 | 0.239 | 0.060 | 0.061 |

¹Includes up to four observations per respondent; excludes respondents aged 65–69 in 1999.

Source: Author's calculations based on data from the NLTCs.

The differences between the observed and predicted age-specific death probabilities are very small and are statistically nonsignificant, with chi-squared values of 1.36 and 0.29, respectively, each with 6 d.f. (reference values are 12.59 and 16.81 at the conventional 5% and 1% significance levels). The graphs show the same data but add the corresponding death probabilities from the U.S. Decennial Life Table (USDLT) for 1989–91.

Figure 3
Probability of Death within One Year, Males

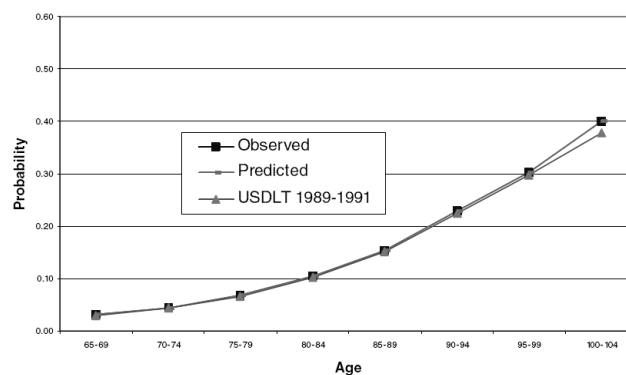
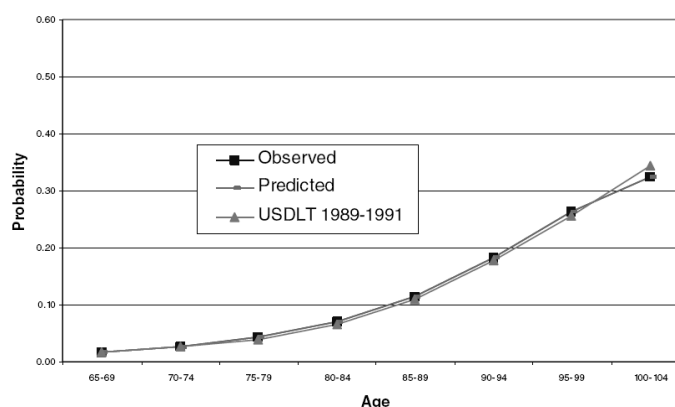


Figure 4
Probability of Death within One Year, Females



Below we attempt to translate these values into the numbers presented by commercial LE providers who represent that they are accurate 86% to 96% of the time. They do not provide nor publish the basis for their estimates. Hence, we cannot be certain that our measures of accuracy are fully comparable with theirs. We do know from a 2010 study done for Deutsche Bank, where 4 independent life expectancy reports were secured from each individual's medical records, that the difference between the low and the high LE for each of 500+ persons, had a delta of 30%. From the same data, when the difference between the high and low LE was more than 30%, the delta was 57%^{viii}.

To begin consideration of measures of accuracy, it is useful to consider the random statistical fluctuations that are expected from estimates based on the different numbers of events likely to be observed in different sized samples, assuming fixed underlying event rates. The table below shows the minimum number of expected events needed to cap the maximum relative error (e.g., [observed number of deaths minus expected number of deaths] ÷ [expected number of deaths]) with one of three levels of confidence.

Table 2
Credibility and Event Counts

| Maximum Acceptable Departure from the Expected Count | Probability of Observed Count Falling Within the Acceptable Range | | |
|---|--|-------|---------------|
| | 90% | 95% | 99% |
| Minimum Required Expected Count | | | |
| +/-2.5% | 4,329 | 6,146 | 10,616 |
| +/-5.0% | 1,082 | 1,537 | 2,654 |
| +/-7.5% | 481 | 683 | 1,180 |
| +/-10% | 271 | 384 | 663 |
| +/-20% | 68 | 96 | 166 |
| +/-30% | 30 | 43 | 74 |
| +/-40% | 17 | 24 | 41 |
| +/-50% | 11 | 15 | 27 |

Source: Based on Longley-Cook (1962).

To be 99% confident that the maximum relative error is less than 2.5%, the sample size needs to be large enough to produce 10,616 deaths (in bold in the table). The annual mortality probabilities in the

NAAJ analysis were based on 20,428 deaths (8,583 males and 11,845 females), indicating that the total rates are very stable but the stratifications by age and other variables may be affected by random statistical fluctuations. To be 90% confident that the maximum relative error is less than 5%, the sample size needs to be large enough to produce 1,082 deaths, which is the standard size used for full credibility in the actuarial literature. To be 95% confident that the maximum relative error is less than 20%, the sample size needs to be large enough to produce 96 deaths, which rounds to about 100. To be 90% confident that the maximum relative error is less than 50%, the sample size needs to be large enough to produce 11 deaths, which rounds to about 10. Thus, as the expected number of deaths falls from 10,000 to 1,000 to 100 to 10, the relative error increases from about 2.5% to 50%.

Practical considerations often dictate sample sizes less than that needed for full actuarial credibility. Table 2 indicates that sample sizes of 271 and 384 can yield relative errors of $\pm 10\%$ at the 90% and 95% confidence levels, respectively, consistent with A.M. Best's recommendation that the collateral pool for longevity dependent life settlement portfolios consist of at least 300 lives.

Random statistical fluctuations are inherently unpredictable. Hence, our measures of accuracy must focus on our ability to generate accurate values for the expected number of deaths among any selected set of insured lives. The tables and graphs from the NAAJ paper (Table 1; Figs. 3–4) show that this can be done for groups of insured lives when the groups are defined on the basis of age and sex.

The next two graphs (Figs. 5–6) show the performance of the model when the NLTCs mortality-exposure data are grouped into 10 categories according to the predicted probability of death, based on the use of fixed cutpoints at multiples of .05 (5%), separately for males and females. Chi-squared statistical tests of fit of the models are presented separately in Tables 3–4.

Figure 5

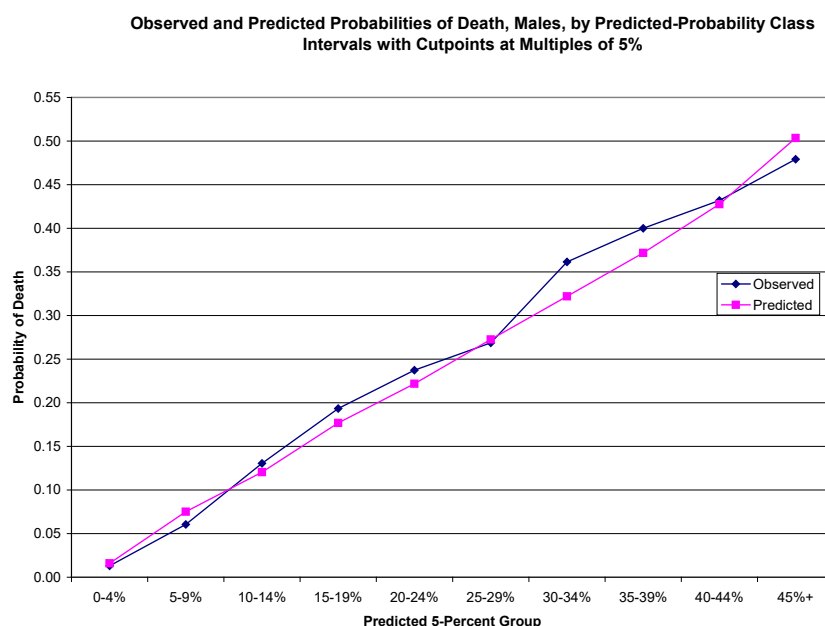
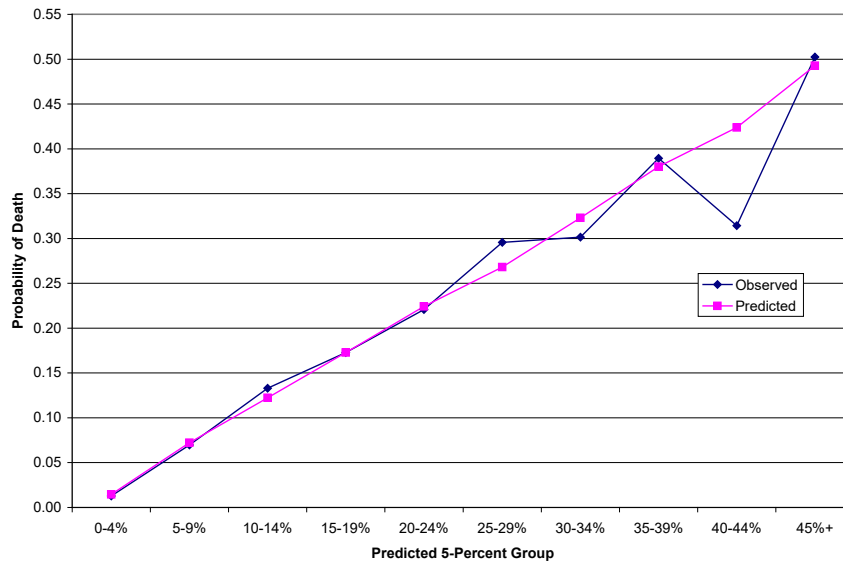


Figure 6

**Observed and Predicted Probabilities of Death, Females, by Predicted-Probability Class
Intervals with Cutpoints at Multiples of 5%**



Visually, one can see that the observed probabilities increase across the 10 categories for both sexes, except for category 9 for females. However, the chi-square test of the deviation for that one point indicates that the difference is statistically nonsignificant, with a chi-squared value of 3.44 with 1 df (Table 4; reference values are 3.84 and 6.63 at the conventional 5% and 1% significance levels).

Table 3

**Observed and Predicted Probabilities of Death, Males, by Predicted-Probability Class
Intervals with Cutpoints at Multiples of 5%**

| Percentage Group | Number of Person-Years at Risk | Observed Number of Deaths | Expected Number of Deaths | Observed Probability | Predicted Probability | Hosmer-Lemeshow Chi-Squared |
|------------------|--------------------------------|---------------------------|---------------------------|----------------------|-----------------------|-----------------------------|
| 0-4% | 61,463 | 801 | 981 | 0.013 | 0.016 | 33.60 |
| 5-9% | 23,256 | 1,407 | 1,747 | 0.061 | 0.075 | 71.73 |
| 10-14% | 20,100 | 2,622 | 2,420 | 0.130 | 0.120 | 19.20 |
| 15-19% | 7,705 | 1,490 | 1,363 | 0.193 | 0.177 | 14.29 |
| 20-24% | 4,557 | 1,082 | 1,011 | 0.237 | 0.222 | 6.44 |
| 25-29% | 2,095 | 563 | 571 | 0.269 | 0.273 | 0.16 |
| 30-34% | 1,361 | 492 | 438 | 0.361 | 0.322 | 9.73 |
| 35-39% | 115 | 46 | 43 | 0.400 | 0.372 | 0.39 |
| 40-44% | 132 | 57 | 56 | 0.432 | 0.428 | 0.01 |
| 45%+ | 48 | 23 | 24 | 0.479 | 0.504 | 0.11 |
| Total | 120,832 | 8,583 | 8,655 | 0.071 | 0.072 | 155.65 |

Table 4
Observed and Predicted Probabilities of Death, Females, by Predicted-Probability Class
Intervals with Cutpoints at Multiples of 5%

| Percentage Group | Number of Person-Years at Risk | Observed Number of Deaths | Expected Number of Deaths | Observed Probability | Predicted Probability | Hosmer-Lemeshow Chi-Squared |
|------------------|--------------------------------|---------------------------|---------------------------|----------------------|-----------------------|-----------------------------|
| 0-4% | 111,425 | 1,434 | 1,614 | 0.013 | 0.014 | 20.33 |
| 5-9% | 44,837 | 3,124 | 3,239 | 0.070 | 0.072 | 4.42 |
| 10-14% | 18,004 | 2,396 | 2,202 | 0.133 | 0.122 | 19.46 |
| 15-19% | 10,245 | 1,770 | 1,770 | 0.173 | 0.173 | 0.00 |
| 20-24% | 6,536 | 1,443 | 1,465 | 0.221 | 0.224 | 0.43 |
| 25-29% | 3,413 | 1,009 | 915 | 0.296 | 0.268 | 13.17 |
| 30-34% | 617 | 186 | 199 | 0.301 | 0.323 | 1.32 |
| 35-39% | 914 | 356 | 347 | 0.389 | 0.380 | 0.35 |
| 40-44% | 70 | 22 | 30 | 0.314 | 0.424 | 3.44 |
| 45%+ | 209 | 105 | 103 | 0.502 | 0.493 | 0.08 |
| Total | 196,270 | 11,845 | 11,885 | 0.060 | 0.061 | 62.99 |

The Hosmer-Lemeshow chi-squared test produces statistically significant total chi-squared values of 155.65 and 62.99, respectively, for males and females, each with 8 d.f. (reference values are 15.51 and 20.09 at the conventional 5% and 1% significance levels). These corroborate the better than 96% accuracy of the model generated by linear regression.

Several comments are in order:

1. The tests indicate that the models displayed in Figures 5 and 6 do *not* fit the data. This means that at least some of the deviations of the observed from predicted numbers of deaths are larger than expected by chance.
2. These are identified by the boldface font in the rightmost columns of Tables 3 and 4 using a cutpoint equal to the critical value of 6.63 using the conventional 1% significance level.
3. For males, the five significant deviations are for the four lowest probability groups 0–19% and 30–34%; for females, the three significant deviations are for the 0–4%, 10–14%, and 25–29% probability groups.
4. The expected counts for the eight groups with significant deviations ranged from 438 to 2,420, and five of the eight exceed the 1,082 cutpoint for highly credible data in Table 2; all eight exceed the minimum level of 300 lives recommended by A.M. Best for life settlement collateral pool sizes.

3 NATEQUITY VALUATION METHODOLOGY

In 2009 the Longevity Cost Calculator was imbedded in a Mark-to-Fair Value methodology Peter Mazonas was invited to present to a panel at the Securities and Exchange Commission. The Panel was exploring how to apply net present value of future portfolio cash flows to Level 3 longevity dependent assets where the outcome is unknowable. This methodology was published in 2011^{ix}. It is today widely referenced in academic, actuarial and accounting journals.

This valuation methodology uses the combination of three commercial medical records only life expectancy underwriter reports (LEs) and the output of the LCC model. At the outset the Bayesian inference “priors” / assumes all four life expectancy reports have equal weightings of .25 each. The hypothesis is that the evidence over time will lead to the “posterior” prediction that the LCC has statistical significance and can be relied upon as the accurate predictor of future portfolio cash flows. Modeling the Bayesian theorem shows that at 65 contract maturities the LCC has achieved better than 96% statistical confidence.

Medical reports life expectancy underwriter reports are prepared by third-party firms that use debits and credits to increase or decrease probable life expectancy for individuals using custom large population mortality tables. Deutsche Bank, as reported above, started developing a mortality indexing product for hedging in 2010. They hired a firm to manage the production of four commercial LE reports on each of 1,500 seniors. They discontinued the effort after collecting about 500 sets of LEs. Mazonas evaluated these 500 outcomes. The variance between the high and the low LE was 31%. When the variance was higher than 30%, the average variance was 57%.^x Life settlement providers acknowledge these errors and attribute them to human error in interpreting or overlooking items in individual sets of medical records.

To overcome this problem, NatEquity has used an automated International Codes of Disease (ICD 9) taxonomy (code dictionary) from WAND, Inc. ICD codes classify the severity of disease conditions up until death. The older ICD 9 diagnostic code set consisted of 13,000 codes. The newer ICD 10/11 code set consists of 68,000 severity categories of disease conditions. These codes are used in medical billing. Medical records and resultant commercial LEs are scanned into OCR data sets and compared to ICD taxonomies. Observed differences are called to the attention of each commercial LE underwriter to resolve differences. In this way the commercial LEs used in the Bayesian Inference process, although different, are as comparable as possible. NatEquity believes this eliminates another variable to arrive at the most accurate data set being measured.

For readers not familiar with Thomas Bayes’ theorem from 1750s, I recommend the New York Times Article^{xi} referenced below and two recent books: *The Signal and the Noise*, Nate Silver, Penguin Press, 2012; and *The Theory That Would Not Die: How Bayes’ Rule Cracked the Enigma Code, Hunted Down Russian Submarines, and Emerged Triumphant from Two Centuries of Controversy*, Sharon Bertsch McGrayne, Yale University Press, 2011. Bayesian methodology was key to Alan Turing’s creation of the Enigma decoding machine; and how Sean Connery, in *Hunt for Red October*, knew which way the Russian submarine would turn when it did a Crazy Ivan – Bayesian Inference.

4 CONCLUSION – NATEQUITY’S VALUATION METHODOLOGY BRINGS STRONG VALUE ADD TO MEASURING FUTURE CASH FLOWS

Consistently applying the Bayesian Inference valuation methodology published by Graham, Stallard and Mazonas allows, after approximately 65 maturities, the predicting of future portfolio cash flows with statistical confidence. This high level of predictable confidence attained using the valuation methodology permits the valuation team to use a much lower risk premium factor in the discount rate used to NPV the future portfolio cash flows. This lower risk premium, 5%, added to a 2.5% risk-free cost of capital, yields an NPV that accretes value to both the balance sheet asset and the corresponding

addition of income to the book balance sheet. This is on a basis where a discount rate of approximately 11.5% produces a valuation at cost with no accreted or diminished value.

Without this predictability, auditors have been known to apply a 15% risk premium on top of a 2.5% risk free cost of capital. This yields a significant decrease in asset valuation and large reductions to book income and earnings per share value. This decrease in valuation is slowly earned back over time, not time that issuers of audited financial statements will tolerate.

July 15, 2024, update to include current reference to SEC Rule 2a-5 and enforcement.

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ⁱ Stallard, E., 2007. Trajectories of Morbidity, Disability, and Mortality among the U.S. Elderly Population: Evidence from the 1984-1999 NLTCs. *North American Actuarial Journal* 11(3):16–53.

<http://www.soa.org/library/journals/north-american-actuarial-journal/2007/july/naaj0703-2.pdf>

ⁱⁱ Life Settlement Financial, LLC, was a Delaware Limited Liability Company, licensed in 2007, that went out of business in 2009. Mazonas, at personal expense, kept the shell business going in hopes of selling the assets. In 2013, Mazonas registered the dba of Longevity Specialty Finance in California. LSF continued to perfect valuation methodologies.

ⁱⁱⁱ *A New Algorithm for Predicting Time to Disease Endpoints in Alzheimer's Patients*, J. Alzheimer's Dis. 2014 Jan 1, 38(3), 10.3233/JAD-131142, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3864687>

^{iv} *Personalized predictive modeling for patients with Alzheimer's disease using an extension of Sullivan's life table model*, E. Stallard, B Kinoshian and Y Stern, *Alzheimer's Research & Therapy* (2017) 9:75.

^v *Longevity Risk in Fair Valuing Level-Three Assets in Securitized Portfolios*, Peter Macrae Mazonas, Patrick John Eric Stallard, Lynford Graham, the Geneva Papers (2011) 36, 516-543. Doi: 10.1057 / gpp 2011.25.

^{vi} *Good Faith Determination of Fair Value*, Securities and Exchange Commission, 17CFR Parts 210 and 270, 12/3/2020

^{vii} <http://www.ncbi.nlm.nih.gov/pubmed/1820287>

^{viii} Unpublished analysis by Peter Mazonas of raw de-identified data provided by the firm who conducted the study and compiled the individual case files.

^{ix} <http://www.palgrave-journals.com/gpp/journal/v36/n4/abs/gpp201125a.html> Copies available upon request.

^x Results are from the Deutsche Bank data set. Similar results were tabulated by EMSI and AVS from data collected from life settlement providers.

^{xi} The Odds, Continually Updated, F. D. Flam, New York Times, September 29, 2014.

http://www.nytimes.com/2014/09/30/science/the-odds-continually-updated.html?_r=0