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Bellagos

Social Long-Term Care Analysis

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Table of Contents

Executive Summary

20 years ago, the government of Bellagos introduced the Social LTC Insurance Act, which is a public insurance program that aided citizens in need of Long-Term Care. The country has experienced a demographic shift in recent years. which has resulted in public pressure to analyze and update the current design of the system. J-PALM Risk Consultants have been one of many firms tasked with this problem and have concluded that in its current state, the Social LTC Program is not sustainable and will only continue being solvent until 2020.

To assess the sustainability of the LTC program, we used the balance sheet approach, in which we analyzed the revenues (tax contributions) and expenses (care benefits and administrative) over the 10-year period. We chose the balance sheet method based on the system's pay-as-you-go characteristics that resemble the Canadian Pension Plan[1]. We define the program as sustainable if the net balance, total revenues less total expenses, from 2018-2028 is positive.

Our solution for the sustainability of the program is a multifaceted approach that involves altering the current tax system to a two-part progressive structure based on income levels and adjusting the tax rates for these income brackets. Further, we also recommend doubling the childless tax rate for both income brackets. The final change is increasing the required minimum number of annual credits paid into the system from two years to five years.

1. Billing, A., & Menard, J. (2013). Actuarial balance sheets as a tool to assess the sustainability of social security pension systems.

For the remainder of the report, we will address the sustainability of the current program, explain how our model was built, provide recommendations and their respective trade-offs, and conclude with data limitations.

Sustainability Assessment

In order to assess the current sustainability of the LTC system, we needed to create a model that could calculate and project forward total expenses and revenues for the next 10 years. We then identified any point(s) in time where the program's reserve fund became fully depleted. Based on our balance sheet approach, if this occurred, we deemed the current standing of the LTC program as not sustainable, needing to be altered to continue operating.

To build our model we first divided the major components of revenues, expenses, mortality, and population. Each component was developed from information provided to us through the Household data, forecasted out to 2028, and then tested under sensitivity scenarios.

Population Forecast

We began our sustainability analysis by forecasting the Bellagos population since the balance sheet method is heavily reliant on the population through the tax contribution volume and the scale of care benefits. To model population changes each year, we used five-year age groups to assess the impact of fertility and mortality. The only exceptions to our five-year groups were our minimum and maximum ages, 0 and 110, respectively. This was done since the zero-age group allows for adjusting the newborn population, and the 110-age has a 100% mortality rate. We assumed a fertility of 1.37 births per woman (ages 16-45) for each year to calculate the number of newborns (age group 0) entering the population. These groups provided a credible number of individuals in each group, even after splitting the groups by gender.

Our population forecast began by observing any trends in the mortality rates. We compared the overall trends from five-year spans and the total ten-year spans while differentiating them by gender. From these different trends, we determined an average yearly change for each age group. This resulted in a 1% yearly improvement in female mortality, a 1.7% improvement in male mortality and a 1.28% average independent of gender. Upon further research, we discovered a study that concluded the mortality rates would improve by at least 1% every year and a maximum of 1.3%[2]. This finding supports our overall projection because it falls within the range of potential rates.

After forecasting mortality, we projected the change in population demographics over the next ten years. Over this period the population distribution shifts to the right, dramatically increasing the median age from 38 years old in 2018 to 44 years old in 2028. We project population to increase 0.62%, or roughly 500,000, with the male population decreasing 300,000 and female population increasing 800,000. Population increases most rapidly during the first five years and decreases in growth the remaining years with almost flat growth over the last two years.

[2] Penn Wharton Business Model. (2016, June 27). Mortality in the United States: Past, Present, and Future. Retrieved April 04, 2018, from http://budgetmodel.wharton.upenn.edu/issues/2016/1/25/mortality-in-the-united-states-past-present-and-future

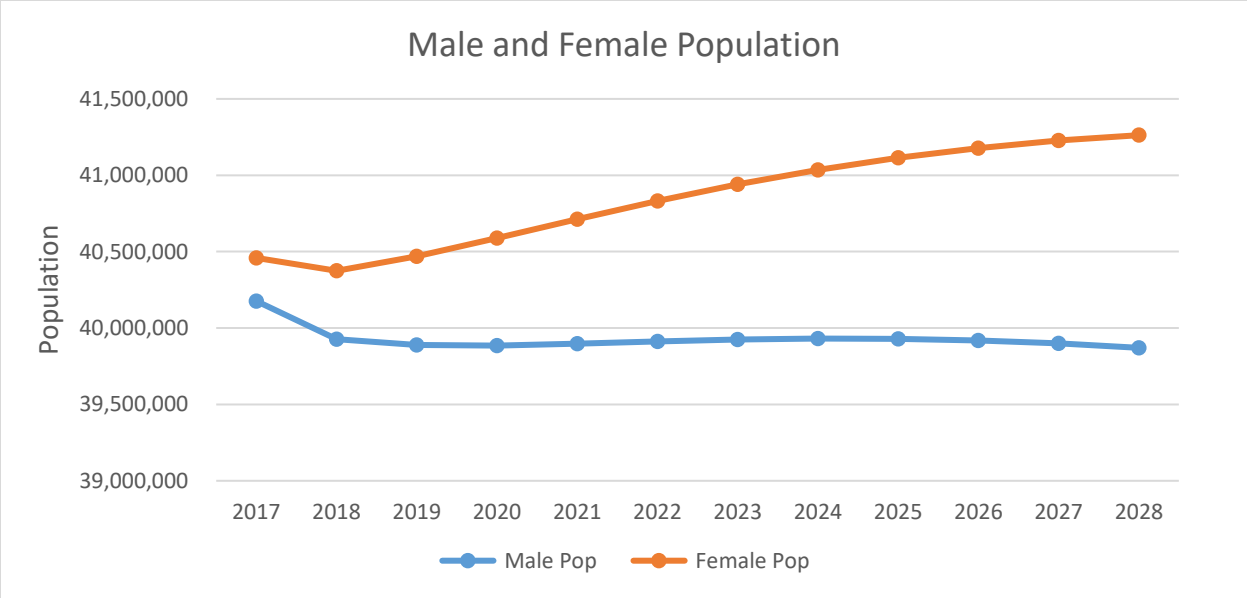

Figure 1: Male and female population projections through 2028

The decrease in male population is caused by many deaths of people over the age of 110 in the first year, as well as an aging population that is not being adequately replenished by younger males; note that the population of Bellagos is weighted more towards females, which would cause the increase in female populations over time.

Revenue Forecast

By using the same age grouping as the population, we examined how the total tax contributions for the program changed as the population changed. We were able to do this by establishing an average taxable income per person in each group and multiplying this by the number of individuals in each group over time to capture the total taxable income each year. Finally, we incorporated an economic factor multiplier to adjust the total taxable income in each group as wage growth and unemployment change the underlying average taxable income per individual assumption. We assumed constant real wage growth of 1%, constant inflation of 1.4%, and on average, unemployment of 4.4%; these are the values

from 2017. With the limited data economic provided, we felt the 2017 economic values were our best estimates for the next ten years. Overall, this process allowed us to forecast the LTC program's revenues through 2028 as the Bellagos' population changes.

We calculated revenue from taxes to be 34.5 billion in 2017 with 89% of the funding coming from the 0.9% standard income tax. Over the next 10 years, revenue increases 1.3 billion each year, totaling 47.5 billion in 2028 with roughly the same contribution percentage split between the standard income and childless tax.

Expenses Forecast

The first step of calculating expenses was to calculate the number of people in care during the year 2017 from the household data sample we were given. We found that approximately 67% was receiving home care and the remaining 33% in facilities. These percentages were used as weights to build our initial population of people in care. To project out to 2028, we used the care level transition matrix in conjunction with our population model to account for all changes throughout the years.

To project the shift in the number of people in each care level, we accounted for the net transfers of people in and out of each age group care level. This includes deaths, number of people transitioning to the next age group, people transitioning to different care levels, and people transferring into that specific care level. Our model projected a 3,850,000 increase for people in home care and only an 82,000 increase in facility care over the next ten years. This smaller increase for facility care is partly due to the fact that the people in facility care are older; since the mortality rate for people in care is three times the general population, anybody over the age of 96 is assumed to be deceased in 2018.

After projecting the population changes for home and facility care, we were then able to forecast our expenses, increasing the average benefits linearly until they reached the stated maximums, while also accounting for inflation. We calculated the total expenses, including home, facility, and administrative expenses for 2017 as ฿26.72 billion, which matches the total expenses that are recorded in the Historical Data for 2017. We project that home care costs will increase ฿26.78 billion over the ten years, while facility care costs will increase ฿2.65 billion. Administrative expenses were forecasted by creating a simple linear regression from historical data, bringing the total change in all expenses to ฿32.10 billion.

Sustainability Summary

Shown in Figure 2, we can see that we are only solvent until 2020, with expenses increasing at a faster rate than revenues. We start at a net of ฿6.6 billion for 2017, and by 2028, we have a negative net of -฿14.5 billion, so this system is not sustainable in the long term.

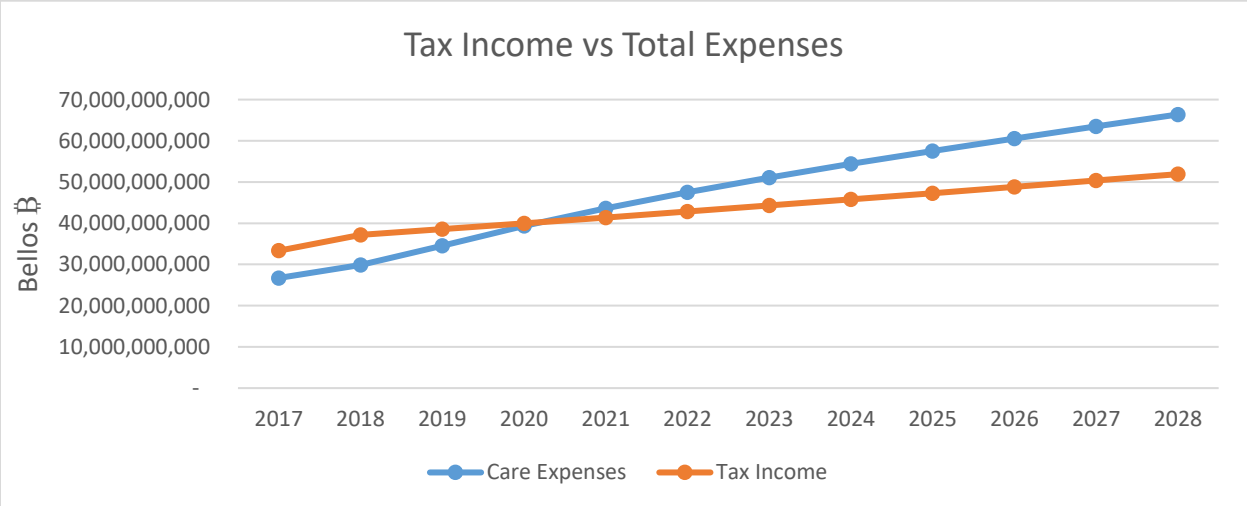

Figure 2: Graph of total expenses vs. expected income from taxes in each year

Solutions

As a result of our findings, we are recommending changes in the three following areas: tax rates, annual credit requirements, and the informal caregiver program. We recommend that Bellagos changes its current tax schedule to a new two-part progressive schedule seen below:

Tax type	Marginal Rate for Income below ฿75,000	Marginal Rate for Income above ฿75,000
Standard Income Tax	0.8%	1.05%
Childless Employee Income Tax	0.3%	0.3%

Figure 3: Proposed Tax Rate

For annual credit requirements, we recommend that Bellagos increase the requirement to five years of credits. By doing this, we would reduce the care expenses by nearly 10%. Finally, we recommend an increase in the funding of the informal care program as a means of encouraging informal care and reducing the amount of care expense incurred by the government[3]. In addition, we recommend that Bellagos keep their surplus revenue and reinvest it in risk-free investments. We are assuming that this was not being done prior to this study being conducted.

[3] AARP. (2015, June). Caregiving in the U.S. Retrieved from https://www.aarp.org/content/dam/aarp/ppi/2015/caregiving-in-the-united-states-2015-report-revised.pdf

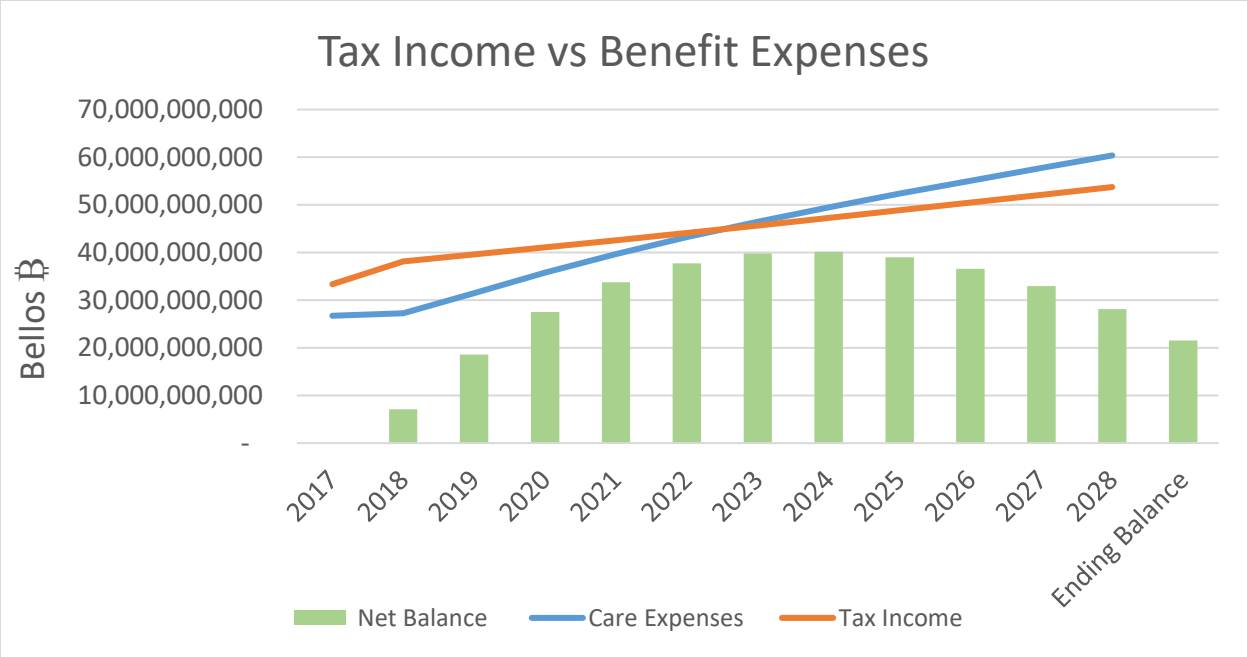

Figure 4: Recommendation Results

Sensitivity Tests

As a means of ensuring our recommendations would stand up to changes to our assumptions, we performed a variety of sensitivity tests. The main assumptions we tested were fertility rate, unemployment rate, nominal wage growth, and mortality. For fertility rate, we tested rates that were consistent with other developed regions. We used North America's fertility rate of 1.9 and Europe's average fertility rate of 1.64. We modeled employment as constant. In order to test this assumption, we used a linear rise of .3% yearly in unemployment. We kept nominal wage growth constant at 2.6% because the U.S. has experienced a similar nominal wage growth and the average nominal wage growth for Bellagos averaged out to be 2.7%[5]. Although we kept the nominal wage growth the same,

[4] United Nations. (2015). World Fertility Patterns 2015. Retrieved from http://www.un.org/en/development/desa/population/publications/pdf/fertility/world-fertility-patterns-2015.pdf

[5] Economic Policy Institute. (2018, March 9). Nominal Wage Tracker. Retrieved April 04, 2018, from https://www.epi.org/nominal-wage-tracker/

we changed the factors that made up the nominal wage growth to follow trends that were seen in the data we were given. As for mortality, we tested an increased improvement in mortality as well as constant mortality.

Tradeoffs

While we believe these recommendations are mathematically sound, there are tradeoffs for each of our recommendations. When considering tax increases we took into account the statistics we were given that said that a vast majority of people with income below ฿75,000 thought their contributions were too high. As a result, we tried to reduce the burden on this class of people. The tradeoff, however, is that those above that ฿75,000 thresholds may be unhappy with the extra tax imposed upon them. We also increased the childless tax as a means to encourage people to have more children to help create a larger tax base in the future. Furthermore, adults with children are less likely to need benefits to pay for professional support from careers outside the family[6]. Although we hope that it encourages people to have more children, we are aware that those who have grown children or those who do not want to have children may be upset that they will pay more in taxes than those with children. Overall, we believe that an increase in childless tax rate will increase the fertility rate while also decreasing the number of taxpayers paying the childless tax.

Additionally, our recommendation to increase contribution requirements may upset those who do not meet the requirements as they will be unable to benefit from the LTC

[6] Foresight Future of an Ageing Population - International Case Studies. (2016, January). Retrieved from http://www.cpa.org.uk/information/reviews/CPA-International-Case-Study-8-Long-term-care-insurance-in-Germany.pdf

program. The tradeoff for the informal care program and the reinvestment of surplus revenues is that the government would have fewer funds to allocate to other areas of operation.

Data Limitations

Household Data

The household sample information that was given to us played a crucial role in creating and forecasting our model. However, we did have an issue in the information given, namely that ~14.5% of the population above age 65 that was in need of long-term care assistance did not have the minimum requirement of paying at least two years into the program. Based on the model we built, our expenses for 2017 matched the historical data expenses. This led us to believe that the historical data reported by the government has already accounted for this subset of the population. Yet, we are unable to verify whether or not this is true based on the information given.

Historical Information

Angela Cortez has supplied us with an annual historical data sheet, providing data from 2013 to 2017 that contained relevant economic, program-specific, and country demographic information. The provided sheet was used extensively in building our model and projecting forward. Many of the economic measures were difficult to forecast forward; with the data provided, linear regression models created unintuitive results. Therefore, we decided to carry forward the most recent measurement throughout the next 10 years constant but understand that these measures are subject to change. The following measures were included in this data limitation: short-term interest rates, unemployment, real-wage growth, and inflation. Because of this, we included our sensitivity test to determine if our assumptions were reasonable and that our recommendations could withstand different environments.

Transition Matrix

The given Care Level Transition Matrix was instrumental in forecasting how population within each care level was changing. We were not able to use the matrix to distinguish between whether a citizen was in-home care or facility care. We calculated percentages from the household data and used those as weights for their respective care type. We had hoped that a matrix specific to each type of care could have been given as it seems reasonable that one may have higher/lower forces of transition between states.

Mortality Measures

Mortality was given to us as increments of 5 years from 2005. Our projected mortality rates were based off a calculated annual average. We believe that having yearly changes would have produced more accurate factors to increase our annual change. We did include mortality in our sensitivity test to identify if it was detrimental to our solution.

Works Cited

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Appendix

Mortality Factors

Annual Mortality Change

Age Group	Female	Male
0	0.9938	0.9780
1-5	0.9978	0.9799
6-10	0.9560	0.9755
11-15	1.0195	0.9702
16-20	0.9948	0.9568
21-25	0.9651	0.9693
26-30	1.0033	0.9727
31-35	0.9957	0.9918
36-40	0.9753	0.9807
41-45	0.9747	0.9720
46-50	0.9742	0.9667
51-55	0.9874	0.9782
56-60	0.9932	0.9913
61-65	1.0000	0.9942
66-70	0.9997	0.9889
71-75	0.9847	0.9794
76-80	0.9811	0.9786
81-85	0.9850	0.9848
86-90	0.9960	0.9942
91-95	0.9992	0.9970
96-100	1.0017	0.9988
101-105	1.0031	1.0006
106-109	1.0029	1.0012
110+	1.0000	1.0000

Stress Testing

Changes	Percent increase or decrease
Constant Mortality	78.73%
2x Expected Decrease	-75.23%
Fertility= 1.19	-0.12%
Fertility= 1.6 (Europe)	0.15%
Fertility= 1.9 (North America)	0.34%
Nominal wage growth(RWG=.6%, Inflatio=2%)	-125.43%
Nominal wage growth(RWG=1.3%, inflation=1.3%)	-14.13%
Nominal wage growth(RWG=1%, Inflation=1.6%)	-61.18%
Employment Factor: -.3% yrly avg	-48.46%

Care Distribution for 2017

Female									
Beg Age	**End Age**	**% HC 1**	**% HC 2**	**% HC 3**	**% HC 4**	**% FC 1**	**% FC 2**	**% FC 3**	**% FC 4**
	65	4.35%	2.94%	4.76%	7.14%	0.00%	0.00%	0.00%	3.03%
66	70	33.04%	20.59%	33.33%	7.14%	0.00%	0.00%	0.00%	20.20%
71	75	20.00%	26.47%	23.81%	14.29%	0.00%	0.00%	12.50%	24.24%
76	80	18.26%	25.00%	14.29%	28.57%	0.00%	50.00%	37.50%	28.28%
81	85	8.70%	16.18%	23.81%	21.43%	0.00%	50.00%	37.50%	9.09%
86	90	6.09%	5.88%	0.00%	7.14%	0.00%	0.00%	12.50%	4.04%
91	95	2.61%	1.47%	0.00%	7.14%	0.00%	0.00%	0.00%	2.02%
96	100	3.48%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.04%
101	105	0.00%	1.47%	0.00%	0.00%	0.00%	0.00%	0.00%	3.03%
106	109	2.61%	0.00%	0.00%	7.14%	0.00%	0.00%	0.00%	0.00%
>	109	0.87%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.02%
		100.00%	**100.00%**	**100.00%**	**100.00%**	**0.00%**	**100.00%**	**100.00%**	**100.00%**

Male									
Beg Age	**End Age**	**% HC 1**	**% HC 2**	**% HC 3**	**% HC 4**	**% FC 1**	**% FC 2**	**% FC 3**	**% FC 4**
	65	4.65%	4.23%	0.00%	0.00%	0.00%	0.00%	7.14%	5.43%
66	70	23.26%	21.13%	33.33%	40.00%	0.00%	33.33%	42.86%	23.91%
71	75	21.71%	23.94%	16.67%	40.00%	0.00%	33.33%	0.00%	22.83%
76	80	18.60%	16.90%	29.17%	0.00%	50.00%	0.00%	7.14%	15.22%
81	85	11.63%	11.27%	4.17%	10.00%	50.00%	0.00%	21.43%	11.96%
86	90	5.43%	4.23%	8.33%	10.00%	0.00%	33.33%	7.14%	4.35%
91	95	2.33%	1.41%	0.00%	0.00%	0.00%	0.00%	7.14%	4.35%
96	100	1.55%	7.04%	4.17%	0.00%	0.00%	0.00%	0.00%	3.26%
101	105	3.88%	1.41%	4.17%	0.00%	0.00%	0.00%	7.14%	4.35%
106	109	4.65%	1.41%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%
>	109	2.33%	7.04%	0.00%	0.00%	0.00%	0.00%	0.00%	2.17%
		100.00%	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**