Bellagos Social Long-Term Care Insurance Program: Evaluation of Sustainability

2018 Society of Actuaries Case Study

The Red Hawk (Pi)rates

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1.0 Executive Summary

To analyze the sustainability of Bellagos' social long-term care program, our team used a microsimulation model on the sample household data to simulate certain demographic changes, such as mortality rates and morbidity matrices, on the sample population. We then applied aggregate controls on the sample data to reflect economic trends on the macro level. This hybrid approach has been used to estimate both tax revenues and healthcare expenses for Bellagos' current long-term care program.

Microsimulation models are often used in evaluating tax revenues, retirement incomes and healthcare policies [1][2][3]. With the household sample data of the baseline year 2017, we combined microsimulation techniques with macro trends to predict future tax revenues and healthcare costs for the years 2018 through 2028.

In our microsimulation model, we also combined dynamic aging with static aging to validate available data and make projections about the future population. All individuals in the current sample household data were aged by one year in each step depending on mortality rates and random numbers generated by the Monte Carlo method. New beneficiaries were added with a similar approach depending on the care level transition matrices given in the data. Newborns were added each year based on the predictions on fertility rates. New households were added with adjusted estimations on their future

incomes depending on their age cohorts. The figure below shows the estimations of revenues and expenses for Bellagos' current long-term care program based on our microsimulation model and Monte Carlo simulations.

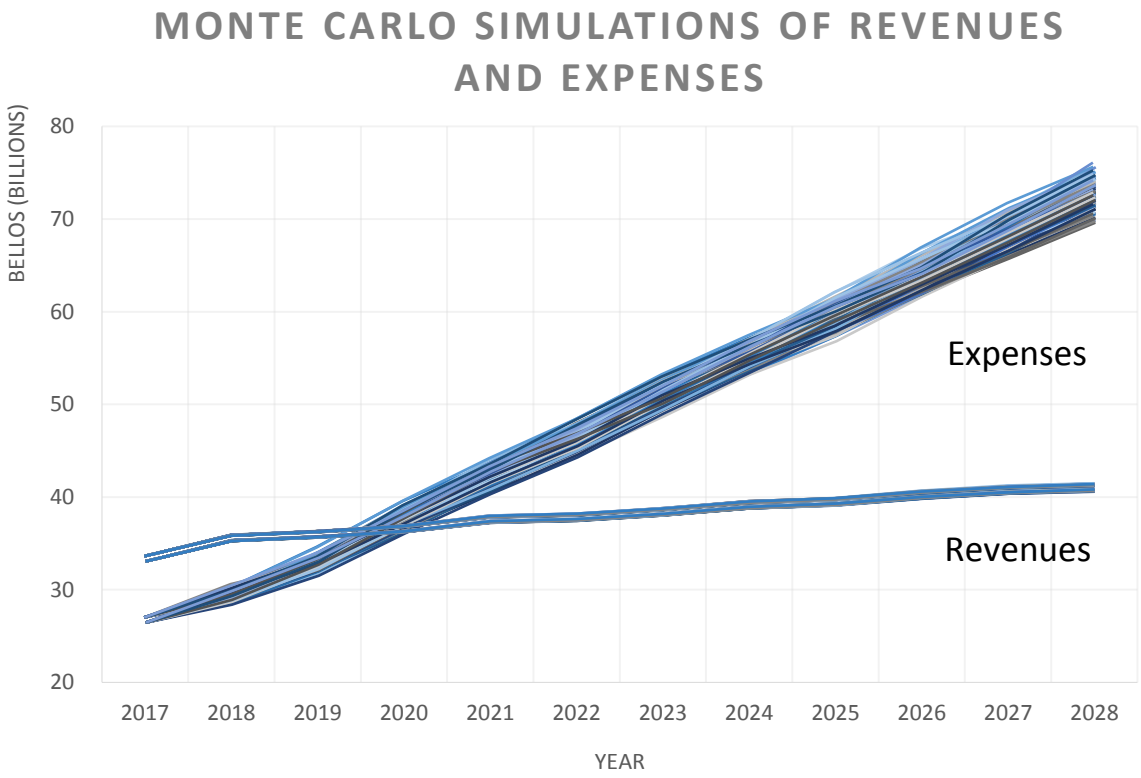

Figure 1.1.1

2.0 Data Analysis & Projections

2.1 Summary of 2017 Data

The calculation for Bellagos' 2017 tax revenue (see figure 2.1.1 below) was completed by differentiating the households with children from those without children. The separation into two groups was required to account for the different tax rates: 0.90% for households with children and 1.05%

for households without children. The total income for the sample was calculated for each category of household and then adjusted to represent the entire Bellagos population by a multiplier. The multiplier is the Bellagos population in 2017 divided by the number of individuals in the sample. Then, the adjusted income for the entire population for households with children and those without were multiplied by their respective tax rates to calculate the tax revenue for each category. Finally, the total tax revenue for Bellagos is the summation of the two previous values.

2017 Tax Revenue			
Households with Children		**Households without Children**	
Income for Sample (Bellos)	198,347,069	Income for Sample (Bellos)	648,910,614
Adjusted Income for Population (Bellos)	769,049,105,923	Adjusted Income for Population (Bellos)	2,516,014,630,500
Tax Rate	0.90%	Tax Rate	1.05%
Tax Revenue (Bellos)	6,921,441,953	Tax Revenue (Bellos)	26,418,153,620
Total Tax Revenue for all Households (Bellos)			**33,339,595,574**

Figure 2.1.1

For the evaluation of Bellagos' 2017 expenses (see figure 2.1.2 below), we accounted for the number of individuals in each state of healthcare. Then, the home care and facility care categories were further separated by the level of care to account for the difference in cost at each level. The total expenses for the sample are the summation of the products of the number of individuals at each degree of care and the cost at each respective care level (brought to a yearly cost by multiplying by 12). The total expenses for the sample were then adjusted to represent the entire

Bellagos population by multiplying the total expenses for the sample by the population multiplier and adding the total government administrative expenses.

2017 Expenses			
Healthcare Status:	**Level**	**Number of Individuals**	**Costs of Care (Bellos)**
Home Care	1	244	221.87
	2	139	413.62
	3	45	607.71
	4	24	902.46
Facility Care	1	2	1006.15
	2	5	1201.91
	3	22	1398.72
	4	191	1626.63
Total Cost for Sample Population (Bellos)		6,121,386	
Adjusted Total Cost for Entire Population (Bellos)		23,734,387,290	
Total Government Administrative Expenses		2,990,530,757	
Total Expenses (Bellos)			**26,724,918,047**

Figure 2.1.2

The predominant age range in the 2017 Bellagos population includes individuals between the ages of 25 and 54 (as seen below in figures 2.1.3 and 2.1.4). The other age ranges are almost evenly distributed with a decrease in individuals as the age increases. Figure 2.1.3 displays the entire population from the 2017 sample and Figure 2.1.4 only accounts for individuals that are listed as household member 1 or household member 2.

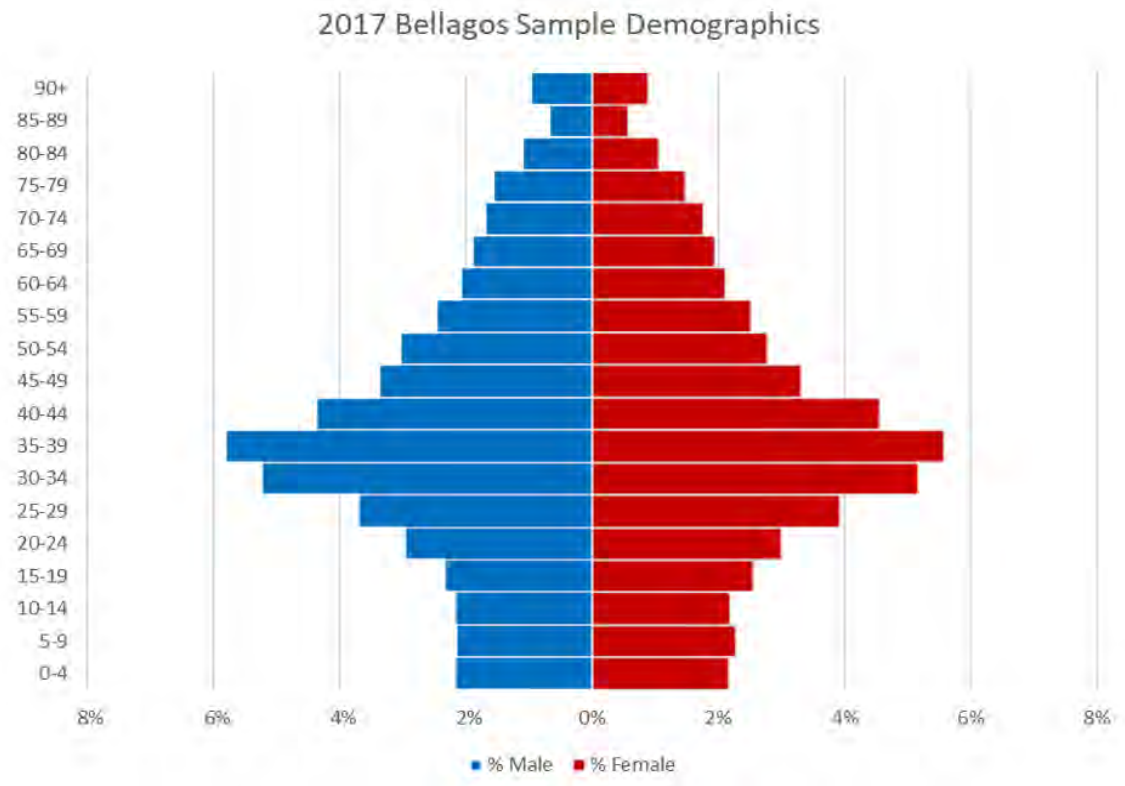

Figure 2.1.3

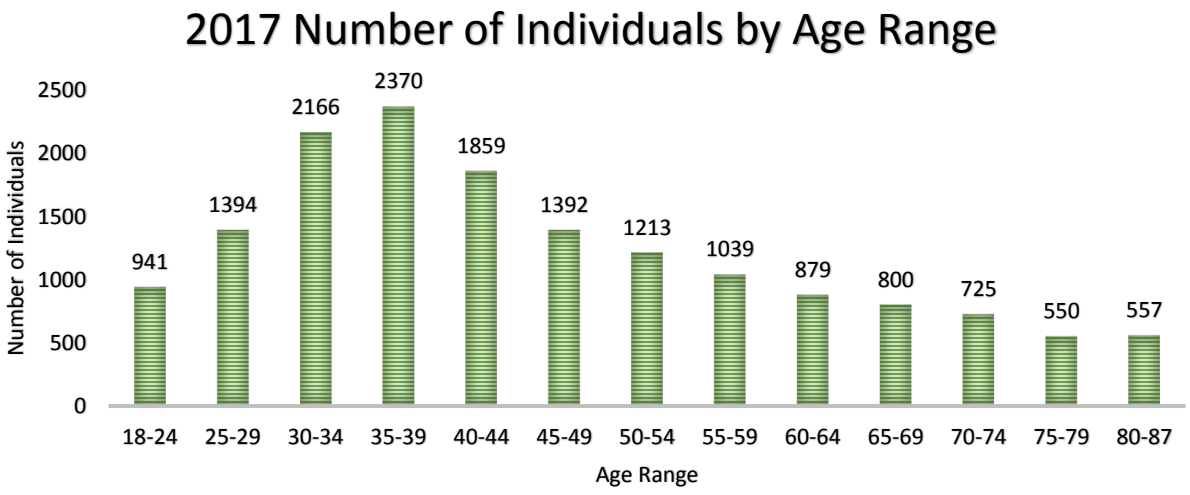

Figure 2.1.4

The average income in Bellagos peaks at the end of an individual's career (ages 60 to 64). Figure 2.1.5 showcases the gradual increase in average individual income from age 18 to age 64 before the decline around the age of retirement. Therefore, the individuals that contribute the most to the tax revenue (not based on the number of individuals in each age range) are those between the ages of 45 and 64.

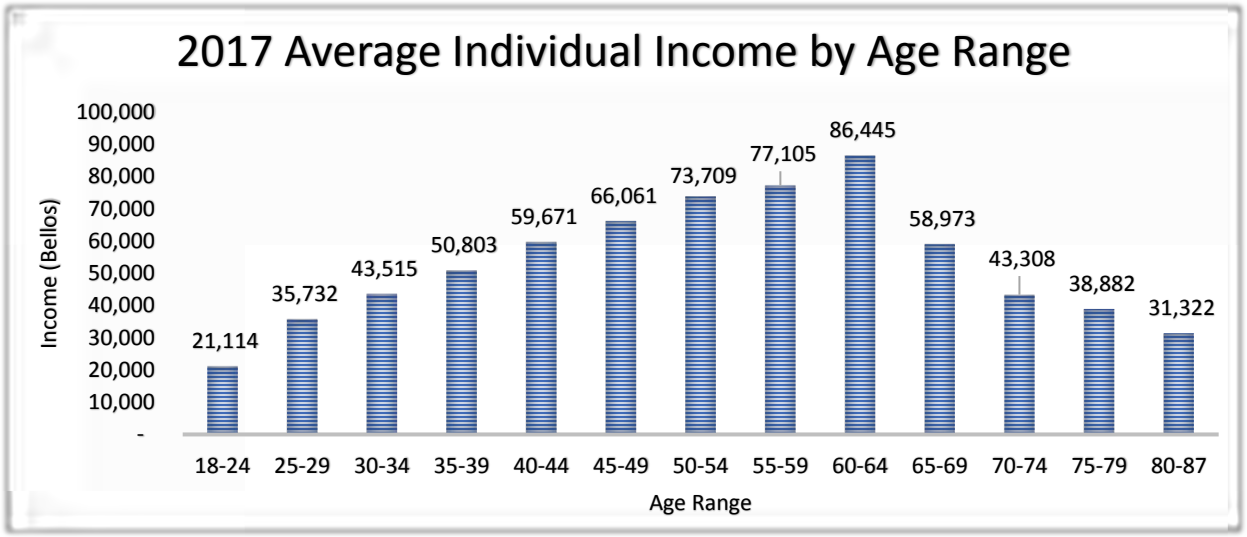

Figure 2.1.5

2.2 Projection of Trends

2.2.1 Population & LTC Insurance Trends

To estimate the future trends of the population and LTC insurance, our team used the given historical data through the procedures of interpolation and extrapolation. The method of least squares with a five-year trend was

implemented to determine the future values for total population, population over age 80, population over and under age 65 and population under the age of 20. The least square method of a five-year trend was also used to predict the number of home care and facility care beneficiaries for each level and the respective costs.

2.2.2 Economic Trends

The estimations of the future unemployment, inflation, fertility and real wage growth rates were also based on the given historical data. Through the procedures of interpolation and extrapolation, future rates were calculated. Although the method of least squares with a five-year trend resulted in a sound projection for the future data of population and LTC insurance trends, it was not applicable for the economic trends. Most of the projected rates for the economic trends resulted in negative values when a five-year trend was applied and were therefore not reasonable estimations. To adjust for this complication, the negative rates were switched to a three-year trend. This allowed for less fluctuation of future data while maintaining a steady and reasonable trend.

2.3 Projection of Mortality Rates

To project the mortality rates for the next decade, our team used the data from 2005, 2010, and 2015 and applied the Lee-Carter model [4][5]

$$m_{at} = \alpha_a + \beta_a \gamma_t + \varepsilon_{at}.$$

First, we took the logarithm for all the mortality rates in the years 2005, 2010 and 2015 to calculate m_{at}. Then, the average of the logarithmic values of the mortality rates for those three years was calculated. After the difference between m_{at} and the average were calculated, a new 110 by 3 matrix was created with ages in columns and years in rows. We used the Singular Value Decomposition (SVD) and random walk with drift model to forecast the γ_t for the years 2020, 2025. After we calculated the logarithm of the mortality rate for 2020 and 2025, we used $e^{m_{at}}$ to find the forecasted mortality rates. In general, mortality rates are projected to decrease in the future years.

3.0 Sustainability Assessment & Risks

3.1 Sustainability of the Program

The results of the Monte Carlo simulations indicate that the Bellagos social long-term care program is not sustainable in its current form. As seen in the executive summary (figure 1.1.1), the expenses are projected to

increase rapidly while the revenue is projected to gradually increase. In 2028, the current program is not sustainable since the expenses are projected to be nearly twice as much as the revenue in the year.

The Monte Carlo simulations display multiple paths for the future revenue and expenses of Bellagos. Our team ran 100 simulations for the revenue and expenses for the years 2018 through 2028. For the revenues, the minimum projection for 2028 is 40,862,342,625 Bellos, the maximum is 41,196,219,576 Bellos and the average is 41,028,158,984 Bellos. The minimum expense projection for 2028 is 69,874,343,829 Bellos, the maximum is 75,840,420,048 Bellos and the average is 72,670,198,301 Bellos. Therefore, the current program cannot be upheld unless components of the plan are altered as displayed in the following figure.

Bellagos 2028 Projections			
Value (Bellos)	**Revenue**	**Expenses**	**Difference**
Minimum	**40,862,342,625**	**69,874,343,829**	**(29,012,001,204)**
Maximum	**41,196,219,576**	**75,840,420,048**	**(34,644,200,472)**
Average	**41,028,158,984**	**72,670,198,301**	**(31,642,039,317)**

Figure 3.1.1

When calculating the tax revenues each year, we first checked each individual's status (alive or dead) by comparing a random number generated from $Uniform(0,1)$ with the mortality rate of the given individual's age. For those individuals who needed home care or facility care, the mortality rates

were adjusted by $3 * mortality\ rate$ as indicated in the care level matrix. We then applied the projected real wage growth rates and inflation rates to reflect changes to each alive individual in the sample household data. Their incomes were adjusted by the following formula:

$$Income_{t,i} = Income_{t-1,i} * (1 + wage_t) * (1 + inflation_t)$$

where $Income_{t,i}$ represents the earning for individual i in year t, $wage_t$ represents the real wage growth in year t and $inflation_t$ represents the inflation rate in year t. After the income adjustment for each individual in the sample household data was made, the new household incomes from the adult dependents (depending on their age cohorts and the average incomes of their age cohorts) were added. Newborns were added by the projected fertility rates. Some households were switched from households without children to households with children. Finally, we adjusted total incomes by using projections on changes of unemployment rates.

Estimations about future costs came from two resources. First, the microsimulation results of the sample household data. Second, the projections on total healthcare costs based on historical data. For the microsimulation results, we generated random numbers for each individual to simulate his/her health status for the upcoming year: healthy, need home care (level 1, 2, 3, 4), or need facility care (level 1, 2, 3, 4). The baseline numbers we compared with were the probabilities in the care level transition

matrix. We multiplied the total number of beneficiaries in each level by the projected healthcare cost to get the total projected healthcare costs for the sample population. We then multiplied each year's multiplier to calculate the total healthcare costs for the entire population. Since the historical data provided the historical healthcare costs, we also did a projection on total healthcare cost based on past data. According to the credibility theory, we assigned a weight of 0.5 to each estimation. Therefore, the estimation of total expenses in the sustainability analysis is the average of these two valuations.

The figures below show the simulations in a reduced manner to enhance the display of the method used. In figures 3.1.1 and 3.1.2, only 20 simulations are graphed from the years 2017 through 2022 to showcase the different paths that extend from the common starting point in 2017.

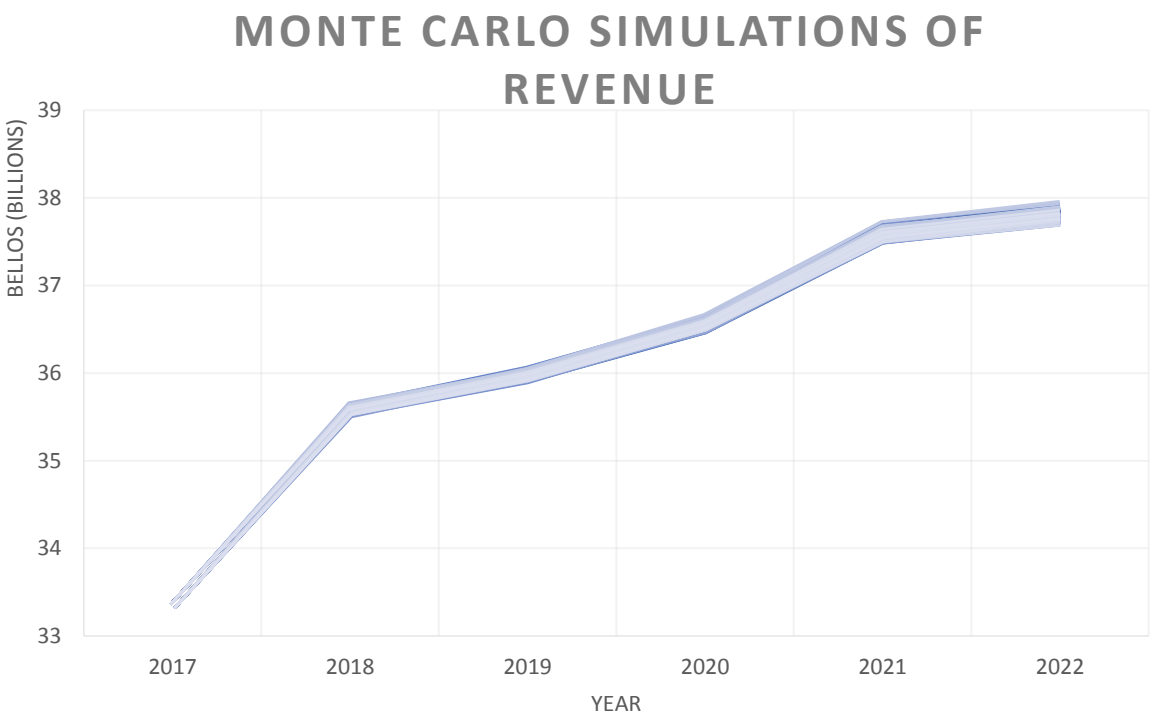

Figure 3.1.1

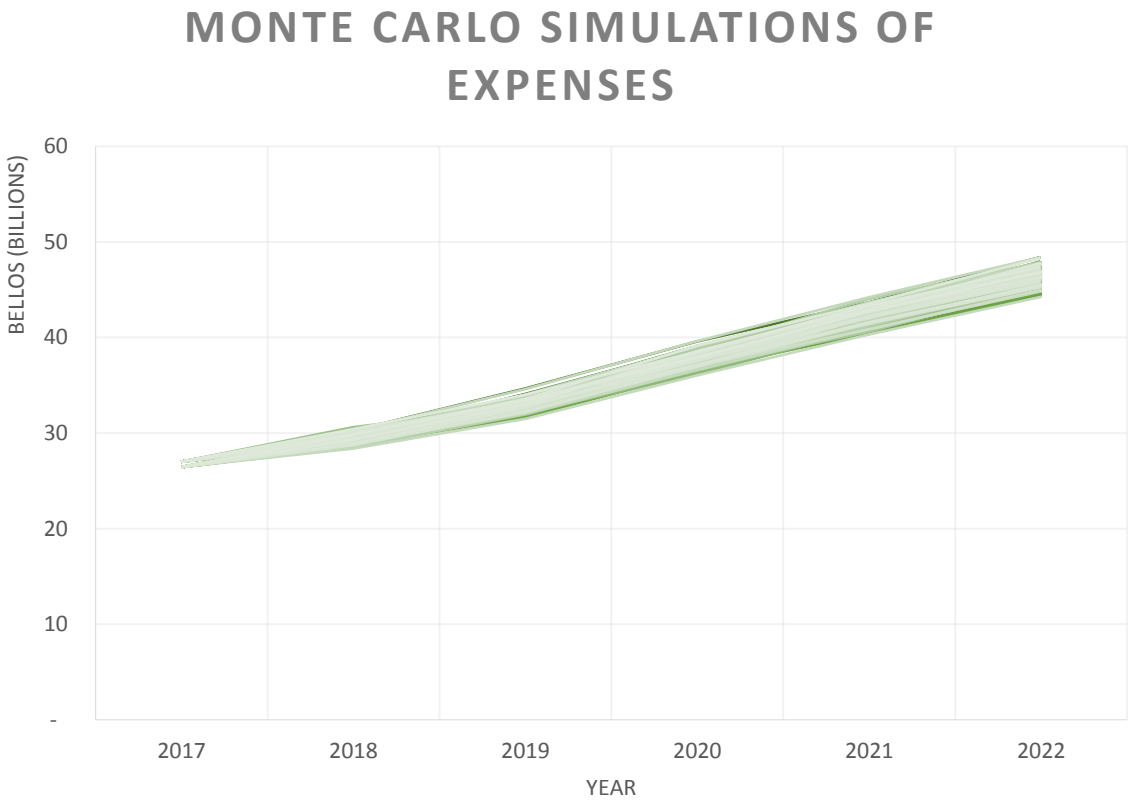

Figure 3.1.2

3.2 Potential Risks & Data Limitations

3.2.1 Pricing Risk

One of the risks associated with the projections for revenue and expenses include the potential for future years to not fit the trends from the historical data. Changes in the state of Bellagos' economy can drastically influence the levels of revenue and expenses if there are large variations from the projections in the unemployment, inflation and real wage growth rates. This potential risk can either increase the potential for the stability of the long-term healthcare program or decrease it based on the changes in the economy. Some given data create limitations for better estimations on pricing. For instance, we only have macro predicted data on government administration expenses when calculating the total healthcare costs. The projections of the number of new households, newborns also rely on the projections of fertility rates heavily. We do not have an accurate number of income increment for each individual other than income adjusted by inflation rates and real wage growth rate.

3.2.2 Mortality Risk

The Lee-Carter model projections are sensible estimations of the future mortality rates based on previous data, but the projected rates do not account for drastic increases in technology. A massive technological

advance in the reduction of the rate of mortality would result in individuals living longer and increasing the expenses of the healthcare program. In contrast, a massive epidemic, although not probable, could briefly spike the mortality risk and decrease the expenses of the Bellagos long-term care program.

3.2.3 Morbidity Risk

The current estimation of total healthcare expenses of Bellagos' long-term care program depends heavily on the morbidity rates provided in the care level transition matrix. With the advancement of technology, the mortality rates will likely decline and increase the risk of higher healthcare costs. The morbidity rates, however, will likely decrease at the same time and might serve as a cushion or even completely offset the influence of higher mortality risk coming from the improvement on technology. According to a research study conducted by Society of Actuaries [7] regarding the pricing for long-term care insurance, the positive effects on morbidity improvement offsets the unfavorable financial impact of mortality improvement.

4.0 Recommendations & Trade-offs

4.1 Recommendations for LTC Program

Since the Bellagos long-term care program is projected to be unsustainable in the future, the conditions of the program must be altered if the government wants to avoid its termination. Several factors can potentially be changed to increase the probability of sustainability, which include the following: increasing the requirements to obtain the coverage (age of eligibility and number of tax credits required for care), an increase in the tax rate for the program, lowering the cost of the care given in the program (such as implementing the caregiver allowance program) or a combination of the various factors. The following alterations for the program are displayed below in figure 4.1.1.

Bellagos 2028 Projections				
Alteration	Value (Bellos)	Revenue	Expenses	Difference
Current Status of LTC Program (No Alteration)	Minimum	40,862,342,625	69,874,343,829	(29,012,001,204)
	Maximum	41,196,219,576	75,840,420,048	(34,644,200,472)
	Average	41,028,158,984	72,670,198,301	(31,642,039,317)
Age of Retirement Moved from the Age of 65 to 69	Minimum	41,041,447,612	51,582,139,547	(10,540,691,935)
	Maximum	41,342,277,589	62,263,782,148	(20,921,504,559)
	Average	41,182,879,172	57,720,830,396	(16,537,951,224)
Healthcare Requirement of 2 Tax Credits Moved to 10	Minimum	40,847,094,853	66,879,311,272	(26,032,216,419)
	Maximum	41,175,389,223	76,229,750,156	(35,054,360,933)
	Average	41,011,216,682	71,573,170,878	(30,561,954,196)
Age of Retirement at 69 and Healthcare Requirement of 10 Tax Credits	Minimum	40,970,729,261	49,575,681,928	(8,604,952,667)
	Maximum	41,350,130,725	56,673,431,810	(15,323,301,085)
	Average	41,140,895,781	53,193,269,221	(12,052,373,440)
Increase in 0.3% in the Tax Rate for Household with and without Children	Minimum	43,682,426,071	70,122,522,941	(26,440,096,870)
	Maximum	43,978,376,645	75,519,015,259	(31,540,638,614)
	Average	43,823,653,581	72,623,002,861	(28,799,349,280)
Implementation of Informal Caregiver Allowance Program	Minimum	40,867,239,640	54,950,251,070	(14,083,011,430)
	Maximum	41,155,873,495	69,516,384,942	(28,360,511,447)
	Average	41,021,214,432	62,370,231,553	(21,349,017,121)
Final Recommendation (Retirement to 69, Tax Credits to 10 and Caregiver Allowance)	Minimum	40,928,325,107	37,791,763,481	3,136,561,626
	Maximum	41,365,996,429	47,430,127,355	(6,064,130,926)
	Average	41,149,647,776	43,135,843,015	(1,986,195,239)

Figure 4.1.1

Our final recommendation is to increase the requirements to obtain the coverage (including delaying the age of eligibility to 69 and increasing the number of tax credits to 10) and decreasing the home care costs by implementing the Informal Caregiver Allowance Program. The rational to delay the eligible age to 69 comes from a similar research for the United States' Medicare system [7]. At the same time, we suggest keeping the current tax rate to avoid backlash from taxpayers [8]. The result is shown in figure 4.1.3.

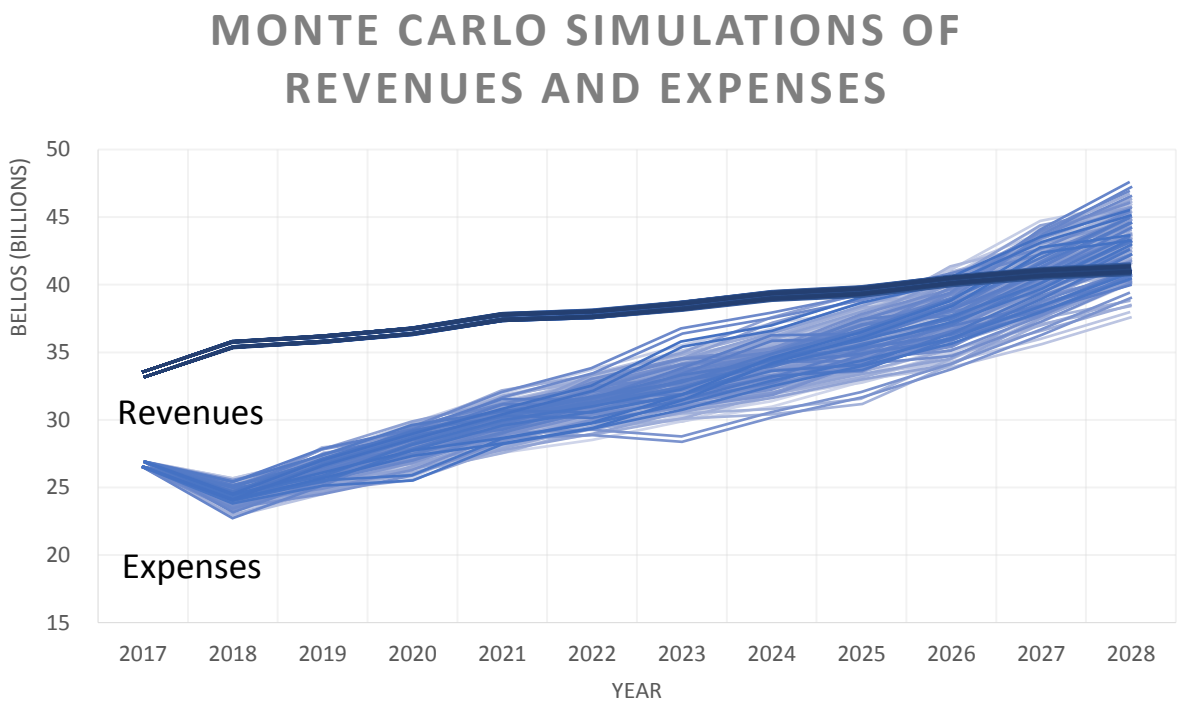

Figure 4.1.2

Although we do not have information regarding whether Bellagos' government saves and invests the surpluses collected each year for future years or spends them for other purposes, we highly recommend that they save and invest the surpluses. Therefore, by saving and investing the surplus in each year at a conservative 3% annual rate of return, the cumulative reserve is projected at 73,418,301,127 Bellos (Figure 4.1.3).

Bellagos Social Long-Term Program 10-year Projection					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Revenues	35,577,769,790	35,979,969,084	36,557,606,379	37,598,411,650	37,828,037,721
Expenses	24,358,699,084	26,209,093,129	27,968,262,424	29,767,044,588	31,321,233,059
Surplus	11,219,070,706	9,770,875,955	8,589,343,956	7,831,367,062	6,506,804,662
Cumm. Surplus	**11,219,070,706**	**21,326,518,782**	**30,555,658,302**	**39,303,695,113**	**46,989,610,628**

2023	**2024**	**2025**	**2026**	**2027**	**2028**
38,421,068,353	39,191,533,605	39,532,371,445	40,307,777,234	40,867,325,963	41,149,647,776
32,682,834,135	34,184,807,098	35,815,350,024	37,801,270,842	40,587,373,896	43,135,893,015
5,738,234,218	5,006,726,507	3,717,021,422	2,506,506,392	279,952,068	(1,986,245,240)
54,137,533,165	**60,768,385,667**	**66,308,458,659**	**70,804,218,811**	**73,208,297,443**	**73,418,301,127**

Figure 4.1.3

4.2 Trade-offs for Sustainability

Increasing the probability that Bellagos' social long-term care program is sustainable comes with a decrease in the quality of the program. An alteration in the program requirements may result in negative feedback from the citizens of Bellagos. Increasing the requirements of obtaining coverage from the program will decrease the expenses, but it will also cut the care for many individuals within the age range of 65 to 69 and individuals that do not have enough tax credits. Also, since the cost of coverage is decreased by the Informal Caregiver Allowance Program, the overall quality of the program may suffer due to inexperienced caregivers. It is possible to avoid the alterations of the program if the surplus is properly saved and invested if by Bellagos' government, but those details were not given. Therefore, obtaining the proper levels of revenues and expenses to maintain the stability of the program will come with several drawbacks or will require a large reserve for investment income.

5.0 References

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[8] Bellagos LTC Social Insurance System Overview

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6.0 Appendix

6.1 Projection of Population & LTC Insurance Trends

6.1.1 Population Trend

Year	Total Population	Population Over 80	Population 65 and Over	Population Under 65	Population Under 20
2018	80.67 M	4.50 M	12.90 M	67.77 M	15.54 M
2019	80.66 M	4.69 M	13.10 M	67.57 M	15.33 M
2020	80.65 M	4.88 M	13.31 M	67.34 M	15.12 M
2021	80.65 M	5.07 M	13.52 M	67.13 M	14.92 M
2022	80.65 M	5.26 M	13.71 M	66.94 M	14.73 M
2023	80.64 M	5.45 M	13.92 M	66.72 M	14.52 M
2024	80.64 M	5.64 M	14.13 M	66.51 M	14.32 M
2025	80.64 M	5.83 M	14.33 M	66.30 M	14.12 M
2026	80.63 M	6.02 M	14.54 M	66.09 M	13.92 M
2027	80.63 M	6.20 M	14.75 M	65.88 M	13.71 M
2028	80.63 M	6.39 M	14.95 M	65.68 M	13.51 M

6.1.2 Home & Facility Care Beneficiaries

Year	Total Home Care	Home Care Level 1	Home Care Level 2	Home Care Level 3	Home Care Level 4
2018	1870.3 K	1005.0 K	581.0 K	186.4 K	97.9 K
2019	2058.1 K	1110.4 K	633.6 K	204.9 K	109.1 K
2020	2230.1 K	1208.0 K	680.6 K	221.8 K	119.7 K
2021	2398.8 K	1303.0 K	727.4 K	238.4 K	129.9 K
2022	2557.6 K	1389.6 K	775.2 K	254.2 K	138.6 K
2023	2737.6 K	1491.7 K	824.2 K	271.9 K	149.7 K

2024	2902.4 K	1583.8 K	871.0 K	288.2 K	159.5 K
2025	3070.3 K	1677.3 K	919.0 K	304.8 K	169.3 K
2026	3239.7 K	1771.9 K	967.0 K	321.5 K	179.3 K
2027	3410.6 K	1867.9 K	1014.8 K	338.3 K	189.5 K
2028	3568.4 K	1960.7 K	1062.3 K	354.8 K	199.3 K

Year	Total Facility Care	Facility Care Level 1	Facility Care Level 2	Facility Care Level 3	Facility Care Level 4
2018	852.0 K	7.9 K	18.9 K	86.9 K	738.3 K
2019	930.7 K	8.4 K	21.3 K	92.7 K	808.4 K
2020	1010.4 K	8.9 K	23.7 K	98.2 K	879.5 K
2021	1068.3 K	9.3 K	25.6 K	101.8 K	931.6 K
2022	1119.6 K	9.7 K	27.0 K	106.3 K	976.6 K
2023	1198.0 K	10.1 K	29.5 K	111.6 K	1046.8 K
2024	1258.5 K	10.5 K	31.3 K	115.9 K	1100.8 K
2025	1318.8 K	10.9 K	33.1 K	120.3 K	1154.4 K
2026	1384.6 K	11.4 K	35.1 K	125.1 K	1213.0 K
2027	1451.1 K	11.8 K	37.2 K	129.7 K	1272.4 K
2028	1511.9 K	12.2 K	39.0 K	134.2 K	1326.5 K

6.1.3 Home & Facility Care Payout

Year	Home Care Level 1	Home Care Level 2	Home Care Level 3	Home Care Level 4
2018	233.42	432.39	635.07	943.40
2019	244.49	452.12	664.00	986.27
2020	255.28	472.31	693.61	1029.14
2021	265.77	492.18	722.68	1072.01
2022	277.06	511.63	751.16	1114.87

2023	287.78	531.69	780.56	1157.74
2024	298.59	551.53	809.60	1200.61
2025	309.48	571.25	838.48	1243.48
2026	320.42	591.07	867.51	1286.35
2027	331.19	610.97	896.65	1329.22
2028	342.08	630.73	925.59	1372.09

Year	Facility Care Level 1	Facility Care Level 2	Facility Care Level 3	Facility Care Level 4
2018	1051.48	1256.39	1462.60	1699.90
2019	1099.68	1313.72	1529.69	1777.62
2020	1148.82	1372.32	1598.06	1856.88
2021	1197.04	1430.04	1665.55	1934.82
2022	1244.37	1486.54	1731.67	2011.18
2023	1293.22	1544.79	1799.71	2090.00
2024	1341.42	1602.39	1867.03	2167.82
2025	1389.39	1659.68	1934.03	2245.26
2026	1437.61	1717.22	2001.30	2323.07
2027	1485.99	1775.00	2068.82	2401.18
2028	1534.05	1832.39	2135.93	2478.75

6.2 Projection of Economic Trends

Year	Unemployment rate	Inflation rate	Fertility rate	Real wage growth rate
2018	3.8%	0.6%	1.39	2.3%
2019	4.3%	1.0%	1.22	1.5%
2020	4.2%	0.9%	1.40	1.7%
2021	3.8%	0.7%	1.33	2.2%

2022	4.3%	1.0%	1.26	1.4%
2023	4.1%	0.8%	1.40	1.9%
2024	4.0%	0.8%	1.29	2.0%
2025	4.3%	1.0%	1.30	1.5%
2026	4.0%	0.7%	1.38	2.0%
2027	4.1%	0.8%	1.28	1.8%
2028	4.2%	0.9%	1.33	1.6%

6.3 Projections of Mortality Rates

	FEMALE					Male				
Age	2005	2010	2015	2020	2025	2005	2010	2015	2020	2025
0	0.00330	0.00312	0.00310	0.00299	0.00291	0.00421	0.00377	0.00337	0.00303	0.00271
1	0.00024	0.00020	0.00023	0.00022	0.00022	0.00030	0.00026	0.00024	0.00021	0.00019
2	0.00012	0.00008	0.00010	0.00009	0.00008	0.00012	0.00019	0.00015	0.00019	0.00022
3	0.00012	0.00010	0.00014	0.00015	0.00016	0.00018	0.00013	0.00012	0.00009	0.00008
4	0.00009	0.00012	0.00009	0.00009	0.00009	0.00016	0.00013	0.00012	0.00010	0.00009
5	0.00011	0.00009	0.00008	0.00007	0.00006	0.00013	0.00011	0.00008	0.00006	0.00005
6	0.00014	0.00008	0.00006	0.00004	0.00003	0.00012	0.00012	0.00010	0.00009	0.00009
7	0.00010	0.00007	0.00006	0.00005	0.00004	0.00010	0.00008	0.00007	0.00006	0.00005
8	0.00008	0.00008	0.00006	0.00005	0.00005	0.00011	0.00008	0.00008	0.00006	0.00005
9	0.00008	0.00008	0.00005	0.00004	0.00003	0.00011	0.00008	0.00007	0.00005	0.00004
10	0.00010	0.00006	0.00007	0.00006	0.00005	0.00008	0.00007	0.00008	0.00008	0.00008
11	0.00012	0.00009	0.00008	0.00006	0.00005	0.00010	0.00007	0.00008	0.00007	0.00006
12	0.00009	0.00006	0.00011	0.00012	0.00013	0.00013	0.00013	0.00008	0.00007	0.00005
13	0.00011	0.00009	0.00006	0.00004	0.00003	0.00017	0.00012	0.00008	0.00006	0.00004
14	0.00015	0.00008	0.00011	0.00009	0.00008	0.00016	0.00015	0.00011	0.00010	0.00008
15	0.00006	0.00004	0.00014	0.00020	0.00033	0.00014	0.00018	0.00016	0.00018	0.00020
16	0.00014	0.00008	0.00013	0.00012	0.00012	0.00027	0.00025	0.00021	0.00019	0.00017
17	0.00014	0.00013	0.00016	0.00017	0.00018	0.00037	0.00024	0.00021	0.00015	0.00011
18	0.00024	0.00015	0.00018	0.00015	0.00013	0.00063	0.00048	0.00032	0.00024	0.00017
19	0.00021	0.00021	0.00012	0.00009	0.00007	0.00058	0.00048	0.00033	0.00026	0.00020
20	0.00020	0.00016	0.00020	0.00020	0.00020	0.00057	0.00039	0.00044	0.00035	0.00031
21	0.00014	0.00013	0.00010	0.00008	0.00007	0.00060	0.00055	0.00048	0.00043	0.00039
22	0.00020	0.00015	0.00014	0.00011	0.00010	0.00060	0.00049	0.00044	0.00037	0.00032
23	0.00018	0.00021	0.00017	0.00017	0.00016	0.00063	0.00044	0.00040	0.00030	0.00024
24	0.00019	0.00013	0.00012	0.00009	0.00008	0.00059	0.00045	0.00040	0.00032	0.00026
25	0.00025	0.00017	0.00013	0.00009	0.00007	0.00057	0.00049	0.00046	0.00041	0.00037
26	0.00015	0.00014	0.00016	0.00016	0.00017	0.00067	0.00062	0.00040	0.00033	0.00026
27	0.00020	0.00022	0.00017	0.00016	0.00014	0.00065	0.00064	0.00050	0.00046	0.00040
28	0.00020	0.00016	0.00026	0.00029	0.00034	0.00066	0.00063	0.00045	0.00039	0.00033
29	0.00027	0.00025	0.00028	0.00028	0.00029	0.00067	0.00065	0.00062	0.00060	0.00058
30	0.00034	0.00024	0.00026	0.00022	0.00020	0.00066	0.00058	0.00053	0.00047	0.00042
31	0.00029	0.00028	0.00033	0.00035	0.00038	0.00074	0.00066	0.00073	0.00070	0.00069
32	0.00033	0.00030	0.00027	0.00024	0.00022	0.00072	0.00077	0.00067	0.00067	0.00065
33	0.00035	0.00035	0.00033	0.00032	0.00031	0.00082	0.00080	0.00067	0.00063	0.00057
34	0.00033	0.00038	0.00035	0.00037	0.00037	0.00079	0.00085	0.00079	0.00081	0.00081
35	0.00048	0.00036	0.00039	0.00034	0.00032	0.00096	0.00086	0.00082	0.00075	0.00069
36	0.00053	0.00049	0.00040	0.00035	0.00030	0.00104	0.00093	0.00085	0.00077	0.00069
37	0.00059	0.00052	0.00039	0.00032	0.00026	0.00099	0.00094	0.00091	0.00087	0.00083
38	0.00057	0.00052	0.00052	0.00049	0.00047	0.00122	0.00119	0.00093	0.00085	0.00074

39	0.00071	0.00068	0.00058	0.00053	0.00047	0.00131	0.00125	0.00105	0.00097	0.00087
40	0.00077	0.00063	0.00058	0.00050	0.00044	0.00156	0.00129	0.00125	0.00109	0.00097
41	0.00079	0.00078	0.00064	0.00058	0.00052	0.00173	0.00138	0.00136	0.00116	0.00103
42	0.00106	0.00089	0.00084	0.00074	0.00067	0.00194	0.00163	0.00148	0.00128	0.00112
43	0.00116	0.00089	0.00086	0.00073	0.00064	0.00221	0.00182	0.00165	0.00141	0.00121
44	0.00131	0.00112	0.00103	0.00091	0.00081	0.00251	0.00199	0.00175	0.00144	0.00120
45	0.00145	0.00114	0.00104	0.00087	0.00075	0.00272	0.00230	0.00207	0.00179	0.00156
46	0.00164	0.00135	0.00125	0.00108	0.00095	0.00315	0.00244	0.00214	0.00173	0.00143
47	0.00182	0.00163	0.00136	0.00117	0.00102	0.00350	0.00300	0.00250	0.00213	0.00180
48	0.00202	0.00180	0.00153	0.00133	0.00116	0.00392	0.00315	0.00272	0.00225	0.00187
49	0.00233	0.00206	0.00174	0.00150	0.00130	0.00429	0.00369	0.00310	0.00266	0.00226
50	0.00238	0.00225	0.00198	0.00181	0.00165	0.00472	0.00398	0.00355	0.00306	0.00265
51	0.00250	0.00242	0.00219	0.00205	0.00192	0.00519	0.00488	0.00381	0.00340	0.00292
52	0.00283	0.00282	0.00246	0.00230	0.00214	0.00572	0.00503	0.00449	0.00398	0.00353
53	0.00311	0.00298	0.00270	0.00252	0.00234	0.00608	0.00561	0.00497	0.00454	0.00411
54	0.00333	0.00314	0.00303	0.00288	0.00276	0.00683	0.00645	0.00554	0.00509	0.00459
55	0.00379	0.00355	0.00332	0.00310	0.00291	0.00732	0.00685	0.00630	0.00588	0.00545
56	0.00389	0.00376	0.00360	0.00346	0.00333	0.00803	0.00762	0.00684	0.00639	0.00590
57	0.00439	0.00399	0.00395	0.00372	0.00355	0.00840	0.00815	0.00755	0.00723	0.00686
58	0.00459	0.00433	0.00440	0.00429	0.00422	0.00926	0.00891	0.00846	0.00812	0.00776
59	0.00494	0.00448	0.00467	0.00450	0.00441	0.00961	0.00956	0.00945	0.00938	0.00931
60	0.00572	0.00533	0.00533	0.00512	0.00497	0.01091	0.01051	0.01022	0.00988	0.00956
61	0.00601	0.00584	0.00576	0.00563	0.00552	0.01186	0.01116	0.01108	0.01061	0.01025
62	0.00640	0.00627	0.00610	0.00595	0.00581	0.01292	0.01201	0.01215	0.01160	0.01124
63	0.00680	0.00677	0.00660	0.00651	0.00641	0.01402	0.01335	0.01340	0.01298	0.01268
64	0.00681	0.00717	0.00734	0.00764	0.00791	0.01469	0.01408	0.01433	0.01400	0.01381
65	0.00767	0.00804	0.00803	0.00824	0.00841	0.01700	0.01554	0.01546	0.01453	0.01384
66	0.00841	0.00870	0.00882	0.00905	0.00925	0.01785	0.01724	0.01633	0.01570	0.01502
67	0.00943	0.00888	0.00998	0.01018	0.01056	0.01947	0.01801	0.01800	0.01707	0.01640
68	0.01034	0.01003	0.01040	0.01039	0.01046	0.02164	0.01964	0.01930	0.01798	0.01697
69	0.01200	0.01025	0.01097	0.01034	0.01002	0.02385	0.02075	0.02068	0.01880	0.01749
70	0.01353	0.01192	0.01267	0.01212	0.01185	0.02715	0.02356	0.02343	0.02125	0.01971
71	0.01489	0.01299	0.01387	0.01322	0.01291	0.02932	0.02528	0.02491	0.02244	0.02065
72	0.01672	0.01424	0.01430	0.01307	0.01222	0.03229	0.02718	0.02616	0.02302	0.02069
73	0.01884	0.01641	0.01628	0.01499	0.01406	0.03566	0.03077	0.02931	0.02614	0.02368
74	0.02125	0.01851	0.01685	0.01491	0.01336	0.03972	0.03433	0.03088	0.02711	0.02390
75	0.02392	0.02241	0.01977	0.01797	0.01634	0.04448	0.03862	0.03532	0.03126	0.02785
76	0.02756	0.02452	0.02229	0.01994	0.01802	0.04920	0.04191	0.03831	0.03347	0.02951
77	0.03064	0.02839	0.02483	0.02234	0.02012	0.05426	0.04703	0.04171	0.03654	0.03204
78	0.03500	0.03256	0.02887	0.02620	0.02382	0.05817	0.05422	0.04688	0.04281	0.03847
79	0.04026	0.03704	0.03329	0.03021	0.02753	0.06448	0.06077	0.05250	0.04830	0.04363
80	0.04663	0.04193	0.03999	0.03681	0.03429	0.07167	0.06638	0.06170	0.05732	0.05319
81	0.05261	0.04843	0.04434	0.04060	0.03737	0.07931	0.07518	0.06698	0.06242	0.05741
82	0.05970	0.05515	0.05223	0.04866	0.04568	0.08935	0.08159	0.07683	0.07097	0.06580
83	0.06978	0.06419	0.05993	0.05534	0.05146	0.10022	0.09007	0.08683	0.07990	0.07431
84	0.07729	0.07327	0.06968	0.06602	0.06281	0.11115	0.10177	0.09792	0.09119	0.08555
85	0.09726	0.08437	0.07975	0.07161	0.06535	0.13312	0.11265	0.11072	0.09838	0.08958
86	0.08989	0.09595	0.09181	0.09339	0.09381	0.11997	0.12544	0.12432	0.12780	0.13017
87	0.11005	0.10841	0.10415	0.10135	0.09855	0.14568	0.14075	0.13494	0.13018	0.12531
88	0.13109	0.12398	0.11839	0.11225	0.10692	0.16500	0.15714	0.15111	0.14451	0.13829
89	0.13789	0.13812	0.13692	0.13650	0.13596	0.17591	0.17063	0.16480	0.15979	0.15469
90	0.16784	0.16758	0.15782	0.15336	0.14841	0.20614	0.20213	0.18654	0.17972	0.17109
91	0.17795	0.15445	0.17304	0.16812	0.16810	0.22092	0.18962	0.20835	0.19324	0.18714
92	0.19857	0.18950	0.19254	0.18881	0.18663	0.23307	0.22947	0.22603	0.22266	0.21927
93	0.21373	0.22091	0.21516	0.21663	0.21666	0.25832	0.25577	0.24788	0.24392	0.23900
94	0.23490	0.22838	0.23291	0.23126	0.23089	0.27042	0.26746	0.26899	0.26744	0.26668
95	0.25928	0.25787	0.25939	0.25925	0.25944	0.29802	0.28998	0.28965	0.28423	0.28013
96	0.28215	0.28164	0.28414	0.28501	0.28614	0.31912	0.31151	0.31207	0.30720	0.30371
97	0.30545	0.30593	0.30954	0.31149	0.31365	0.34031	0.33337	0.33478	0.33058	0.32780
98	0.32906	0.33054	0.33510	0.33811	0.34127	0.36140	0.35510	0.35743	0.35386	0.35179
99	0.35281	0.35523	0.36069	0.36470	0.36878	0.38240	0.37675	0.37982	0.37693	0.37556
100	0.37624	0.37963	0.38596	0.39096	0.39598	0.40290	0.39790	0.40180	0.39963	0.39901
101	0.39928	0.40351	0.41067	0.41657	0.42244	0.42283	0.41861	0.42325	0.42177	0.42188

102	0.42165	0.42662	0.43451	0.44117	0.44777	0.44215	0.43870	0.44384	0.44303	0.44378
103	0.44320	0.44888	0.45719	0.46452	0.47170	0.46071	0.45786	0.46356	0.46331	0.46464
104	0.46376	0.47000	0.47868	0.48652	0.49416	0.47838	0.47617	0.48225	0.48251	0.48433
105	0.48327	0.48984	0.49871	0.50684	0.51474	0.49507	0.49342	0.49986	0.50072	0.50306
106	0.50159	0.50844	0.51731	0.52555	0.53354	0.51074	0.50972	0.51622	0.51751	0.52020
107	0.51859	0.52558	0.53442	0.54276	0.55081	0.52539	0.52488	0.53148	0.53309	0.53608
	0.53424	0.54135	0.54995	0.55817	0.56611	0.53907	0.53889	0.54561	0.54747	0.55068
109	0.54868	0.55569	0.56408	0.57216	0.57994	0.55167	0.55187	0.55853	0.56060	0.56395
110+	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000