

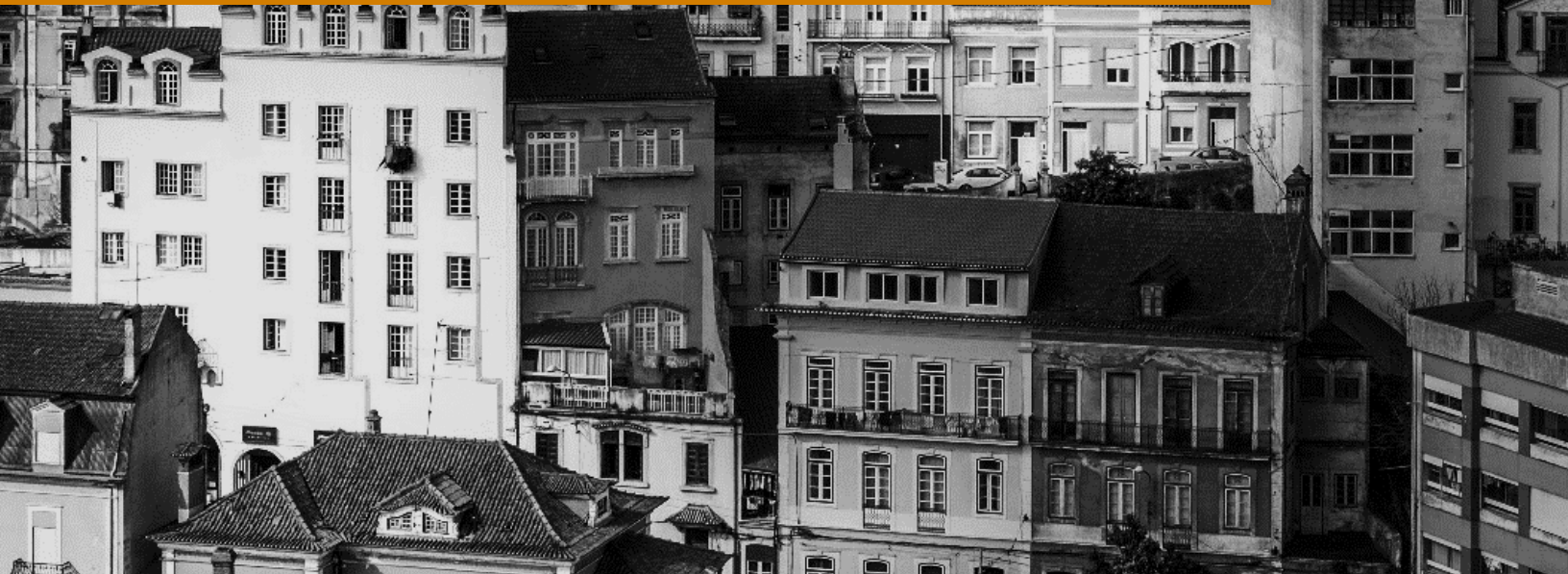


BELLAGOS

LTC SOCIAL INSURANCE SYSTEM ANALYSIS 2018

ACE
Actuarial Consulting Enterprise

SOA 2018 Student Research Study Challenge





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1. EXECUTIVE SUMMARY

This report discusses the sustainability of the Social Long-Term Care (LTC) Insurance Program of the developed nation of Bellagos and includes the analysis methodology, sustainability assessment, recommendations, and data limitations.

According to the results obtained, Bellagos's current LTC system is not sustainable as the overall expenses will outgrow the contributions to the program within ten years.

This report presents three alternative scenarios that address the sustainability of the system. The first alternative describes a gradual increase in taxes. The second suggests an increase in the age that Bellagos citizens start being able to enter the LTC program. The final alternative is to decrease the maximum monthly payout and increase taxes.

2. ANALYSIS METHODOLOGY

2.1 PURPOSE AND BACKGROUND

ACE (Actuarial Consulting Enterprise) was hired by the Bellagos Risk Management Commission (BRMC) and has conducted an evidence-based analysis of the financial sustainability of the Social LTC Insurance Program for the next ten years. The research and recommended policy changes to address the future needs of Bellagos citizens will be discussed in this report.

Bellagos is a stable, developed nation with a relatively large population. Generally, the population of Bellagos can be roughly compared to that of Germany (*The World Bank, 2018*). The majority of Bellagos citizens in need of long-term care rely on the Social LTC Insurance Act that was introduced in March of 1998. Due to demographic shifts, economic growth, and other factors since then, it is necessary to evaluate and revise the current LTC insurance program to adequately meet the needs of Bellagos citizens throughout the next decade and beyond.

2.2 ENVIRONMENT ANALYSIS

2.2.1 DEMOGRAPHIC ANALYSIS

ACE recreated the entire population of Bellagos based on the 2017 Bellagos Census. Individuals are grouped by age and gender, and the probabilities of incidence in the sample are considered representative of the entire population of 80.6 million.

The Demographic Pyramid (Figure 1) shows a high concentration of seniors. As a matter of fact, the population younger than 25 represents 26% of the whole while 25% are seniors over 55 years old, meaning there may not be enough contributors to support the beneficiaries in the future of this pay-as-you-go system. This tendency may be difficult to reverse given the country's fertility rates, which dropped from 1.98 in 2013 to 1.37 in 2017, nearly classifying Bellagos's fertility rate as "very low¹" and contributing to the aging of the overall population.

2017 Demographic Pyramid of Bellagos

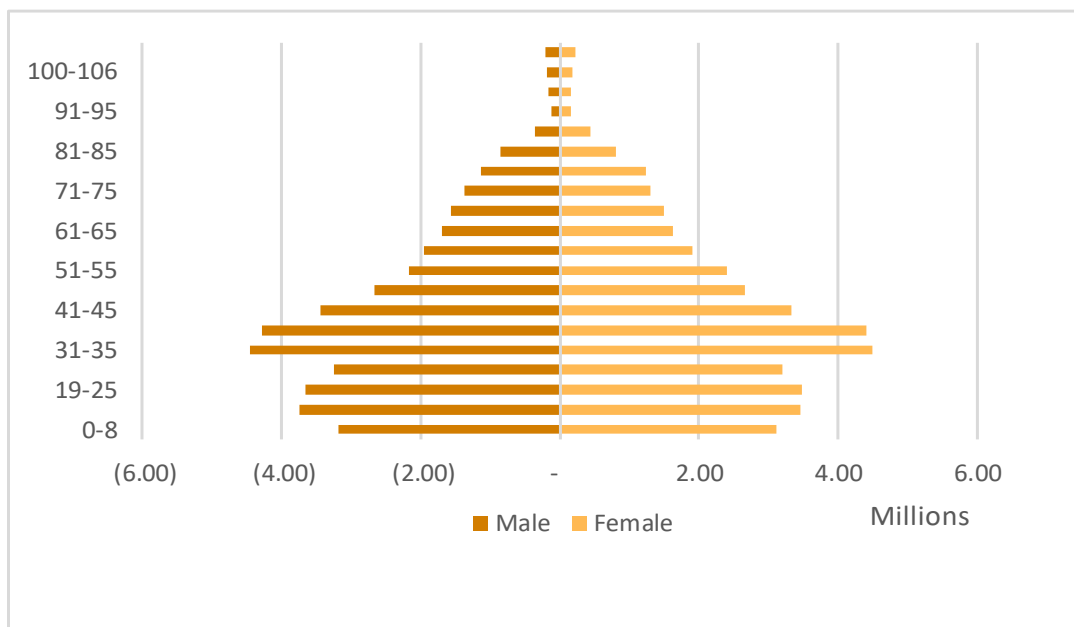


Figure 1: Estimated population structure of Bellagos
 Source: 2017 Bellagos Census and ACE analysis

2.2. MACROECONOMIC ANALYSIS

The overall economy of Bellagos has declined over the past five years: the GDP shows lower economic growth rates between 2013 and 2017. Moreover, the average basic living

¹ Total Fertility Rate (TFR) is a common measure of fertility which defines the average number of children a woman would have during her reproductive life if she lives her childbearing years subject to an age-specific fertility rate. A TFR of 2.1 is considered the replacement fertility rate while a TFR of 1.3, a very low fertility rate, indicates a decline of population. (*United Nations*).

expenses per citizen jumped from ₱839.34 per month in 2013 to ₱892.22 per month in 2017, the real wage growth rate has slowed down, and the unemployment rate grew modestly from 3.3% in 2013 to 4.4% in 2017. Consequently, the declining economy may affect the program's long-term sustainability.

2.3. ASSUMPTIONS

To develop the analysis, the following assumptions are made:

2.3.1 INFLATION RATE

The inflation rate for the next ten years is assumed to be 0.08%, based on a weighted average of the last five years. The inflation rates of the most recent two years, 2016 and 2017, are given a weight of 70% and the previous three years a weight of 30% because the inflation rate is expected to more closely resemble recent years.

Inflation Rate from 2013 to 2017

	2013	2014	2015	2016	2017
Inflation Rate	0.230%	0.480%	0.530%	0.910%	1.020%

Figure 2: Observed data of the Inflation Rate from 2013 to 2017.
Source: Bellagos Government

2.3.2 TAX-PAYERS

From the 2017 Bellagos Census, 90.6% of the individuals over 18 received an income eligible to pay taxes, the source of funding of the LTC system. This percentage is assumed to remain constant over the next ten years because there is no information to suggest otherwise.

2.3.3 PAYOUTS

The average percentage growth of inflation-adjusted payouts over the last five years was evaluated based on historical data (Figure 3). Because of the consistency of the data, the real payout average of 5.3% is used as the annual increase of the average payout per beneficiary, at all levels for the next ten years. This implies a nominal expenditure growth of 6.1%. This rate of increment is applied to project future payments, starting with the levels registered in 2017 (Figure 4).

Yearly Percentage Growth of Payouts (Inflation-Adjusted)

	Care Level	2014	2015	2016	2017	Average
Home Care	1	5.4%	5.7%	6.0%	4.1%	5.3%
	2	5.8%	5.1%	4.8%	5.4%	5.3%
	3	5.7%	5.1%	4.8%	5.4%	5.2%
	4	5.8%	5.1%	4.8%	5.4%	5.3%
Facility Care	1	5.7%	5.1%	4.8%	5.4%	5.2%
	2	5.8%	5.1%	4.8%	5.4%	5.3%
	3	5.8%	5.2%	4.8%	5.4%	5.3%
	4	5.7%	5.1%	4.8%	5.4%	5.2%
Real Payouts Average:						5.3%

Figure 3: Analysis of the evolution of the LTC payouts.

Source: Bellagos Government and ACE analysis

Monthly Payout Average

Level	Home	Facility
1	221.9	1006.2
2	413.6	1201.9
3	607.7	1398.7
4	902.5	1626.6

Figure 4: Registered payouts in 2017 (in Bellos)

Source: Bellagos Government

The government's current payment limit will be assumed to grow by inflation every year.

Maximum Monthly Payout

Care Level	Home Care	Facility Care
Level 1	235	1,023
Level 2	440	1,279
Level 3	700	1,432
Level 4	950	1,688

Figure 5: Maximum Monthly Payouts in 2017 (in Bellos)
Source: Bellagos Government

2.3.4 ADMINISTRATIVE EXPENSES

During the last five years the ratio between the administrative costs and the total expenditures was fairly constant around 10%. Therefore, it is assumed that the ratio remains the same for the next ten years.

2.3.5 PROBABILITY OF HAVING CHILDREN

Given that tax contributions in Bellagos are increased for childless individuals, the probability of having at least one minor dependent is critical to appropriately analyze the program's funding.

Probability of Having Children by Age

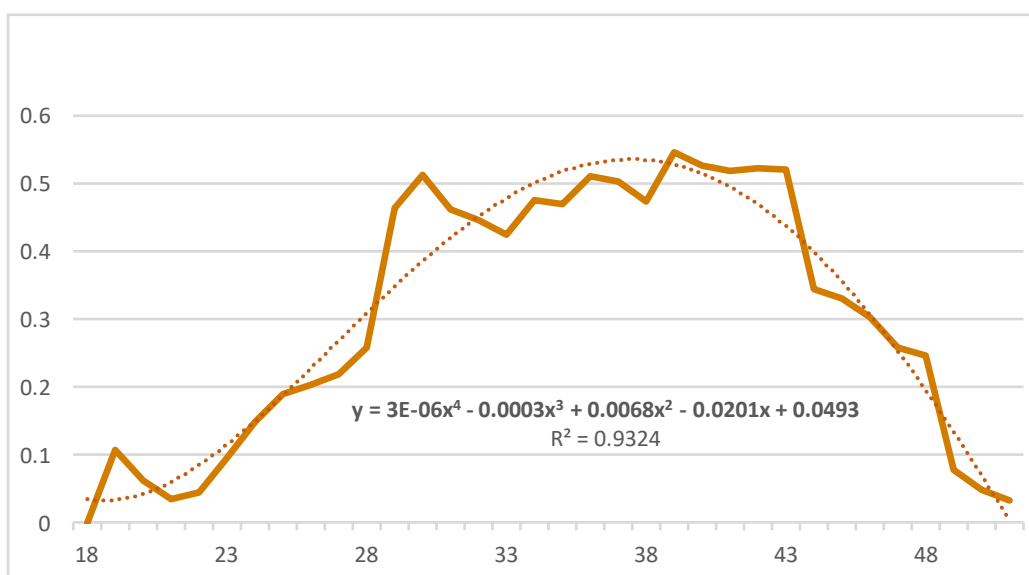


Figure 6: Analysis of the probability of Bellagos Citizens having children by age.
Source: 2017 Bellagos Census and ACE analysis

It is assumed that this probability, by age, follows a polynomial distribution of order four since it presents a good fit to the sample of observed data, with a coefficient of determination, R^2 , of 0.9.

2.3.6 PERCENTAGE OF INDIVIDUALS PER CARE LEVEL

To estimate the expected payments of the LTC system, it is necessary to determine the percentage of individuals in each care level that remain at home or in facilities. This is a calculated average proportion of home or facility beneficiaries per care level of the last five years, as seen in Figure 7.

Distribution of Individuals between Home and Facility

	Care Level 1	Care level 2	Care Level 3	Care Level 4
Home	99%	97%	65%	10%
Facility	1%	3%	35%	90%

Figure 7: Average Percentage of affiliates receiving treatment at home or in a facility per level from 2013 to 2017.

Source: Bellagos Government and ACE analysis

2.3.7 INCOME BY AGE

The population of Bellagos is divided into two groups in terms of income: individuals between 18 and 65 whose income increases with age, and seniors over 65 whose income decreases with age. Because of this difference in trend, the incomes of these groups are approximated with two different polynomials as shown in Figure 8 and Figure 9.

The trendline in the graphs is based on the income averages of the 2017 Bellagos Census, which are assumed to grow with inflation each year.

Income Working Ages

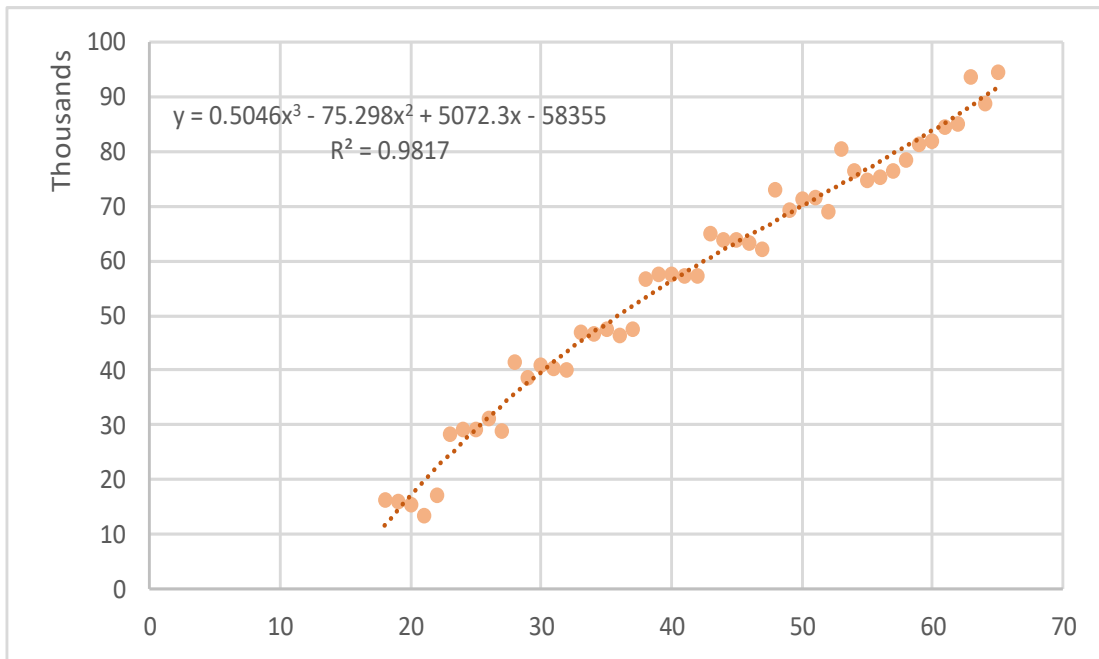


Figure 8: Fitted trendline of the income of individuals between 18 and 65 years old.
 Source:2017 Bellagos Census and ACE analysis

Income Retirement Ages

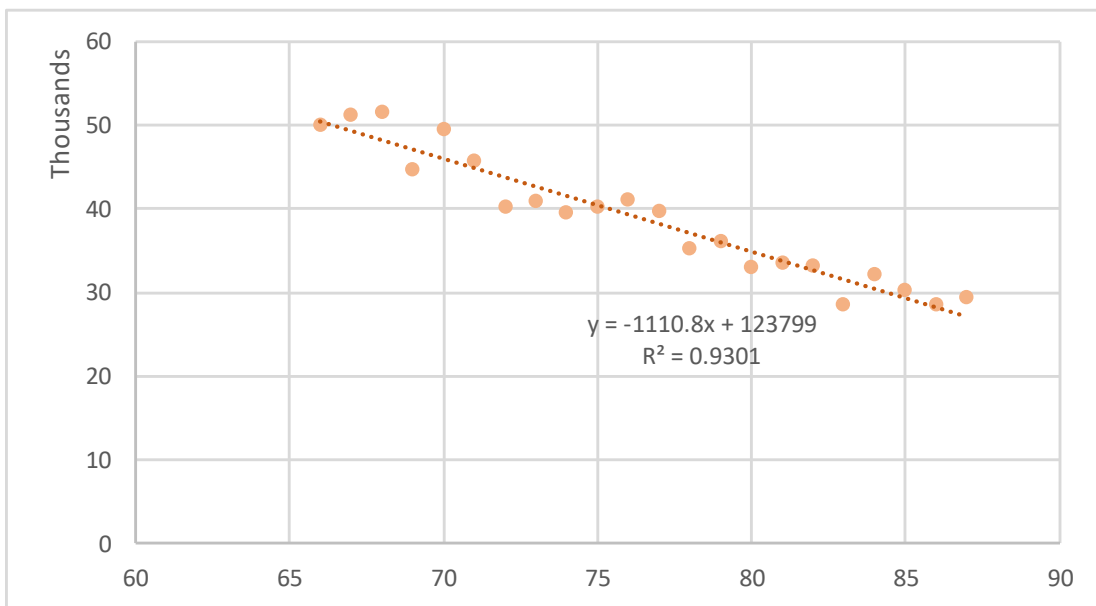


Figure 9: Fitted trendline of the income of individuals over 65 years old.
 Source:2017 Bellagos Census and ACE analysis

2.3.8 INFORMAL CARE PROGRAM

In 2016, the Bellagos government implemented a new program to incentivize home care due to national caregiver shortages. Since the effects of this new measure are undetermined but still expected to have an impact on the amount of people utilizing the informal care program, it is assumed that the percentage of the total population receiving home treatment will increase by 0.1 percentage points each year.

2.3.9 MORTALITY TABLE

The table of mortality from 2015, generated from the Bellagos Mortality and Population Reports, is used for the analysis since it contains the most updated information available. It is important to note that according to the information from the Bellagos government, the individuals under treatment in all levels are subject to a mortality three times higher than the one given in the table.

2.3.10 PRIVATE INSURANCE

The proportion of individuals with private insurance tends to be around 10% in the historical information provided. Hence, it is considered this same percentage for the next decade.

2.4. METHODOLOGY

According to International Actuarial Standards, the projections related to benefits like those provided by the Long-Term Care Insurance Program of Bellagos require not only financial and demographic assumptions previously addressed, but also probabilistic models to quantify the risks that affect the future payouts and resources of such social security systems. To

accomplish this, the population of Bellagos is projected for the next ten years using gender and age mortality patterns.

The basic formula used to project the general population of working taxpaying adults from ages 18 to 65 is given by:

$$P_{x,t} = P_{x,0} \times p_{x,t} \quad (1)$$

where

$P_{x,t}$ = number of lives aged x at time zero surviving the next t years

$P_{x,0}$ = number of lives aged x at the cut-off date

$p_{x,t}$ = probability of a life aged x at time zero² to survive the next t years

In the case of the population of seniors, 65 and older, the projection considers the probabilities of surviving and the probability of transition between the different levels of risk (healthy, level 1, level 2, level 3, and level 4). It is considered that individuals with private insurance, who require treatment, will go to a private facility, not exercising their right to use the public system despite paying taxes. Using this methodology, the projection of population includes the number of survivors per year and the details about how many of them are expected to be healthy or receive treatment at the different levels of care. The general formula in this case is given by:

$$P_{x,t}^i = \sum_j^{n_i} P_{x,t-1}^j \times p_{x+t-1,1}^j \times t_{j,i} \quad (2)$$

Where

$P_{x,t}^i$ = projected population out of the group of age x at time 0 expected to be in state i at time t

n_i = number of possible states from which a life can transition to state i

$p_{x,n}^j$ = probability of survival for the next n years for a life aged x that belongs to risk group j

$t_{j,i}$ = probability of transitioning from state j to state i

² Time zero is considered the year 2017.

Once the projected population is obtained for all age groups, the expected value of future contributions is obtained considering the income, age, proportion of tax-paying citizens per age group and probability of having children.

Moreover, the payouts of future payments associated to claims is estimated. For this calculation, the critical values include the expected number of individuals receiving treatment at every level every year, the expected cost per individual on each level, the probabilities of receiving treatment at home or facility with the respective differences in the costs, and the limits established for this payment depending on each risk group, adjusted every year by the long-term inflation. With these amounts, the administrative expenses are also estimated to be 10% of the payouts on health care bills.

There are more details about the methodology used in the Annex that will be provided as part of the deliverables.

3. SUSTAINABILITY ASSESSMENT

This section addresses the sustainability of the Bellagos LTC Social Insurance System for the next decade.

The analysis of the current state of the LTC system conducted by ACE (Figure 10) projects deficits starting in 2020 and substantiates that the program will not be able to address the future needs of the population. The negative gap between expenses and contributions goes from ₱630 million in 2020 to ₱9.1 billion in 2028.

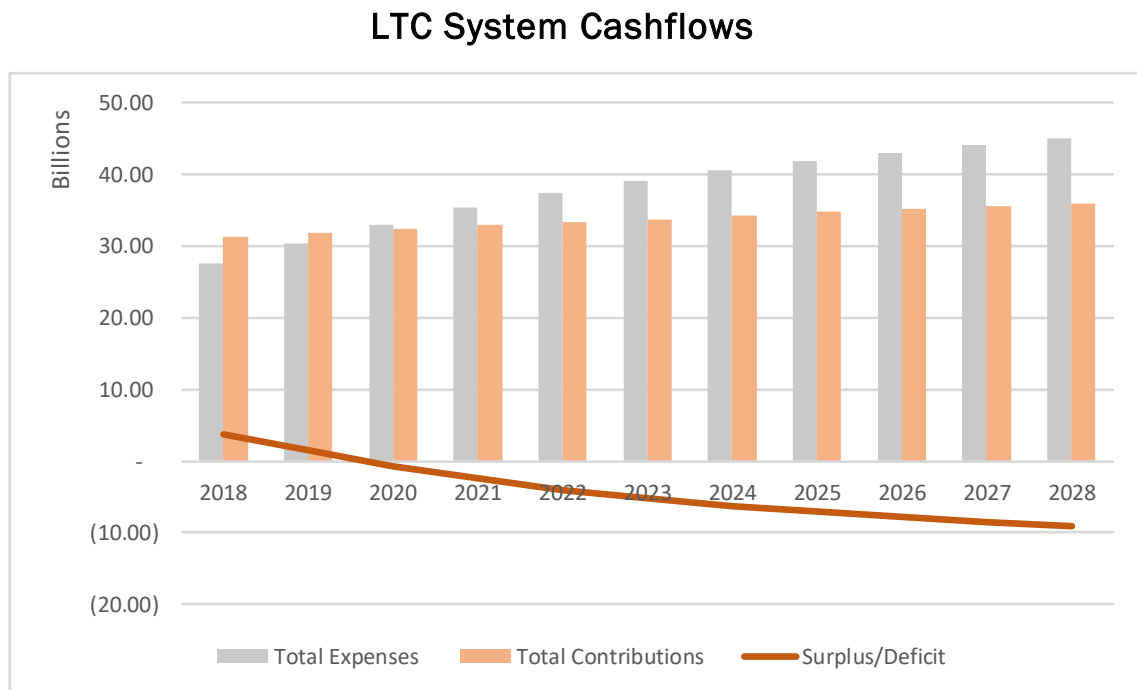
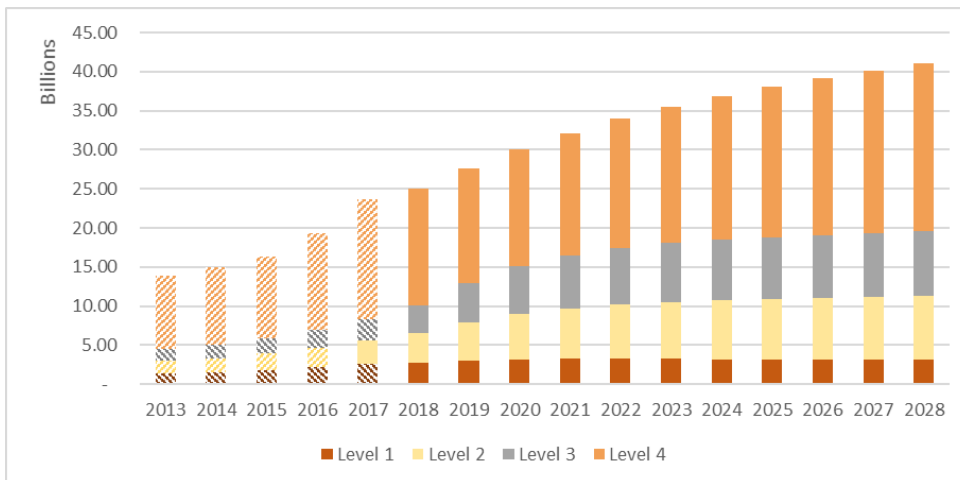


Figure 10: Projection of expenditures, contributions and surplus/deficits of the LTC program for the next decade (in bellos).

Source: Bellagos Government and ACE analysis

Tax contributions will increase an average of 1% each year for ten years. Meanwhile, health benefit costs will increase an average of 5% per year. The difference of costs between the care levels over the total expenses can be explained not only by the different health needs, which imply different prices, but also by the transition matrix and the different probabilities of staying at home or in a facility. Level 4 represents on average 60% of the total expenses, while care levels 3 and 2 both represent only 20%.

LTC Expenses per Care Level



Average Percentage of Beneficiaries per Level in the Last Five Years

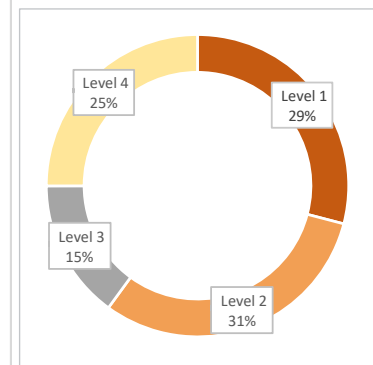


Figure 11: [Left] Past data and projection of expenditures of the LTC program for the next decade (in billions). [Right] Composition of the average percentage of beneficiaries per level in the last five years.

Source: Bellagos Government and ACE analysis

As the individuals transition from one level to another, the average cost to the government doubles (Figure 12). Since the number of individuals in each level is rising, especially in the next five years, these costs explain the increase of total expenditures.

Total Monthly Expenditures for Home and Facility Care

Care Level	Home Care		Facility Care		Total Monthly Expenditures
	Maximum Monthly Payout	Probability of Staying at Home	Maximum Monthly Payout	Probability of Staying in a Facility	
1	235	99%	1,023	1%	242.9
2	440	97%	1,270	3%	464.9
3	700	65%	1,423	35%	953.1
4	950	10%	1,688	90%	1614.2

Figure 12: Weighted average of monthly maximum payout of home and facility care per level according to the probabilities stated in Assumption 2.3.6.

Source: Bellagos Government and ACE analysis

4. RECOMMENDATIONS

4.1 SCENARIO 1 - INCREASE IN CONTRIBUTIONS

To ensure the financial sustainability of the system, one option is to gradually increase the tax contributions made by the citizens of Bellagos. Since the system's deficit progressively worsens over time, introduction of a gradual increment allows the program to slowly adjust the funding scheme.

Suggested Tax Contributions from 2018 to 2028

	Standard Income Tax	Childless Employee Income Tax	Cumulative Yearly Tax Increase (in percentage points)
2018	0.90%	1.05%	-
2019	0.90%	1.05%	-
2020	0.90%	1.05%	-
2021	0.96%	1.11%	0.055
2022	1.01%	1.16%	0.110
2023	1.07%	1.22%	0.165
2024	1.12%	1.27%	0.220
2025	1.18%	1.33%	0.275
2026	1.39%	1.54%	0.485
2027	1.39%	1.54%	0.485
2028	1.39%	1.54%	0.485

Figure 13: Weighted average of monthly maximum payout of home and
Source: Bellagos Government and ACE analysis

This measure would collect sufficient contributions to fully cover all the system's expenditures (Figure 14). With a surplus between 2023 and 2025, years where the contributions represent on average 107% of the total expenditures, the government could then invest the surplus to cover future deficits.

LTC System Cashflows with New Tax Contributions

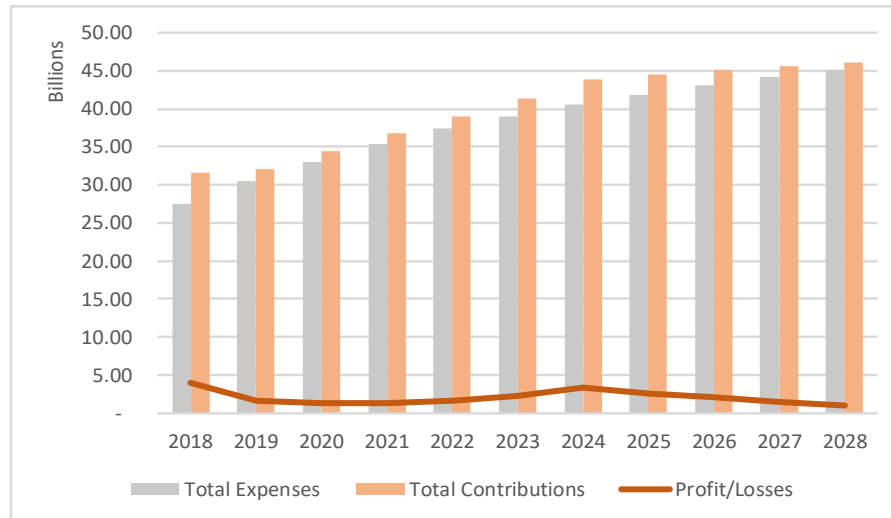


Figure 14: Projection of expenditures, contributions and surplus/deficits of the LTC program for the next decade (in bellos) with new income taxes.

Source: Bellagos Government and ACE analysis

4.2. SCENARIO 2 - INCREASE OF THE AGE REQUIRED FOR ELIGIBILITY

Due to Bellagos’s demographic changes, the second scenario considers an increase in the age required for eligibility, i.e., the minimum age at which a citizen is entitled to coverage by the Social LTC Insurance Program, from 65 to 66 years old.

Total Expenses

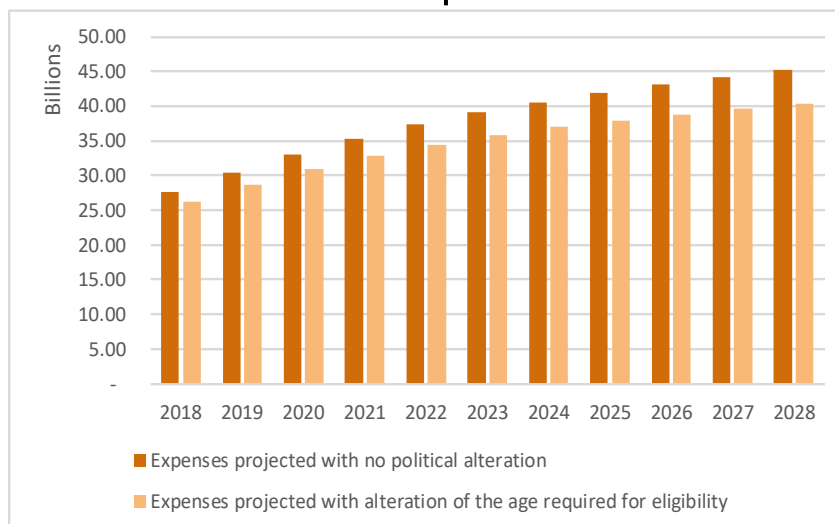


Figure 15: Comparison of total expenses with and without alteration in the age required for eligibility

Source: Bellagos Government and ACE analysis

As seen in Figure 16 this measure alone is not sufficient to sustain the LTC program, and the benefits do not outweigh the implied political difficulties.

LTC System Cashflows with New Eligibility Age

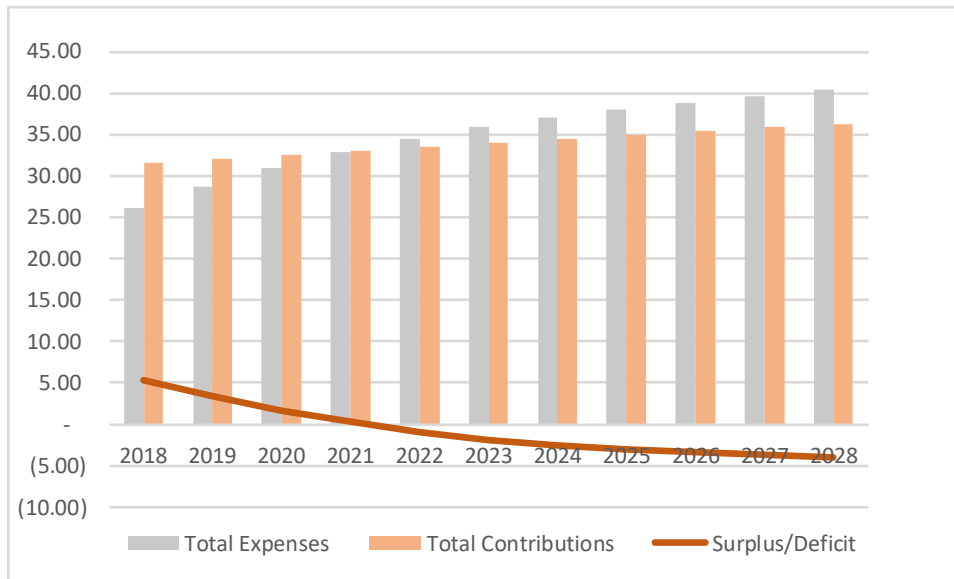


Figure 16: Projection of expenditures, contributions and surplus/deficits of the LTC program for the next decade (in bellos) with 66 years old as the minimum age at which a citizen is entitled to coverage by the Social LTC Insurance Program.

Source: Bellagos Government and ACE analysis

4.3. SCENARIO 3 - DECREASE IN THE MAXIMUM MONTHLY PAYOUT

Since the biggest challenge when it comes to the financial sustainability of the LTC system lies in the expenditures, the third scenario considers a decrease in the maximum monthly payouts both for home and facility care as shown in Figure 17.

Maximum Monthly Payouts

Care Level	Current Maximum Payouts		Proposed Maximum Payouts	
	Home Care	Facility Care	Home Care	Facility Care
Level 1	235	1,023	235	1,023
Level 2	440	1,279	430	1,250
Level 3	700	1,432	660	1,360
Level 4	950	1,688	910	1,640

Figure 17: Comparison of current and Proposed Maximum Monthly Payouts.

Source: Bellagos Government and ACE analysis

Total Expenses

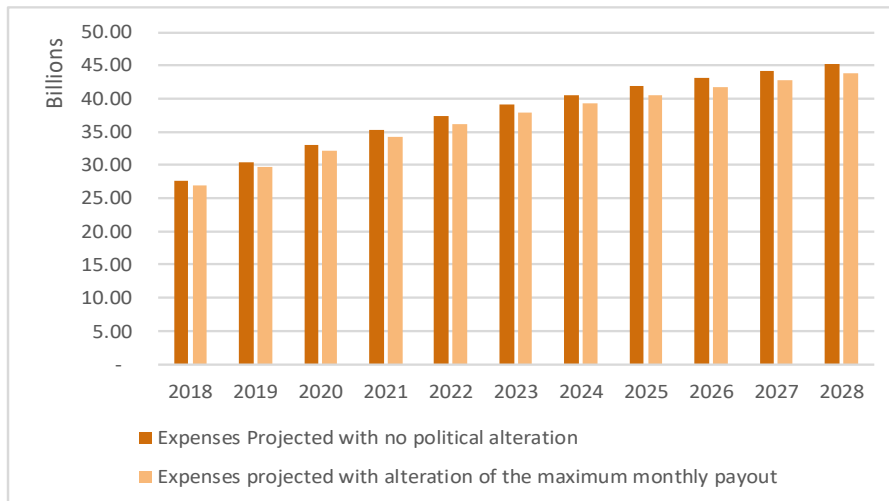


Figure 18: Comparison of total expenses with and without alteration in the monthly maximum payout

Source: Bellagos Government and ACE analysis

ACE presents the option of a combination of this measure with a tax increase because reduction of the maximum payout alone is not effective to financially sustain the system for the next decade. A bigger decrease in the maximum monthly payouts threatens the quality

of the future services of the LTC system since the proposed limits are already below the current average expenditure for most levels of treatment. Figure 19 presents the taxes for the citizens in this scenario:

Suggested Tax Contributions from 2018 to 2028

	Standard Income Tax	Childless Employee Income Tax	Cumulative Yearly Tax Increase (in percentage points)
2018	0.90%	1.05%	-
2019	0.90%	1.05%	-
2020	0.90%	1.05%	-
2021	0.94%	1.09%	0.0004
2022	0.98%	1.13%	0.0008
2023	1.03%	1.18%	0.0013
2024	1.08%	1.23%	0.0018
2025	1.13%	1.28%	0.0023
2026	1.13%	1.28%	0.0023
2027	1.13%	1.28%	0.0023
2028	1.13%	1.28%	0.0023

Figure 19: Weighted average of monthly maximum payout of home and
 Source: Bellagos Government and ACE analysis

The results obtained when combining these two measures are shown in Figure 20.

LTC System Cashflows New Tax Increase and Maximum Monthly Payout Decrease

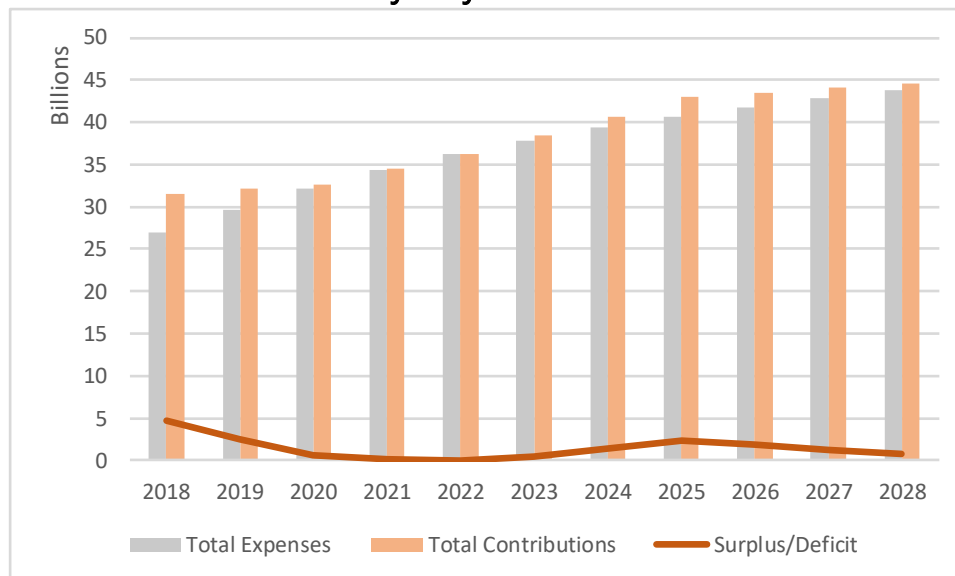


Figure 20: Projection of expenditures, contributions and surplus/deficits of the LTC program for the next decade (in bellos) with new income taxes and decrease in the maximum monthly payouts.
 Source: Bellagos Government and ACE analysis

5. CONCLUSION

ACE recommends Scenario 1, an increase of the income tax contribution. Since the system is expected to face financial difficulties in the short-term, and based on the different scenarios analyzed, an increment in the contributions is inevitable to guarantee the long-term financial sustainability of the LTC program. All other alternative measures would generate political difficulties that will not eliminate the necessity of increasing taxes in the future. Hence, a gradual increase in the funding scheme results in the simplest and most effective alternative to address the future needs of the population.

6. DATA LIMITATIONS

The data limitations include:

- The projections are limited by the minimal historical data of only five years.
- Because the informal Caregiver Allowance Program was introduced by the government in 2016, the impact of this initiative is difficult to predict with accuracy.
- It is unclear how to estimate the probabilities of transitioning from home care to facility services or vice-versa since the historical information provided does not contain any details about it.
- The breakdown of age groups in the historical data does not include gender-specific information. Since mortality patterns follow the age and gender of individuals, this information would support more accurate results.

7. BIBLIOGRAPHY

Charpentier, Arthur, Computational Actuarial Science with R, 1st ed, CRC Press Taylor & Francis Group, 2015.

Dickson, D., Hardy, M., and Waters, H., Actuarial Mathematics for Life Contingent Risks, 2nd ed, Cambridge University Press., 2013.

United Nations, *Total Fertility Rate*.

www.un.org/esa/sustdev/natlinfo/indicators/methodology.../total_fertility_rate.pdf.

World Bank. (2018). <https://data.worldbank.org/>.