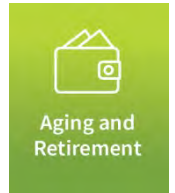


Market Readiness of Long-Term Care Products in Asia-Pacific Markets

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Executive Summary

The purpose of this study is to provide valuable insights and recommendations for insurance companies that are considering entering the market of commercial long-term care insurance (LTCI) in the Asia-Pacific, based on individual health status. The study reviews the development of LTCI in the main markets in Asia-Pacific, drawing conclusions about market experiences and offering inspiration for product development. We have also proposed two sample products and completed product pricing and profit testing to identify key risk drivers.

Section 1 of the study reviews and analyzes the social long-term care (LTC) system and the development of commercial LTCI in main markets in Asia-Pacific. The study also addresses the challenges of commercial LTCI product development and key considerations for insurance companies.

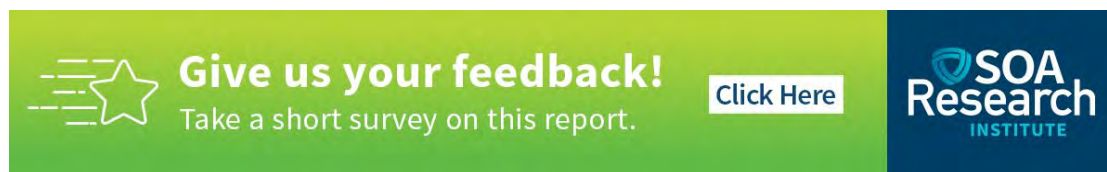
In section 2, two baseline products with cash payout are proposed based on analyzing market features in the Asia-Pacific. The incidence rate assumption is derived from the population census data. A first principles approach is used for modeling. Product pricing and profit testing including sensitivity testing are conducted based on the two proposed products. The study identifies the main risk drivers for LTCI products and provides suggestions for product design and risk mitigation measures.

KEY TAKEAWAYS

1. LTCI products are challenging for insurance companies due to the involvement of more assumptions, the lack of credible experience data for determining these assumptions, the need to balance risk with eligibility determination and claim investigation practices.
2. The role of the local government and the government-led social LTC system in the local market is crucial to develop commercial LTCI products as they promote public awareness and also provides referable assessment results.
3. In markets where critical illness (CI) insurance dominates the health insurance market, it's important to distinguish between LTCI and CI business. Otherwise, LTCI requiring pre-defined illness may overlap with CI coverage in the view of policyholders.
4. For product features, the benefit with cash payout enables more flexible choices. The benefit term is recommended to be longer than 10 years but no more than to age 100, to balance acquisition expenses and risks of very old ages. As the benefit is usually paid consecutively, it is recommended to consider how to ensure that paid benefits at least cover paid premiums. Incorporating related care services into the product is also considered attractive, although this raises the necessity for service management within the company.
5. Based on the sensitivity testing, investment income, LTC incidence rate, recovery rate and expenses including service expenses are significant risk drivers affecting profit margin results. The business mix such as average sum assured, and age composition is also an important factor in generating satisfactory profits.

6. To mitigate risks, the payout duration cap and the deferment period¹ should be incorporated.

In this report, assumptions and methods that are as universally applicable as possible have been utilized in our modeling. However, it's important to note that assumptions may vary significantly among different companies in different markets. An Excel spreadsheet accompanies this report for readers interested in inputting their assumptions to investigate the results.



¹ A deferment period means that LTC benefit will begin to be paid after a deferment period from the claim date. It is required to ensure that the assessed disability is not temporary.

Introduction

The aging population is a global issue for many regions. *The World Population Prospects* shows the rapid growth of the aging population in Asia-Pacific. Japan has already evolved into a super-aged society². Apart from the growing elderly population, the fertility rate³ has been constantly declining. In regions such as Hong Kong, the total fertility rate has dropped below 1. Low fertility rate further accelerates the pace of population aging, reduces family population and thus increases the pressure for families and societies.

The delivery of long-term care services is one of the solutions to support an elderly's daily life with dignity. For the insurance industry, LTC insurance provides financial support for service delivery. In this study, LTCl refers to the insurance offering LTC services, cash benefit payouts or reimbursement mainly for the elderly who are unable to live an independent life. In some markets, LTCl is combined with disability insurance (DI). DI provides income compensation for the insured unable to work and targets younger people before retirement. DI is usually related to the insured's previous occupation and salary while LTCl aims to cover LTC services costs and offer financial support. This study focuses on LTCl, and DI is beyond the scope.

Although local governments in the Asia-Pacific have established complete or partial public LTC systems in the form of social welfare or insurance with the goal of achieving the long-term care delivery, the public system usually covers only basic needs. It is unsustainable for the public system alone to cover all LTC related needs. Public-private partnership is the key to provide more comprehensive cover that meets various needs. It thus leads to the market opportunity of commercial LTCl. In Asia-Pacific, the market development stage of commercial LTCl varies among different regions due to different reasons.

Unlike conventional insurance products, the development of LTCl presents more challenges. More assumptions are involved, and reliable experience data is usually inaccessible for most markets. More status transitions of the insured require more accurate modeling. Apart from these technical difficulties, the moral hazard risk resulting from less objective assessment and benefit incentives imposes challenges to claim investigations and settlements. Therefore, thorough consideration and evaluation should be completed before an insurance company develops an LTCl product.

² In this report, a society is qualified as aging society if the share of people aged 65 years or more is between 7% and 14% of the total population, as aged society if this share is between 15% and 20% and as super-aged society if this share is 21% or higher.

³ In this report, fertility rate refers to the number of live births per woman

Section 1: Overview of the LTCI in Asia-Pacific markets

1.1 MAINLAND CHINA

The aging population presents a challenge to society in Mainland China. With economic growth and medical advancements, the average life expectancy increased from 67.77 years in 1981 to 77.93 years in 2020. However, the fertility rate has consistently declined since 1991, dropping to only 1.2 in 2021. Although Mainland China entered an aging society in 2000, later than other Asia-Pacific societies, its transition to becoming an aged society in 2021 took only 21 years.

In recent years, the number of nursing homes and community nursing centers has been increasing. In 2021, there was a combined capacity of 8.16⁴ million beds in various inpatient facilities and places in non-residential long-term care facilities nationwide. But on average, there were only 40 beds or places accessible for every 1,000 elder citizens aged 65 or above. As the demand to improve the quality of life for the elderly is urgent, both the government and the society have stated their intention to develop an inclusive long-term care system.

1.1.1 THE SOCIAL LTCI SCHEME

Compared with other traditional social insurance, the framework of social LTCI was established recently. In 2016, the Ministry of Human Resources and Social Security issued *Guidelines for Establishing Long-term Care Insurance System Pilots*, designating 15 cities for the initial pilot of the LTCI program. The document also indicated there would be a nationwide LTCI scheme in the future. The number of pilot cities then has increased to 49 at present. In 2021, the National Healthcare Security Administration published normalized standards for the evaluation of the long-term care levels. Insurance companies and nursing service companies are allowed to participate in social LTCI with public bids and annual examinations, with examination results accessible to the public on the website of the Healthcare Security Administration. Over the past two years, the number of designated institutions and caregivers has increased by nearly 50% (Table 1).

Table 1

THE NUMBER OF DESIGNATED INSTITUTIONS AND CAREGIVERS IN MAINLAND CHINA, 2020-2022

Year	2020	2021	2022
No. of designated institutions	4,845	6,819	7,679
No. of caregivers (000)	191	302	331

Data source: Statistical report of national medical insurance from 2020-2022, National Healthcare Security Administration.

The social LTCI framework is based on the social medical insurance system. The social medical insurance consists of two main components: medical insurance for urban employees, and medical insurance for urban and rural residents. The former is targeted at employees and freelancers. Premiums are based on the employee's average salary and are contributed jointly by both employers and employees. The medical insurance for urban and rural residents aims at children, students, and non-employed residents. The individual pays a fixed amount of premium and the government subsidizes the rest. Of the 49 LTCI pilot cities, 39 include both urban employees and urban and rural residents in their coverage. The remaining ten

⁴ Ministry of Civil Affairs, Statistical Bulletin on Development of civil affairs undertakings.

cities only cover urban employees with medical insurance. Therefore, the social LTCI system does not provide full coverage even in these pilot cities.

The basic framework of social LTCI is as follows:

- **Funding:** Social LTCI premium per person widely ranges from 30-200 CNY per year. The premium of urban employees is higher, ranging from 100-200 CNY while urban and rural residents pay less premium ranging from 30-50 CNY. Similar to the social medical insurance scheme, social LTCI premiums are shared equivalently between employers and employees. For urban and rural residents, the local government subsidizes up to 40%-50% of the total premium, with the remaining paid by the individual.
- **Assessment standards:** The assessment standards of care levels primarily rely on normalized standards published in 2021. Some pilot cities use normalized standards alongside with Activity of Daily Living (ADL) Scale or develop their own criteria. Normalized standards evaluate a person's ability of ADLs, cognitive, and sensory perception and communication then score each ability as secondary indicators. The scores from secondary indicators would then be aggregated into a primary indicator (full Capacity, minor impairment, moderate impairment and severe impairment). Finalized assessment results would be determined by primary indicator and then be divided into 6 levels based on the following assessment matrix (Table 2). The final assessment results are issued by designated appraisal institutions established by the local government and the fee is approximately 200-300 CNY for each assessment.

Table 2

ILLUSTRATION OF THE LTC ASSESSMENT MATRIX USED IN MAINLAND CHINA

ADLs	Cognitive ability, and sensory perception and communication ability			
	Full capacity	Minor impairment	Moderate impairment	Severe impairment
Full capacity	Normal	Normal	Minor level	Moderate level
Minor impairment	Minor level	Minor level	Minor level	Moderate level
Moderate impairment	Moderate level	Moderate level	Moderate level	Severe level 1
Severe impairment	Severe level 1	Severe level 1	Severe level 2	Severe level 3

- **Eligibility:** In most pilot cities, the insured assessed as severe level 1-3 is eligible for LTCI claim. A few pilot cities expand coverage to moderate level or dementia such as Suzhou and Nantong. Besides, assessment results would be reviewed every two years to evaluate the latest status.
- **Coverage and benefits:** The government offers three forms of care service for those eligible including medical institutional care, nursing home care and home care. The service includes basic daily living care such as cleaning, feeding and toileting; non-therapeutic care such as blood pressure measurement; medical care such as dressing changes and topical medications; and functional care such as physical exercises. Social LTCI reimburses the corresponding care service expenses with a fixed reimbursement ratio ranging from 65%-90% depending on the type of medical insurance, the care level and the care service category. It implies that there is a copayment ratio for the insured. In general, the reimbursement ratio of employee medical insurance holders ranges from 80%-90% while that of urban and rural basic medical insurance holders is 65%. Social LTCI also caps monthly payments. The limitation for medical institutional care is around 2000-3000 CNY per month and limitations for nursing home care and home care are 1500-2000 CNY and 300-500 CNY per month respectively.

By the end of 2022, the public-sector LTCI scheme has not yet rolled out nationwide. The scheme covered 49 cities with 169.9 million insured individuals, and 1.2 million beneficiaries. The premium income was 24.08 billion CNY and claim payments reached 10.44 billion CNY in total.⁵

Currently, the financial support provided by the social LTCI scheme is basic and limited. In first-tier cities such as Shenzhen, a non-profit nursing home charges 3600-6400 CNY monthly including 3000 CNY for room fees and 600-3400 CNY for care service fees depending on the care level. According to *The 2018-2019 Long-term Care Survey Report in China*, the average disability duration for those assessed as minor care level was 4.9 years, 6.5 years for moderate care level and 9.3 years for severe care level based on Barthel Index. Therefore, the financial gap for disabled residents could lead to a heavy burden.

1.1.2 COMMERCIAL LTCI MARKET

In recent years, the commercial health insurance market has increased quickly in Mainland China due to the growth of critical illness insurance and medical insurance. The compound annual growth rate of commercial health insurance during 2013 – 2020 exceeds 30%⁶. However, the development of commercial LTCI is still slow. As Swiss Re estimated in 2021, the commercial LTCI accounted for only 1% of the entire health insurance market premiums.⁷

By the end of first quarter of 2023, there are a total of 351 products including both long term and short-term care insurance and only a third of them are available for sale according to the public insurance product database from the Insurance Association of China (Figure 1). Among these products:

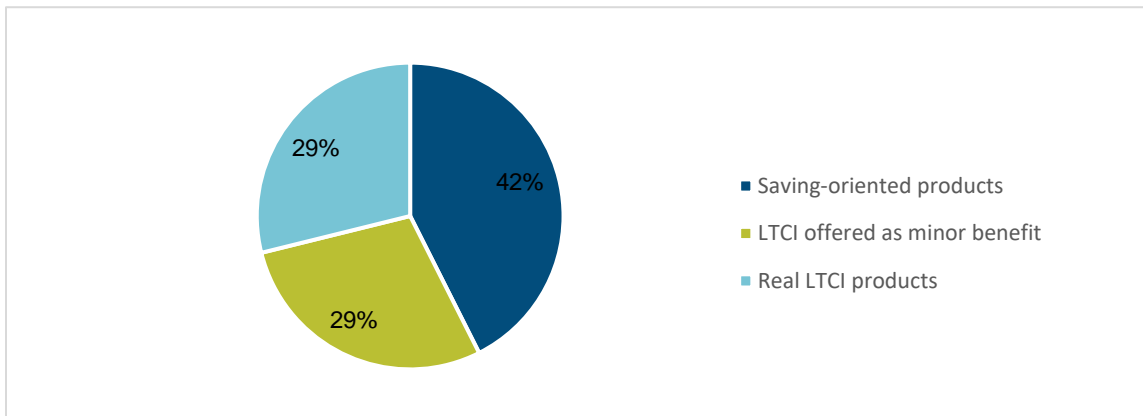
- The number of care products supplied is less than 10% of CI products and 5% of medical insurance products. Although the number of care products has increased in recent years, such kind of product is still much less popular.
- Product features vary. Of these, 149 products are savings-oriented in essence. These products primarily take the form of universal life insurance and increasing sum assured (SA) whole life insurance, with purely nominal care coverage part. There are around 100 products that offer care coverage but the core coverage focuses on unconditional annuity, diseases and accidents. The cost of care coverage accounts for a minor proportion. The rest could be considered as widely acknowledged commercial care products. However, the majority of these products are group insurance and the benefit term is only 1 year. Products offering long-term care coverage are scarce.

⁵ National Healthcare Security Administration, Statistical report of national medical insurance, 2022.

⁶ Source: China Banking and Insurance Regulatory Commission

⁷ Swiss Re, Private long-term care insurance opportunities in China.

Figure 1
THE SUPPLY COMPOSITIONS OF LTCI PRODUCTS IN MAINLAND CHINA



Note: The data in the figure was collected on April 8, 2023 for comparison purpose. Please be aware that numbers are subject to change.

- The eligibility also varies without a widely used standard. Common standards include:
 - medical diagnosis of pre-defined critical illness mainly based on CI insurance as well as qualification of a specified care level;
 - disability level based on *China Insurance Disability Standard and Code*;
 - 6 ADLs including bathing, dressing, eating, transferring, toileting and continence;
 - Barthel Index, similar to 6 ADLs but covering more comprehensive activities such as mobility-related tasks and enabling a more detailed assessment;
 - cognitive impairment level.

Based on the current product offerings, it is clear that insurers are cautious about the related risks. Most insurers offer short-term products to mitigate long-tail risks. Additionally, most products require a medical diagnosis of a pre-defined critical illness combined with ADLs as the coverage eligibility to decrease the difficulty of assessment and frequent review. Insurers and reinsurers believe that once the insured is diagnosed with a critical illness and also loses some ADLs, the impact is permanent and the probability of recovery is extremely low. Therefore, the follow-up review might be considered as unnecessary.

In the current commercial LTCI market, the product evolution of Ping An Life could be treated as a typical example (Table 3). In 2016, Ping An Life started to develop long-term care products. In the early stage, the product covered physical disability only, and then the coverage expanded to include long-term care status caused by accidents or specific diseases. After several years of product iterations, the most recent version uses an endowment as its base to provide return of premiums (ROP) upon death or contract maturity. The corresponding rider is a long-term care product. For such a combination, the policyholder's long-term care risk is covered under the rider while ROP is guaranteed, making it appear more acceptable for customers. Besides, all products are designed as level premium with cash surrender value (CSV).

Table 3
THE LTCI PRODUCT FEATURES INCLUDE A, B, AND C OF PINGAN LIFE INSURANCE COMPANY

Product		A	B (Rider)	C (Rider)
Issue year		2016	2020	2021
Benefit period (BP)		Whole life	To age 80/90	To age 80/95
Benefit coverage	LTC/disability	100% SA payable monthly during disability capped at 360 months	100% SA payable during LTC status capped at 36 months	Minor LTC: 50% SA payable during minor LTC status after age 75 capped at 12 months Severe LTC: 100% SA payable during severe LTC status capped at optional 36/60/120 months
	Extra LTC/disability	1000% SA payable at disability	100% SA during LTC status caused by accidents before age 70 capped at 36 months	100% SA during LTC status caused by accidents before age 75 capped at optional 36/60/120 months
	ROP	-	Upon disability	Upon transition to severe LTC level
	Wavier of premiums (WOP)	✓	✓	✓
Eligibility		Disability level 1-3	Loss of 3 ADLs or cognitive impairment caused by accidents or pre-defined illness	Minor level: 1 ADL Severe level: 3 ADLs or cognitive impairment caused by accidents or pre-defined illness

The LTCI product developed by Taikang Life is another interesting example. Taikang Life is an insurance company known for its continuing care residential chain communities. Taikang community has completed the national layout in 26 capital cities and it provides medical and senior care for the elderly with different levels of care needs. The high occupancy rate of these communities can be attributed to their appealing quality of living standards for the elderly.

A policyholder or the insured is eligible for residence in the community with a guarantee as long as total paid premiums exceed the minimum requirement and the resident's age meets the age requirement. The policyholder's parents could be eligible for residence with priority as long as certain requirements such as total premiums payable are met. Based on its experience in the community, Taikang developed an LTCI product using the Barthel Index as assessment standards (Table 4). The product is exclusive to residents living in Taikang community. This allows Taikang better informed of the real health condition of the insured, significantly reducing the difficulty in assessing actual care needs and mitigating potential moral hazard risks. Besides, Taikang Life also offers an endowment as the rider for ROP upon death or maturity. The premium pattern is level premium and CSV is available. The features of the LTCI product are summarized below.

Table 4
TAIKANG THE LTCI PRODUCT FEATURES OF TAIKANG LIFE INSURANCE COMPANY

Product	Taikang LTCI
BP	To age 106
Coverage	1. basic benefit: payable until death of recovery capped at 180 months Minor care level: 100% SA monthly Severe care level: 150% SA monthly 2. severe cognitive impairment benefit: extra 30% SA monthly 3. WOP
Eligibility	Minor care level: Barthel Index score 31-60 Severe care level: Barthel Index score 0-30 Severe cognitive impairment: score of Mini-Mental Status Exam (MMSE) ≤ 15 with dementia diagnosis

Although in recent years several insurance companies have begun to consider investing in their own care residential chain communities, the upfront costs for this investment are extremely high. Additionally, the break-even year is longer than that of regular investments. Besides, the subsequent maintenance costs should not be underestimated. The market acceptance is closely related to the quality of the community environment and services. As a result, most insurance companies are cautious about establishing their own care residential chain communities, which poses some challenges to replicating the Taikang mode.

With the development of health insurance and market competitive pressure, more insurers have started to offer value-added services attached to insurance products. At the same time, the professional care service providers that used to provide service exclusively for social LTCI beneficiaries also wish to explore the commercial insurance market to expand the revenue sources. As a result, these third party administrations (TPAs) begin to cooperate with insurance companies and offer home care services to the insurers' policyholders.

Typically, the insurance company purchases home care services to attach to a certain insurance product or for its policyholders with certain requirements from a qualified TPA. The service is aimed at promoting insurance product sales. For example, China Merchants Life developed a pension annuity in 2022. The product offered a 20-year home care service (Table 5) with a guarantee once the insured lost at least 3 ADLs caused by accidents or was diagnosed with 15 pre-defined diseases such as severe Alzheimer.

Table 5
THE SAMPLE SERVICE CONTENT PROVIDED BY TPA

Service content	Service hour each time	Max times
Service need assessment	60 min	3
Online consulting	30 min	3
Rehabilitation home care	45 min	20
Basic home care	45 min	20
Medical home care	45 min	20

In this mode where care is provided as an additional value-added service, TPAs would offer a quotation per policy and then charge each policy in force rather than charging only when the insured enters the care status. The service is triggered only when the insured meets the specified requirements. The quotation can be either yearly renewable or guaranteed within a certain period such as three years. During the guarantee period, risks such as incidence rate and cost overrun are either fully taken by TPAs or partially taken by

TPAs restricted within a maximum service utilization rate. It implies that the insurance company has transferred related risks to the TPA, relieving the company from the cost of establishing its own nationwide care service team or department. Compared to the insurance company, TPAs are more experienced in care service supply and expense control. Additionally, TPAs have an incentive to control expenses since the revenue is fixed per policy and every penny saved would become TPAs' profit. Most TPAs adjust their quotes annually based on the previous years' experience or provide guarantees for a maximum of 3-10 years. Longer term guarantees are rare at present.

Since the care service market attached to commercial insurance is still in the very early stage, TPAs are willing to offer relatively low prices to expand the market presence and win competitive advantages. At present, the prices range from 2-20 CNY per policy, contingent upon the specific service and the quotation term. The current price seems cheap and attractive. However, in the long run, the price is likely to increase, perhaps even beyond expectations, due to rising labor costs and market maturation.

While the insurance industry is stringently regulated, TPAs are not, suggesting that the long-term stability of TPAs might not be as promising as that of insurers. An insurance contract, including the value-added service as additional benefits, represents a long-term agreement between the policyholder and the insurance company. However, the term of a service contract between a TPA and an insurer is much shorter. In the case of sharp increase in expenses, poor service quality or even bankruptcy of the TPA, the insurance company then has to replace another qualified TPA to provide the service. Such a transition could be effort-intensive and could negatively impact the insurer's reputation. Hence, insurers should be wary of the additional expense risk and counterparty risk that arise from collaboration with TPAs.

1.1.3 SUMMARY

Mainland China entered aging society in 2000, later than other markets. The development of social LTCI is still slow with limited coverage population and benefits. Although supported by the government, the number of care institutions and caregivers has been increasing; there are only 40 nursing beds available for every 1,000 elderly people aged 65 or above. In reality, most elderly citizens depend on family members or hire care workers without medical knowledge or training for their care needs.

The development of commercial LTCI is also lagging behind. Its premium volume is low and accounts for only 1% of the total health insurance market share. The product supply is limited as well. Products with real care coverage are scarce. Most of these products limit the standard to the diagnosis of pre-defined diseases to mitigate risks.

In the past 30 years, people's awareness of critical illnesses such as cancer and stroke has significantly enhanced. Customers have realized the need for CI products, resulting in a high acceptance of CI insurance. Once the insured is diagnosed with any of the pre-defined illnesses, they are entitled to the sum assured claim payment. For the customer, the lump sum payment could be used as either medical expenses or income compensation caused by the illness. By the end of 2018, the insured rate⁸ of CI insurance products reached 12% and the average age was 27 years old. However, customers, especially young customers have a vague awareness of long-term care risks and the need for LTCI.

⁸ Insured rate = the number of insured holding CI policies/total population. Data source: The Statement Report of China Life Insurance Experienced Critical Illness Table 2020.

The constraint of limited social LTCI coverage brings another challenge. Without a national social LTCI, the claim investigation for insurance companies is extremely difficult. The insurance company is highly concerned about the reliability of the appraisal institute as well as moral hazard risk. If the assessment standard is purely based on the loss of ADLs, then the risk of insured individuals pretending to meet the requirements or even colluding with the appraisal institute to defraud insurance benefits cannot be overlooked. Additionally, frequent health condition reviews are often impractical. An insured individual might recover from a previous care level but conceal this improvement to continue receiving benefits. If a market is covered by national social LTCI, then insurance companies could refer to the appraisal results from the social insurance. However, since the current social insurance covers only a few cities, the insurance company has to complete the claim investigation independently once the insured claims benefits and keep review frequently in cities without social insurance.

In such circumstances, insurers choose to require critical illness diagnosis as the assessment standard to bypass such risks and difficulties since the diagnosis of critical illness is mainly based on biometric indicators which is more objective. Besides, the assessment standard based on critical illness is more acceptable to the industry due to the enhanced knowledge of risks with more credible experience data and thus risks are more manageable. But this has led to an overlap between LTCI and CI products, as both products offer similar illness coverage in the view of customers. However, most LTCI products only cover 10-25 diseases related to LTC risk while most CI products cover more than 100 different diseases as well as plentiful optional coverages. This leads to the impression that LTCI covers much less than CI. Consequently, the market might expect a corresponding premium discount, especially as the main critical illness, cancer, is often not covered in LTCI. Currently, the premium for LTCI is not proportionally to 10-25% of the CI product since both insurers and reinsurers approach LTCI development cautiously. In conclusion, the popularity of CI products has somewhat overshadowed the need for LTCI.

1.2 HONG KONG

Hong Kong transitioned into an aging society back in 1983 and became an aged society in 2013, ahead of Mainland China. According to the latest statistical report released by the Hong Kong government, the aging trend continues, and persists, with those aged 65 and above accounting for an increasing proportion of the overall population, growing from 13% in 2011 to 21% in 2022. Although there was a slight dip in 2022 due to the impact of COVID-19, life expectancy in Hong Kong remains high. The average life expectancy for males and females stands at 81.3 years and 87.2 years respectively, ranking amongst the highest in Asia.

1.2.1 THE SOCIAL LTC SYSTEM

In response to the aging population, the Hong Kong government provides a wide range of services to help the elderly live with independence, participation, care, self-fulfillment and dignity. There are two main types of care services: residential care services and community care services.

The Hong Kong Social Welfare Department's residential care service, which encompasses Care and Attention Homes for the Elderly and nursing homes, caters to the elderly aged 65 or above who are in poor health, disabled, or have cognitive impairments and cannot be adequately cared for at home. Citizens aged between 60 and 64 may also apply for the service if needed. Applications are required to undergo Standardized Care Need Assessment to determine their long-term care needs and match them with the appropriate service.

The service includes both subsidized and non-subsidized places. For the subsidized part, the government does not directly provide beds but instead, provides funding to the non-governmental organizations (NGOs) to subsidize their operational costs. For the non-subsidized part, private operators are allowed to

be engaged in the residential care homes. However, they must be licensed with the government's permission to ensure the services meet the statutory standards equivalent to those of NGOs. To increase the supply, the government also purchases the nursing beds from private sector under the Enhanced Bought Place Scheme. As statistics show, there are 1,079 residential care homes, offering 77,374 beds in Hong Kong⁹, of which 41% are subsidized and the rest are non-subsidized as of the end of 2nd quarter 2023. The expense after subsidy for residential care service is relevantly low as the monthly fees for nursing homes are 2,054 HKD, while fees for Care and Attention Homes for the Elderly range from 1,660 to 2,060 HKD for the individual.

Another main service component is Community Care and Support Services. It provides a range of care and support services to frail elderly aged 60 and above in the original communities. The services aim to facilitate users to continue living in the community, maintaining their optimal level of functioning and providing support to caregivers. Community Care and Support Services encompass a comprehensive range of community-based services, as outlined in the table below (Table 6):

Table 6
THE SUMMARY OF COMMUNITY CARE AND SUPPORT SERVICES IN HONG KONG

Category	Sub-category 1	Sub-category 2	Services
Community Care Services for the Elderly	Home-based	Integrated Home Care Services (IHCS)	Provide home care services such as nursing care, meal delivery and homemaking, physical rehabilitation, and transportation for community-living frail elders
		Enhanced Home and Community Care Services (EHCCS)	
	Center-based	Day Care Centers for the Elderly (DE)	Provide similar services at its centers and offers transportation services that bring frail elders from their homes to the centers
Elderly Center Services	-	-	Provide community support services for the elderly, allowing the elderly and their caregivers to access a variety of services at centers near their residences, in order to establish a caring community for the elderly
Other Community Support Services	-	-	Help the elderly develop their potential and contribute to society

Source: Chui, E. W. T. (2011). Long-term care policy in Hong Kong: Challenges and future directions. *Home health care services quarterly*, 30(3), 119-132.

By the end of first quarter 2022, there were 93 DEs with 3,836 beds available, 61 teams offering IHCS and 31 teams offering EHCCS. Unlike residential care services, private operators are less involved in community care services.

The Hong Kong government also provides a monthly cash allowance for severely disabled citizens or citizens aged 65 or above through the Social Security Allowance Scheme (SSA). The Scheme is funded by government expenditure, and applicants are not required to make any contributions. It includes normal disability allowance, higher disability allowance, old age allowance, old age living allowance, Guangdong Scheme and Fujian Scheme. The allowance is easily accessible. For example, to apply for the old age

⁹ Social Welfare Department - Overview on Residential Care Services for Elders (swd.gov.hk)

allowance, applicants only need to satisfy the residence requirements, and they must not be receiving any other allowance under the scheme or be under legal custody.

The Hong Kong government financially subsidizes NGOs and a part of private operators to maintain the operation of residential care services. It also provides Community Care and Support Services. Additionally, the government offers cash allowances to the elderly through the public welfare system. However, the acceleration of the aging population has led to a significant increase in the government's financial burden. As the statistics show, the expenditure of SSA scheme on the old age allowance and the old age living allowance has increased by 89% in the past 5 years (Table 7).

Table 7
THE HONG KONG PUBLIC EXPENDITURE ON SSA SCHEME

Category	2017		2022	
	Number of cases	Amount of payment (HKD millions)	Number of cases	Amount of payment (HKD millions)
Disability Allowance	146	3,703	167	4,607
Old Age Allowance	246	3,884	322	5,530
Guangdong Scheme	16	256	20	686
Fujian Scheme	-	-	2	74
Old Age Living Allowance	474	14,280	675	28,857

Data source: Hong Kong in Figures (2023 Edition) by Census and Statistics Department

The long waiting time for the subsidized services also highlights the pressure the aging population places on the government (Table 8 & Table 9).

Table 8
THE WAITING TIME FOR THE SUBSIDIZED COMMUNITY CARE SERVICES FOR THE ELDERLY

Community Care Services (CCS)		Waiting time (in months)
Subsidized CCS for the elderly	IHCS (Frail cases)/EHCCS	7
	Day Care Centers/Units for the Elderly	3
Subsidized CCS for the elderly	Care and attention places	10
	Nursing home places	15
Overall		9

Data source: Hong Kong Social Welfare Department

Table 9
THE WAITING TIME FOR THE SUBSIDIZED RESIDENTIAL CARE SERVICES FOR THE ELDERLY

Subsidized residential care services		Waiting time (in months)
Care and attention places	Subvented homes and contract homes	24
	Private homes participating in the Enhanced Bought Place Scheme	3
	Overall	10
Nursing home places		13

Data source: Hong Kong Social Welfare Department

In conclusion, Hong Kong provides social long term care services and old age or disability allowance under the SSA scheme. However, the growing elderly population has increased the financial pressure on the government to sustain the allowance scheme. Meanwhile, the prolonged waiting time for public care services has become intolerable for citizens. These unsolved issues seem to present an opportunity for the development of commercial LTCL.

1.2.2 COMMERCIAL LTCI MARKET

As a developed insurance markets globally, there isn't a widely popular basic LTCI product available. AIA Hong Kong attempted to develop an LTCI rider product based on the loss of ADLs in 2016, and this product is no longer available. Prudential Hong Kong also provides an LTCI rider policy based on the loss of ADLs required to be attached to the certain base policy. These rider products are not common in the market.

Currently, commercial LTCI is often integrated into other insurance products rather than being offered as a standalone policy. For example, some medical products provide LTCI coverage or services in addition to the medical main coverage (Table 10). The related benefits include home nursing, daycare procedure outpatient care, physiotherapy post-confinement, etc.

Table 10
THE LTCI PRODUCT FEATURES IN HONGKONG INCLUDING BUPA HERO VHIS PLAN (DELUXE) AND VTONE MEDICAL PLAN (STANDARD PLUS)

Product	Bupa Hero VHIS Plan (Deluxe)	vTheOne Medical Plan (Standard Plus)
Company	Bupa	FWD
Pre- and Post-confinement/ day case procedure outpatient care	All clinic visit(s) within 90 days before admission and all clinic visit(s) within 365 days after discharge	Maximum 32 visit(s) before hospitalization or clinical surgery and all clinic visit(s) within 90 days after discharge
Physiotherapy post-confinement	Covered under pre-admission and post-hospitalization out-patient Care	
Home nursing	90 days (No itemized sublimit per day)	196 days (No itemized sublimit per day)
Outpatient dialysis	No itemized sublimit	

Several reasons could be attributed to the situation of commercial LTCI in Hong Kong:

- Much like in Mainland China, the CI insurance is the pillar product in the health insurance market. However, different from Mainland China, the typical CI product in the market of Hong Kong is participating. It provides not only illness coverage, but also saving features to some extent., which makes CI products more attractive to customers. As discussed in the previous section, the popularity of CI product hinders the development of LTCI to some degree. CI accounts for the main cause leading to long-term care needs. When this need is covered by CI products, pure cash payout LTCI may seem less attractive, as CI products could cover a greater variety of diseases, offer a wider range of benefits and an earlier claim payout.
- Although Hong Kong has offered various forms of support and services for its aging population, the absence of a government-run LTCI program leads to assessment difficulty for insurance companies. Similar to Mainland China, insurance companies face challenges in directly leveraging the assessment results from social security services, which adds to their concerns in developing commercial LTCI.
- The public welfare allowance scheme provides financial support to some degree to cover nursing home care or community care expenses. Additionally, the government provides residential care services and Community Care and Support Services to elderly individuals assessed as unable to live at home or in need of community care. Despite concerns about service quality, these schemes provide basic social coverage for the elderly and thus reduce the demand for the commercial LTCI.

1.3 TAIWAN

Taiwan has been proactive in addressing the challenges of an aging population, drawing lessons from Japan's experience. The society became an aging society in 1993 and an aged society in 2018. The average life expectancy in 2021 was 81 years. The growing population of the elderly and low fertility rate drew society's attention early. In 2001, the Taiwan Ministry of Health and Welfare began to review the healthy life expectancy for individuals annually. The finding shows that on average, during one's life cycle, one would stay in an unhealthy stage for 7-8 years living with chronic diseases and the need for others. Women tend to have 1-2 more years of unhealthy life compared to men.

1.3.1 THE SOCIAL LTC SYSTEM

In 2007, the Ten-year Long Term Care Plan 1.0 (LTC 1.0) was officially launched. It laid the foundation for the social LTC system and mode of care services in Taiwan. LTC 1.0 was then reformed into the Ten-year Long Term Care Plan 2.0 (LTC 2.0) in 2017. From 2015 to 2017, the Long-term Care Service Network was also established.

The main features of Ten-year Long Term Care Plan 1.0 included:

- The scheme was funded by the government with general tax revenues;
- The care level assessment was based on ADLs and instrumental ADLs (IADLs) including minor level with 1-2 ADLs or IADLs loss for the elderly living alone, moderate level with 3-4 ADLs or IADLs loss and severe level with more than 5 ADLs or IADLs loss;
- The scheme mainly focused on the elderly aged 65 or above while younger citizens with additional conditions were also subsidized;
- In total, 8 categories care services were provided: 1) daycare and family support service, 2) home care service, 3) community and home rehabilitation service, 4) auxiliary equipment purchase and home facility enhancement service, 5) food service for the elderly, 6) respite care service, 7) transportation pick-up service, and 8) long-term institutional care service;
- The service hours, frequency and compensation limits were determined based on the care level. Taking daycare and family support service, and home care service as examples, service hours for the minor, moderate and severe level were limited to total 25 hours, 50 hours and 90 hours per month respectively, with a cost of 200 TWD per hour. Besides, the compensation limit for long-term care institution services was 18,600 TWD per person per month;
- The compensation ratios were determined based on household income as 100% assistance for low-income residents, 90% for middle-income residents, and 70% for general income residents.

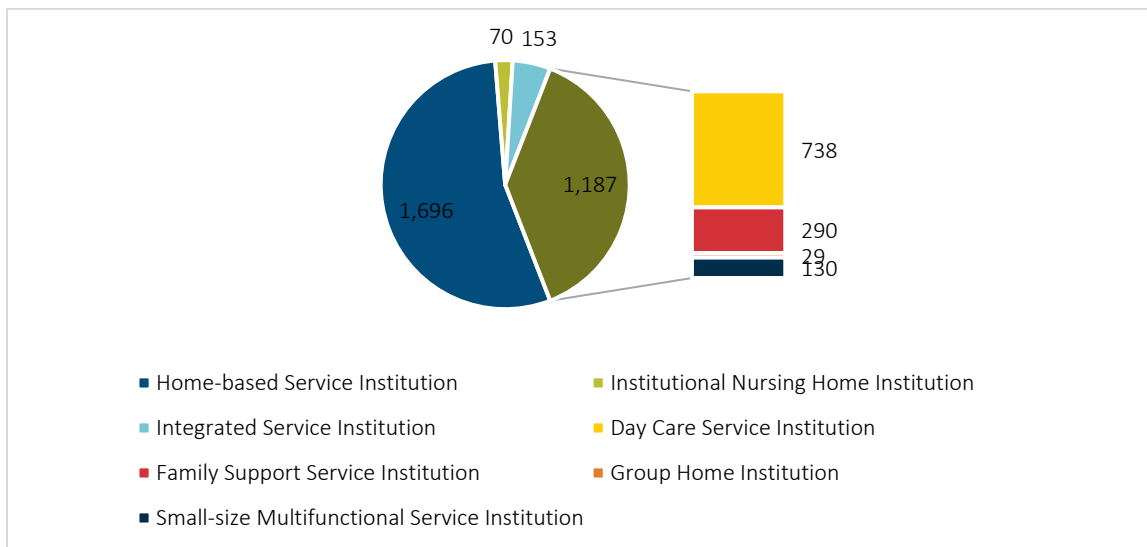
LTC 1.0 relieved the family care pressure to some extent and also simulated the growing supply of long-term care facilities as well as improvement of service quality. However, challenges such as limited coverage, inflexible service options, insufficient budget, and shortage of caregivers called for the reformation of the plan¹⁰. To address public needs, the government started the reformation in 2015 and introduced LTC 2.0 in 2017, which allowed for more comprehensive and accessible subsidies on LTC services to keep the sustainability of the scheme. The main changes included:

¹⁰ Yeh, M. J. (2020). Long-term care system in Taiwan: the 2017 major reform and its challenges. *Ageing & Society*, 40(6), 1334-1351.

- Setting tax-funded model for the LTC 2.0 plan. The Long Term Care Services Act was promulgated in 2015 to set up a special fund for scheme financing. The main financing sources include estate tax, gift tax and tobacco and alcohol tax.
- Expansion of target subsidized population. The residents such as those aged 50 above with mild dementia, and aged 50 below with disability or mental disorder are included.
- Expansion of care service. The service content is expanded from 8 categories to 17 categories to further improve the service quality and increase the service flexibility.
- Establishment of A-B-C Community Caring Network. The LTC 2.0 plan aims to establish a community-based care system with diversified services. The system is completed by a three-level care service levels. The Level C centers are the smallest built in every third village, providing preside care, meal delivery, etc. The Level B centers focus on every school district, providing daily life care, small-size multi-function services, etc. The level A centers are built in every township or district to provide a comprehensive and integrated care services;
- Diversified care levels. The plan expands the previous three levels to eight based on more assessment aspects such as communication ability, cognitive functions, family and social support.¹¹

In 2022, the service utilization rate under the LTC 2.0 plan achieved 69.51%. And the scheme served 576,566 persons in total with the aggregation of 101,440 related personnel. By the end of 2022, there were 3,106 nursing institutions (Figure 2 & Figure 3).¹²

Figure 2
THE NUMBER OF LTC SERVICE INSTITUTIONS IN TAIWAN, 2022

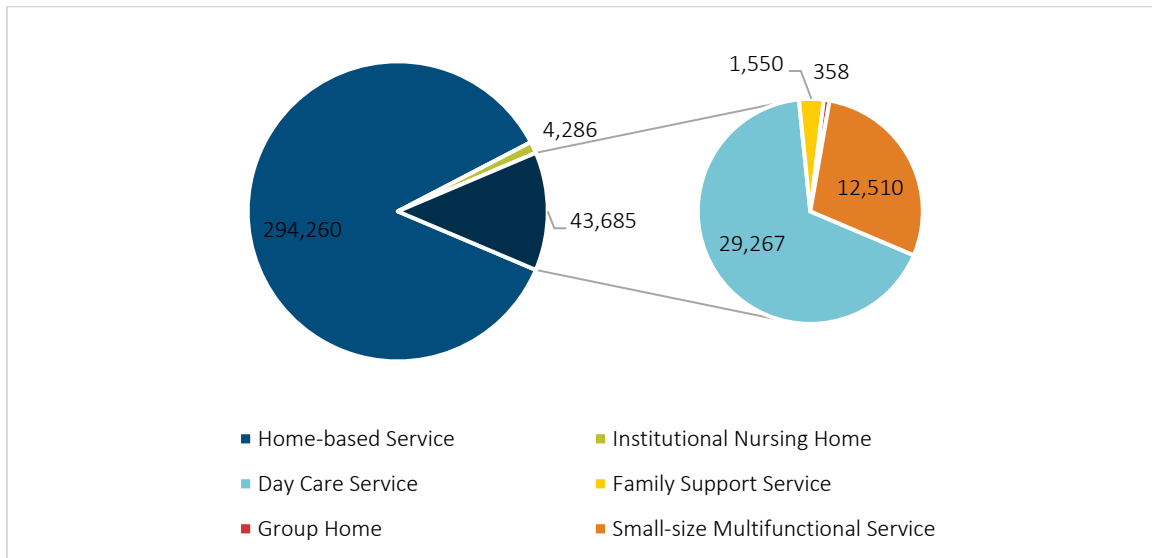


Data source: Taiwan Ministry of Health and Welfare

¹¹ Taiwan Ministry of Health and Welfare (MOHW) (2016) The Ten-year Long Term Care Plan 2.0 Prospectus.

¹² Taiwan Ministry of Health and Welfare, Long Term Care Service.

Figure 3
THE NUMBER OF BENEFICIARIES SERVED UNDER THE LTC 2.0 PLAN IN TAIWAN, 2022



Data source: Taiwan Ministry of Health and Welfare

However, the main caregivers in Taiwan are still family migrant care workers (26%) and family members (40%), the LTC2.0 service only accounts for 23%¹³. In Asia-Pacific markets, the elderly tend to prefer family or home care rather than institutional care. Besides, the LTC 2.0 plan limits on service and expenditure. For those assessed as moderate or severe LTC level, limited-service hours and compensation under the LTC 2.0 plan seems insufficient to cover their daily needs. Citizens with LTC needs still have to pay a significant amount out-of-pocket for the full volume of the services they need. According to statistics from the Life Insurance Association of Taiwan, the cost of caregiving in Taiwan ranges from 6,000 to 39,000 TWD per month. Home care by foreign caregivers' costs approximately 21,000 TWD per month, while Taiwanese caregivers charge between 30,000 and 90,000 TWD per month. Daycare centers cost between 6,000 and 15,000 TWD per month, elderly care institutions charge between 15,000 and 26,000 TWD per month, and long-term care facilities cost between 16,000 and 39,000 TWD per month. Therefore, diverse care needs and higher compensation requirements call for the supply of commercial LTCI.

1.3.2 COMMERCIAL LTCI MARKET

Commercial LTCI is more developed in the market of Taiwan. The majority of products pay out by cash rather than expense reimbursement. There are three mainstream eligibilities of LTCI products in Taiwan and some products recognize more than one (Table 11):

- Physical function such as ADLs and cognitive function. The benefit term of such products varies from one year to whole life.
- Pre-defined specific diseases such as Alzheimer, Parkinson, etc. Such products are more like CI insurance.

¹³ Taiwan Executive Yuan, The 11th Meeting Report of the Impetus Committee of Long-Term Care Policy (2020).

- Disability level caused by accidents or illness. Most of these products have one-year term with guaranteed renewability, and the main purpose is to prevent the risk of reduced income due to the disability.

Table 11
THE TYPICAL LTCI PRODUCT FEATURE IN TAIWAN

Insurance company		BankTaiwan Life Insurance	Hontai Life Insurance	Allianz Life Insurance
Premium Paying Period (PPP)		10/20/30 years	10/20 years	1 year
Benefit Period (BP)		To age 100	Whole life	1 year (renewable to age 75)
Benefit	LTC 1	A lump sum of 600% SA payable upon transition to LTC status	A lump sum of 1200% SA payable upon transition to LTC status	100% SA payable monthly with a 180-month payment guarantee until recovery.
	LTC 2	100% SA payable monthly capped at 16 years until recovery	Year 1-20: 12* SA p.a. Year 11-20: 13* SA p.a. Year 21-30: 14*SA p.a. Year 31+: 15*SA p.a. With 5-year payment guarantee until recovery	
	WOP	√	√	
Eligibility		loss of 3 ADLs or assessed as severe or above by the Clinical Dementia Rating Scale	13 diseases: severe sequela of stroke, paralysis, aplastic anemia, Alzheimer, Parkinson, primary pulmonary hypertension, etc.	Disability level 1-6

It is worth noting that though the majority of LTCI products provide cash benefits, the market also supplies LTCI products with care service benefits available. Taking one LTCI product by Cathay Life as an example, the product covers until age 85, and once the insured is assessed as having cognitive impairment, the insured is entitled to a lump sum cash benefit of 1200% SA. In each later year, as long as the insured is still in the long-term care status, he or she is entitled to choose either cash benefit of 1200% SA or long-term care service with the equivalent value of 1200% SA. The service is provided by an appointed TPA, which charges 550 TWD per service hour and contains mental care, oral cleaning, respite care and so on.

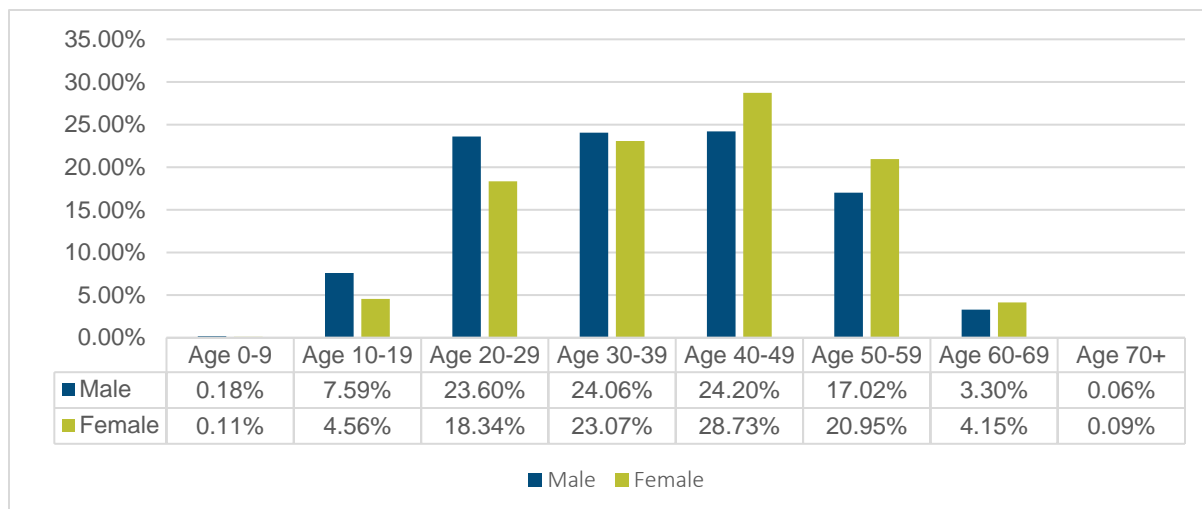
Taiwan Financial Supervisory Commission has analyzed the LTCI policies in force and summarized the policy features by the end of 2022 as follows:

- For the overall health insurance market, total premiums were 418.8 billion TWD with 108.3 million in-force policies and premiums of new business were 36.4 billion TWD. Total premiums of LTCI were 24.8 billion, accounting for 6% of the overall health insurance, and premiums of new business were 2.9 billion TWD, accounting for 8% of the entire new business of health insurance;
- The overall insured rate of LTCI reached 4.12%;
- The average SA was approximately 200,000 TWD;
- For the gender composition, 54.4% of the insureds were female;

- For the age composition (Figure 4), main age groups were distributed between 20-59. It appeared that the average age of female was older than that of male.¹⁴

Figure 4

THE ISSUE AGE DISTRIBUTION OF THE INSURED WITH LTCI IN TAIWAN, 2022



Data source: Taiwan Financial Supervisory Commission

The social LTC system in Taiwan is public welfare and subsidizes target citizens. The scheme provides various services for the groups with long-term care needs, helping to relieve the family care pressure and improve residents' daily life quality with dignity.

The market share of commercial LTCI in Taiwan is obviously higher than the market of Mainland China and Hong Kong and the supply of products is diversified, with 2-3 different types of LTCI products on sale for almost each insurance company. Two reasons could be attributed to the development of commercial LTCI in Taiwan.

1. Customers have perceived a good understanding of the longevity risk and the long-term care need due to early recognition of the aging population and low fertility rate. The social LTC scheme with accessible services has also further enhanced people's awareness of long-term care risk and the need for LTCI coverage. It has established a universal assessment standard of physical and cognitive function, helping to lay the foundation for commercial insurance. Also, the social system has accumulated years of experience data for actuarial pricing, underwriting and claims to help the promotion of commercial LTCI.
2. CI products do not dominate the health insurance market as two markets discussed above do. Instead, cancer insurance is more popular in Taiwan. With the absence of widely acknowledged CI products, LTCI products could be more flexible. Overlap between CI products and LTCI products with disease diagnosis is not an obstacle for this market. Customers could purchase both a cancer insurance policy and an LTCI insurance policy to address the disease risk and long-term care risk independently. The flexibility enables insurance companies to promote LTCI with various standards. Many products

¹⁴ Taiwan Financial Supervisory Commission, Cross-analysis of gender, age, administrative region and annual income distribution of long-term care insurance insured.

combine long-term risk arising from impairment of physical or cognitive function as well as diagnosis of diseases or disabilities. The combination expands target customers from the elderly to younger people as the product is enabled with income compensation.

1.4 OTHER AP MARKETS

1.4.1 SINGAPORE

In response to the need arising from the aging population, Singapore introduced social LTCI in 2002 known as ElderShield 300 and then reformed it to ElderShield 400. In 2020, the upgraded scheme CareShield Life was introduced with the transformation from voluntary participation and limited coverage to compulsory participation and whole life coverage.

With years of planning, ElderShield was introduced in 2002 as a basic long-term care insurance scheme targeted at severe disability, especially during old age. All Singapore residents and permanent residents without pre-existing disability aged 40 or above and born after 1932 with MediSave Accounts were automatically enrolled, unless they voluntarily opted out of the scheme. Once they opted out and wished to rejoin, the underwriting procedure was mandatory¹⁵.

The premium rate was determined at the age of entry, varying from issue age, gender and payment method. Premiums were payable until age 65¹⁶. In addition, to encourage the elderly to participate in the scheme, the Singapore government subsidized partial premiums for residents aged 56 and above. Also, MediSave accounts were allowed to pay for premiums for a resident's family members.

Coverage continued to lifetime, even after total premiums were completed. Benefits were payable based on the loss of ADLs. Loss of 3 ADLs or more was considered care needed. The deferment period was 90 days, during which care benefits would not be paid. After the deferment period, the insured received a monthly cash payment of 300 SGD, for a maximum of 5 years. During the payout period, insurance companies appointed by the government would review the status of the insured frequently. If the insured recovered, the benefits would be discontinued until the insured became eligible again.

In 2007, the government reformed the scheme by increasing monthly payments to 400 SGD and extending the maximum payout duration to 6 years. The scheme name was adjusted to ElderShield 400 accordingly. As the scheme reformed, the insured under the original scheme was allowed to pay for extra premiums to switch to ElderShield 400.

The government also reviewed ElderShield 300 and summarized the 5-year experience data by the end of 2006¹⁷:

- Younger citizens accounted for the majority. There were a total of 750,000 policyholders insured, with 54% of them aged below 50. Those aged 60 and above accounted for 15% of all age groups.

¹⁵ Pengcheng Feng & Jingtao. (2014). Performance and Reference about the ElderShield Program in Singapore. *Commercial Insurance*, (3), 64-66.

Pengcheng Feng & Jingtao. (2014). Summary of the ElderShield Program in Singapore and the Enlightenment to China. *Commercial Insurance*, (2), 62-65.

¹⁶ Singapore Ministry of Health

¹⁷ Singapore Ministry of Health, ElderShield Experience 2002-2007

- The opt-out rate decreased. The rate of the first year was the highest with 38% at the launch of the scheme and then kept decreasing to 14% in 2006.
- The claim admission rate was 84%. There was a small portion of successful claims registered with less than 3 ADLs but admitted by the insurers on an ex-gratia basis.
- The overall claims rate was 3‰ varying by age group. Two main reasons were considered to explain such a low claim rate: the scheme was still in its early stage as policyholders were largely young, and the scheme deliberately excluded the high-risk groups.
- The majority of successful claim was from the old age group (Table 12). Despite forming only 15% of all policyholders, those aged 60 and above accounted for 62% of successful claims. The breakdown table of successful claims by age group below revealed the fact that the incidence probability increased with age.

Table 12
BREAKDOWN OF SUCCESSFUL CLAIMS BY AGE GROUP OF ELDERSHIELD 300

Age at claim	As a share of total successful claims	Claim rate per 1,000 population
40-49	13%	1
50-59	26%	3
60-69	46%	12
70+	16%	16
Total	100%	3

Data source: Singapore Ministry of Health

With the growth of aging population and care service cost, the government introduced an enhanced scheme CareShield Life in 2020 and is still in-force at present. The main changes include:

- Compulsory enrollment and expansion of age: all Singapore residents and permanent residents aged 30 and above are compulsorily enrolled in the scheme. Opt-out of the scheme is no longer allowed;
- Expansion of coverage: the benefit term and payout period are expanded to lifetime. As long as the claim requirement is met, the insured is entitled to lifetime benefits. The scheme also increases the monthly benefit amount to 600 SGD in 2020. Monthly payouts will increase annually until age 67 or when a successful claim is made, whichever is earlier. The corresponding premiums increase with monthly payouts, with an expected annual increase of 2% from 2020 to 2025;
- More subsidies for increasing premiums: premiums should be paid until age 67 and have increased compared to ElderShield scheme due to longer benefit period and higher payouts. To alleviate residents' financial burden due to higher premiums, the government provides financial subsidies for low to middle-income households as well as new entrants. If a resident still cannot afford premiums after subsidies, the resident may be eligible for additional support.

The government has appointed private insurance companies to provide insurance coverage. These companies have also developed supplemental LTCI available to customers for policyholders with ElderShield 300, ElderShield 400 and CareShield Life respectively. Apart from the appointed companies, other insurance companies are not qualified to develop commercial LTCI products. Therefore, Supplement plans are considered as commercial LTCI in Singapore. To purchase Supplement plans, the customer needs to be an existing policyholder under ElderShield or CareShield Life. Premiums could be paid in cash or via the insured's own or the insured's family member's MediSave accounts.

Compared to basic LTCI plans, the main difference in Supplements includes:

- Less strict eligibility: the requirement of ADLs loss is extended to 2 ADLs or even 1 ADL;

- Higher payouts: monthly benefit amount is discretionary to customers but the maximum benefit is capped at 5,000 SGD per month;
- Enrichment of coverage: supplements offer various additional benefits such as additional lump sum payment in the first month when the insured transits to long-term care status, death benefits during benefit payout period and additional payouts if the insured's children are aged 22 below;
- Longer benefit term for ElderShield Supplements: as the basic ElderShield offers limited benefit term, Supplements offer 12-year or lifetime coverage.

However, the social scheme only provides basic support for residents. According to the estimation from the Singapore Agency for Integrated Care, the cost of home nursing starts from 62 SGD per visit. The cost of community day care ranges from 945-1430 SGD per month and the cost of a nursing home ranges from 2200 - 4200 SGD per month depending on the care level. Thus Supplements seem necessary and it is indeed the truth. According to the Ministry of Health, the additional enrollment rate of Supplements based on ElderShield gradually increased over these years, reaching nearly 40% by the introduction of CareShield Life in 2020 (Table 13).

Table 13
ENROLLMENT RATE OF SUPPLEMENTS BASED ON ELDERSHIELD¹⁸

Year	Additional enrollment rate of Supplements based on ElderShield
2007	3%
2009	15%
2011	24%
2013	29%
2015	33%
2017	37%
2018	38%
2019	38%
2020	39%

Additional enrollment rate = No. of ElderShield Policyholders with Supplements / No. of ElderShield Policyholders

The framework of LTCI in Singapore is mainly based on the social LTCI scheme with transition from voluntary to compulsory enrollment and from limited benefit to lifetime benefit. During the development, the government plays a crucial role.

The commercial insurance market of Singapore is similar to the markets discussed above as CI product is one of the most popular health insurance products. But the difference is that the enrollment rate of LTCI Supplements reaches closely to 40% based on a widely-covered basis of social scheme. This may reveal the role of the government and the social scheme. Widely promoted and covered social scheme has increased customers' awareness. Although in other markets such as Hong Kong, the government has provided sufficient support, the support is in the form of public welfare and financial subsidies rather than insurance. At the same time, the completion of the social scheme lays the foundation for commercial LTCI. As discussed above, whether the insured is indeed in the status of ADLs loss is a great challenge for commercial insurance companies. With the completion of the social scheme, the commercial LTCI could leverage the assessment results from social LTCI to tackle the problem.

¹⁸ Singapore Ministry of Health

1.4.2 JAPAN

Japan is one of the markets with the highest proportion of aged people in the world. In the past, the long-term care need for the elderly was solved by the social welfare system in Japan. But problems such as less service flexibility for users, low competition of service suppliers and high service fees remained unsolved. In the 1990s, Japan began the preparation for the adoption of the LTCI system and in 2000 introduced the compulsory social LTCI system with the goal of supporting for independence, rather than simply providing personal care¹⁹.

Under the system, residents aged 40 and above are automatically enrolled. Individuals aged 65 and above are referred to as the primary insured, while those aged 40-64 are referred to as the secondary insured. The system is funded by the government tax revenue with 50% and premiums paid by individuals and employers with another 50%²⁰.

The requirement for service provision differs for two categories of the insured. For the primary insured, the applicant certificated as needed support/long-term care is eligible for care services. The certification application and assessment procedures are strict. To access long-term care services, beneficiaries must undergo two separate assessments. The first-step assessment involves a standardized questionnaire about the individual's physical condition and cognitive function, covering 85 items across 7 body parts. In addition to this questionnaire, a written opinion letter from the attending physician is required. After passing the initial assessment, a second-step assessment is conducted by a local committee of experts in the fields of medical, healthcare, and welfare. This committee determines the beneficiary's level of need and corresponding quantity of services based on previous assessment results. In principle, the committee would review the updated care level every six months. For the secondary insured, the requirement is limited to certain conditions resulting from age-related diseases, such as terminal cancer and rheumatoid arthritis²¹.

Based on physical and mental condition, as well as daily living abilities, the scheme divides the LTC status into a total of 7 levels with Support Level 1-2 and more severely Care Level 1-5. Each level corresponds to different care services and service hours. The insured assessed as Support Level is eligible for preventive long-term care benefits and that assessed as Care Level is eligible for long-term care benefits.

The scheme provides a variety of long-term care services including institutional, home and community-based services. It affords up to 90% of total care costs. Policyholders need to pay for related service expenses with a 10% copayment ratio and persons with income above a certain level need to pay for 20% after 2015.

The commercial market of LTCI in Japan is relatively well-developed and comprehensive. Many insurance companies offer a variety of commercial LTCI products with different product features (Table 14).

Mainstream features of commercial LTCI products in Japan could be summarized as:

- Basic product features: most products are base policies. A few products offer participating features. Some products provide LTCI as a rider attached to medical insurance products. The

¹⁹ Ministry of Health, Labor and Welfare, Long Term Care Insurance System of Japan

²⁰ Yuan, X., & Liu, H. (2019). Comparison of long-term care insurance system in Japan and Germany and implications for China. *Jpn. Res*, 33, 64-72.

²¹ Minmin Xu & Na Duan (2019), the experience and lessons from the long-term care insurance in Japan and Korea. *Journal of Insurance Professional College* (Bimonthly), 5.

- coverage term is usually as long as lifetime. The issue age varies from a young age to a very old age such as 85;
- Assessment standards: most products require the health condition of the insured assessed as equivalent to Care Level 2 or above. Some products extend to the requirement for specific diseases such as dementia. A few products are purely based ADLs;
 - Benefit payment: most products offer a lump sum cash payment as the insurance benefit, rather than expense reimbursement of care costs. The contract terminates once the benefit is paid. A few products offer limited term payouts or even lifetime payouts with a guaranteed payment of certain years;
 - Other coverage: many products offer death benefits. For such product, long-term care benefit is then designed as the acceleration benefit of the death benefits.

Table 14
THE FEATURE OF TYPICAL COMMERCIAL LTCI PRODUCTS IN JAPAN

Insurance company	Gibraltar Life	Sony Life	Taiyo Life
Issue age	15-75	20-85	20-79
BP	Whole life	Whole life	Whole life
Benefits	A lump sum of 50% SA payable on transition to disable level and the rest payable when the insured dies.	200% SA in the first year of LTC status and 100% SA in each subsequent year. Optional death benefit (DB): 0.1%/ 100% SA when the insured dies before transition.	100% SA each year while the insured stays in the LTC status with a guarantee 20-year payment, i.e., the recipient receives unpaid benefits if the insured dies during the guarantee payment period. DB before transition: max (paid premiums, reserves)
Eligibility	Care Level 2 or above		

Source: <https://upset-review.com/life-insurance/care-insurance/index.html>

The sufficient supply of commercial LTCI products implies the development of commercial LTCI market in Japan. Contrary to the market of Mainland China and Hong Kong, CI is not as popular in Japan. The market of Japan is more similar to the market of Taiwan, cancer insurance or specific disease insurance covering cancer, myocardial infarction and stroke dominates the market. Statistics from Life Insurance Association of Japan show that the number of new policies of cancer insurance policies reached 1.68 million, accounting for 13% of the individual insurance in 2022. Cancer insurance or diseases insurance with 3 specific disease overlaps less with LTCI than CI. Also, the existence of social LTCI helps the promotion of commercial LTCI from many aspects including experience data accumulation, underwriting and more importantly, claim investigation.

1.5 SUMMARY OF MARKET REVIEW

Societies in the Asia-Pacific have faced similar challenges due to an aging population in recent decades. Some markets entered an aging society earlier than others and started the establishment of the social LTC system earlier. As people grow older, the need for long-term care increases as the probability of failure to live an independent life increases. Addressing the long-term care need for the elderly is crucial for an aging or aged society, since it directly affects citizens' ability to lead dignified daily lives and places pressure on society to provide sufficient and proper care. The development of commercial LTCI can be considered as one of the solutions to this challenge.

Experience from markets in Taiwan, Singapore and Japan underscores the importance of social LTC schemes. The existence of social LTC scheme with universal coverage promotes awareness of the longevity

risk, the risk of long-term care and the corresponding necessity for commercial LTCl. Besides, the government-led scheme enables generic long-term care assessment standards and more reliable assessment results. This paves the way for the development of commercial LTCl with the guidance of experience data, underwriting and claim settlement, etc.

For commercial LTCl products in Asia-Pacific, the mainstream eligibility requirements include ADLs, disease diagnosis and physical disability. Most products offer cash benefit payouts while very few product provides care services as an insurance benefit. Most elderly people prefer home care by caregivers or family members rather than nursing homes. Cash payment enables flexible choices for the insured.

It is worth noting the relationship between CI and LTCl. Unlike other markets, CI products or similar cancer insurance dominates the health insurance markets in Asia-Pacific. CI products cover more than 100 critical illnesses including those that may lead to a need for long-term care. Therefore, CI products could be regarded as the replacement for LTCl to some extent, especially for the type of LTCl products based on the diagnosis of specific pre-defined illnesses. When an LTCl product covers fewer diseases with a not-so-cheap price, it is unlikely to attract its target customers. People would rather pay higher premiums for CI products with broader coverage.

In the markets of Taiwan and Japan, there is still an opportunity to develop LTCl as CI is not as dominant, and LTCl has less overlap with cancer insurance. Customers could purchase both cancer insurance and LTCl policies to address their needs. In Singapore, though CI insurance is a pillar product, the insured rate of commercial LTCl as supplemental to the social LTCl scheme is not as low as expected. The supplements are based on ADLs in accordance with social LTCl and offer various coverage apart from simple LTC benefits. The criteria overlap less with CI insurance requiring diagnosis of pre-defined illness, leaving room to promote commercial LTCl from a CI dominant market. From Singapore's experience, an LTCl product with proper eligibility and enriched coverage is more likely to succeed in a CI-dominant market.

For the markets of Mainland China and Hong Kong, without guidance from a nationwide social LTCl scheme, business segmentation between currently dominated CI and LTCl becomes more important. If the product is designed based on the pre-defined illness simply to reduce the claim assessment risk and moral hazard risk, the product is less likely to generate satisfactory premium volume, though risks are indeed reduced.

Insurance companies in these two markets may consider adopting a system similar to the Japan's social LTCl system. The scheme partitions the insured by age and offers different coverages. Partitioned coverages match different risks and needs as younger people are more exposed to CI risk and the elderly are more exposed to LTC risk. Customers in these two markets are well-informed about the risk of critical illness. Therefore, the combination of CI and LTCl could better fit the CI domination in the market to promote the necessity of LTCl.

One notable feature of LTCl is the consistent payouts as long as the insured remains in a long-term care status. This feature is slightly similar to pension annuity, which is mature and mainstream. It is worth considering the combination of LTCl and annuity. The concept of pension annuity coincides with that of LTCl: both products provide the solution for a better life when one grows old. The product combination could be advertised as pension doubles when the insured becomes disabled. Moreover, once the insured transits to a long-term care status, the life expectancy decreases accordingly as the health condition deteriorates. This reduces the longevity risk for pension annuity.

Companies with experience in managing elderly communities may refer to the Taikang mode in Mainland China. Such companies have insights into residents' health conditions living in their own communities.

Besides, elderly residents in the community are also target customers of LTCI products. Promoting LTCI products to community residents could be a form of precision marketing, requiring fewer resources.

Section 2: Pricing of two sample LTCI products

2.1 PRODUCT FEATURES, MODELING METHODOLOGY AND ASSUMPTIONS

2.1.1 PROPOSED PRODUCT FEATURES

Two sample products are designed based on the characteristics of the Asia-Pacific markets (Table 15). For both products:

- The eligibility criteria are the inability to perform at least 3 out of the 6 ADLs. ADLs are widely acceptable and easy to understand for most markets and loss of 3 ADLs is usually considered as a severe level of LTC status. Assessment based on ADLs enables incorporation of recovery rate in pricing to reduce the premium and reveal a more complete risk profile. It also differentiates from the CI product with distinguished criteria.
- Insurance benefits are designed as cash payout. As discussed above, the cash payout product is more popular in Asia-Pacific and it enables more flexible choices for the elderly. Another common way is to reimburse related expenses. However, reimbursement products require more sufficient nursing homes available for the insured while people may find it difficult to access a satisfactory nursing home in some markets.
- Both products offer a fixed service expense budget to support value-added service attached to the policy that is purchased from TPAs.
- The premium pattern is designed as level premium with CSV available. For products with long term BP, the alternative option of the premium pattern is an annual renewable term (ART). Premiums are usually low when the insured enters the pool and then increase with growing age and policy years, leading to risks known as the death spiral as premiums gradually become unaffordable for policyholders and policy surrenders are discretionary to them with few costs. Under such circumstance, the healthy population is more likely to surrender if they consider premiums as unaffordable or if there are competitive products with cheaper premiums while the unhealthy population tends to stay in the pool. Therefore, the claim experience would deteriorate rapidly resulting from different behaviors of different populations.

For the difference between two products:

- Product I is pure LTCI. The insured is entitled to annual cash payment while staying in the LTC status unless the insured recovers or dies. Product I aims at customers aged 40 or above to cover LTC risks due to growing ages.
- Product II combines both LTCI and CI. The product offers CI coverage when the insured is aged under 60 and then switches to LTCI coverage once the insured turns to age 60. From the experience in the market of Mainland China, younger customers are more interested in CI insurance as the average age of CI insurance policyholders is 27. Therefore, product II is designed to attract younger policyholders. In one's life cycle, risks differentiate in each stage. Before one retires, CI is regarded as a main risk. In this stage, the incidence rate of CI increases rapidly while one is still at working age and supports the family financially. The diagnosis of critical illness is likely to result in working inability with an effect on family support and post-diagnosis life. In the

stage of post-retirement, LTC becomes a main risk when one ages as the family's supporting responsibility is relieved, the daily costs could be covered by pension, but potential long-term care costs may become unaffordable.

Table 15
THE DETAILED FEATURES OF TWO SAMPLE LTCI PRODUCTS

Product		Product I	Product II
Benefits	Death Benefit (DB)	Once the insured dies, insurer pays the maximum of paid gross premiums or CSV and the contract terminates.	
	CI	-	Once the insured is diagnosed with CI before age 60, insurer pays SA and the contract terminates.
	LTC	Once the insured transits to LTC status, insurer pays SA yearly until the insured dies or recovers.	Once the insured transits to LTC status after age 60, insurer pays SA yearly until the insured dies or recovers.
	Waiver of Premium (WOP)	Once the insured transits to LTC status, the subsequent outstanding premium is waived.	
PPP		5/10/15/20 years	
BP		10 years/To age 80/To age 100	
Additional TPA service		While the insured stays in the LTC status, the contract offers additional care service with fixed annual budget.	

2.1.2 MODEL IMPLEMENTATION METHOD

Unlike other health insurance products, LTCI benefits are typically not lump sum but rather provide coverage based on the insured person's current health status. The benefit is paid while the insured stays in the LTC status and is suspended once the insured recovers. Therefore, it requires more assumptions to evaluate the insured's expected health status in the future. It imposes a significant challenge to evaluate the number of policies between different groups, making modeling an LTCI product more complicated.

There are two mainstream modeling approaches for LTCI: the first principle and the claim-cost²².

The first principle approach imposes a Markov assumption to describe the process in the model. It calculates the expectation of the insured's future health status through the incidence rate and the recovery rate. The incidence rate reflects the transition probability of the off-claim(healthy) lives pool into the on-claim(disabled) lives pool while the recovery rate reflects the transition probability of the on-claim lives pool into the off-claim lives pool. The first principle approach enables precise partitions of off-claim lives and on-claim lives and their interactions.

There are several advantages of using this approach:

- It allows projection of expected cash flows on two separate partitions, leading to more precise cash flow evaluation;
- It helps insurers to evaluate LTCI product's profit and the underlying profit drivers more accurately, particularly in the current environment where accounting principles demand increasing precision;

²² American Academy of Actuaries, Long-Term Care Insurance Practice Note (May 2021)

- It allows prompt assumption adjustments following the company's experience analysis update to ensure the best-estimated assumptions more suitable for the current situation.

There are also several disadvantages of the first principle modeling approach:

- It requires more precise and credible assumptions such as incidence rates, recovery rates and mortality rates for different partitions;
- Modeling is more complicated, which impacts the runtime of actuarial model calculations;
- It may need reformation on the actuarial software as some actuarial software may not support the status transition models required by this approach.

Another common approach is the claim-cost approach, which is similar to traditional modeling of health insurance products. It involves assumptions such as incidence rate and pre-stored claim cost assumptions to evaluate the LTCI. The pre-stored claim cost assumptions represent the present value of benefits at claim settlement, similar to an annuity factor to represent claim durations. Such approach does not differentiate between off-claim lives and on-claim lives. Therefore, modeling using the claim-cost approach is similar to modeling a CI product with the long-term care claim treated as an extra claim cost.

There are several advantages of claim-cost approach:

- It requires fewer assumptions with only incident rates and corresponding pre-stored claim cost assumptions;
- Modeling is simpler compared to the first principle approach. The reformation cost of actuarial software is lower for most companies;
- If the product includes a maximum payout duration in its product feature, such approach can easily incorporate in the modeling.

There are also some limitations in this approach:

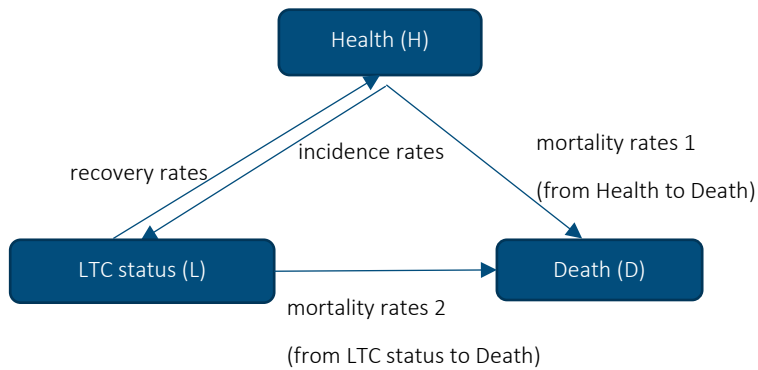
- The precision is lower due to the mix of off-claim lives and on-claim lives;
- There is an implicit and fixed discounting factor in the pre-store claim cost factors. Under different basis, the use of the same pre-store claim cost factors cannot reveal the effect of discounting factor explicitly, leading to discrepancies in reserve and profit evaluation.

In this study, the first principle approach is used to better reflect the effect of recovery rate on off-claim live, on-claim lives and their interactions. The premium is derived by:

$$PV(\text{gross premium}) = PV(\text{expenses}) + PV(\text{claims})$$

Policies in-force are split into different groups. The transitions between different groups of people in the modeling are shown in the Figure 5.

Figure 5
ILLUSTRATION SAMPLE FOR STATUS TRANSITIONS



Therefore, the main related pricing assumptions in this study include:

- Incidence rate: transition probability from the health population to the LTC status population
- Mortality rate 1: mortality rate of the healthy population
- Mortality rate 2: mortality rate of the LTC status population
- Recovery rate: transition probability from the LTC status population to the health population
- CI incidence rate: morbidity rate for the healthy population and only used in product II

To calculate the number of policies in different populations, following equations are used.

$$\begin{aligned}
 l_{x+0}^H &= 1, l_{x+0}^L = 0, l_{x+0}^D = 0 \\
 l_{x+t}^H &= l_{x+t-1}^H \times q_{x+t}^{H \rightarrow H} + l_{x+t-1}^L \times q_{x+t}^{L \rightarrow H} \\
 l_{x+t}^L &= l_{x+t-1}^H \times q_{x+t}^{H \rightarrow L} + l_{x+t-1}^L \times q_{x+t}^{L \rightarrow L} \\
 l_{x+t}^D &= l_{x+t-1}^H \times q_{x+t}^{H \rightarrow D} + l_{x+t-1}^L \times q_{x+t}^{L \rightarrow D} + l_{x+t-1}^D \times 1
 \end{aligned}$$

The actuarial model used in this study is an Excel-based model. When using the first principle approach, there is a limitation in quantifying the maximal payout duration. Therefore, the products and models discussed in this study do not incorporate a maximal payout duration for the long-term care benefit.

2.1.3 MAIN ASSUMPTIONS AND DATA

Incidence rate

The data used as the incidence rate is from China Population Census Yearbook 2020 Table 8-2. It contains self-reported ADLs for people aged 60-99 with gender and exact age distinguished. Since the data is based on population census, the exposure for each age is larger than other data sources, particularly for very old ages. The total sample size is as large as 20 million. Besides, the population census is completed by the government nationwide. Therefore, the corresponding incidence rate and its trend is regarded as more reliable.

The incidence rate for age X is thus:

$$q_x^{LTC} = \frac{l_x^{LTC}}{l_x^{total\ population}}$$

Note that LTC status in the census is defined as loss of at least 1 ADL in the most recent one month. Besides, the loss of ADLs is self-reported rather than not strictly assessed by any professional institutions. In this study, the population census with self-reported 1 ADL is used as the incidence rate for LTCI requiring at least 3 ADLs to leave room for the safety margin for insurers.

Also, the study has derived incidence rates for people aged 18-59 and 100 from the original data using the CBD extrapolation method and the MLE parameter estimation. The degree of the fitting is acceptable as the squared value of R is close to 1 and the P-value is close to 0, showing that the results are significant. Details are shown in Appendix A. See Appendix Table B4 for completed incidence rate used for pricing.

Mortality rate of the healthy

The mortality rate 1 used is 100% China Life Insurance Mortality Table (2010—2013) Life Table 1&2 (see Appendix Table B2). The table is the standard mortality used for the health insurance business.

Mortality rate of the LTC

The mortality rate 2 used is 200% China Life Insurance Mortality Table (2010—2013) Life Table 1&2. As analyzed in the sensitivity testing section, lower mortality of the LTC indicates more conservative profits due to higher LTC benefit payout. As recommended by a reinsurer and there lacks corresponding studies for Asia-Pacific markets, the mortality rate 2 is assumed to be 200% of the mortality rate 1.

Recovery rate

It is difficult to determine the recovery rate:

- There is a lack of supportive researches about the recovery rate for insurance industry. To study the recovery rate, the insurance company usually needs to observe and analyze the on-claim lives. For undeveloped markets, the incidence rate alone is already a challenge. The number of LTCI policies in force is too small to support experience analysis. Therefore, this is no credible recovery rate available to use.
- The recovery rate is sensitive to subjective judgment. Unlike CI, the LTC criteria is not based on objective biometric indicators. There is also a lack of widely acknowledged institutions or professionals equivalent to hospitals or doctors to issue assessment results in undeveloped markets. Therefore, the actual may deviate dramatically from expected.
- The recovery rate is subject to the review frequency. Too frequent review increases investigation costs for insurers significantly while lower frequent review may underestimate the recovery rate. The insurance company needs to balance the review frequency between investigation costs.
- Moral hazard risks cannot be ignored for indemnity products. It is likely that the insured would be strongly motivated to strive for the benefit payout even if he or she is completely healthy or already recovered.

Referring to the experience study of SOA in the US²³ and the research results of Xinjun Wang²⁴ based on data from Mainland China, the recovery rate is assumed to be 20% per year.

The recovery rate from the SOA experience study was 39%. The study analyzed more than 9 million private LTCI policies provided by 35 insurance companies. The LTC criteria was diversified and the benefit payment method included reimbursement and indemnity. Xinjun Wang analyzed 16,304 samples from the years 2013-2015 using China Health and Retirement Longitudinal Study dataset. The adjusted recovery rate was estimated to be 30%-40%. Adjustment is made to ensure the LTC criteria consistency with the sample products.

As sample products are based on 3 ADLs and provide cash payout, the moral hazard risk is assumed to be higher than reimbursement products. The recovery rate is thus determined as 20% in accordance with prudence principle.

CI incidence rate

The CI incidence rate for product II is assumed to be 150% China Life Insurance Experienced Critical Illness Table (2020) CI4 (See Appendix Table B3). The table is the standard incidence rate for core 28 critical illnesses. Due to the prudence principle and the possibility of illness expansion, an extra 50% margin is used.

Loading

The average loading is assumed to be approximately 10% (Table 16). To keep the product premium acceptable, the loading is relatively lower than other regular health insurance products.

Table 16
THE LOADING ASSUMPTIONS FOR PRODUCT I AND PRODUCT II

PPP	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-15	Year 15+
5 year	30%	10%	5%	2%	2%	0%	0%
10 Year	45%	20%	20%	5%	5%	2%	0%
15 Year	60%	30%	20%	10%	10%	2%	0%
20 Year	65%	35%	25%	15%	10%	2%	1%

Profit testing assumptions

Main assumptions are summarized below. Detailed are listed in Appendix B.

- Investment rate: 4.5%;
- Incidence rate: 80% of the pricing incidence rate with selection factor;
- Mortality rate 1: 80% of the corresponding pricing rate with selection factor and improvement factor;
- Mortality rate 2: same as the corresponding pricing rate with selection factor and improvement factor;
- CI incidence rate: 110% Table CI4 with deterioration factor:
- Recovery rate: same as pricing;
- Acquisition expense: 60 per policy and 20% per annualized first year premium(AFYP);
- Maintenance expense: 120 per policy and 5% per AFYP;

²³ SOA, Long-Term Care Experience Committee Intercompany Study Report 6 1984-2007

²⁴ Xinjun Wang & Jiayu Wang. (2018). Long Term Care Insurance Pricing Based on the Markov Model. Insurance Studies (10), (10), 87-99.

- TPA expense: 20 per policy with a growth of 10% for every 5 years;
- Others: please refer to the Appendix B.

2.2 PRICING RESULTS

2.2.1 PREMIUMS

Premium comparison: product I vs product II

Premiums of partial model points for male are shown in the following table (Table 17). The premium trend is closely related to the benefit coverage and the corresponding incidence rate.

Table 17

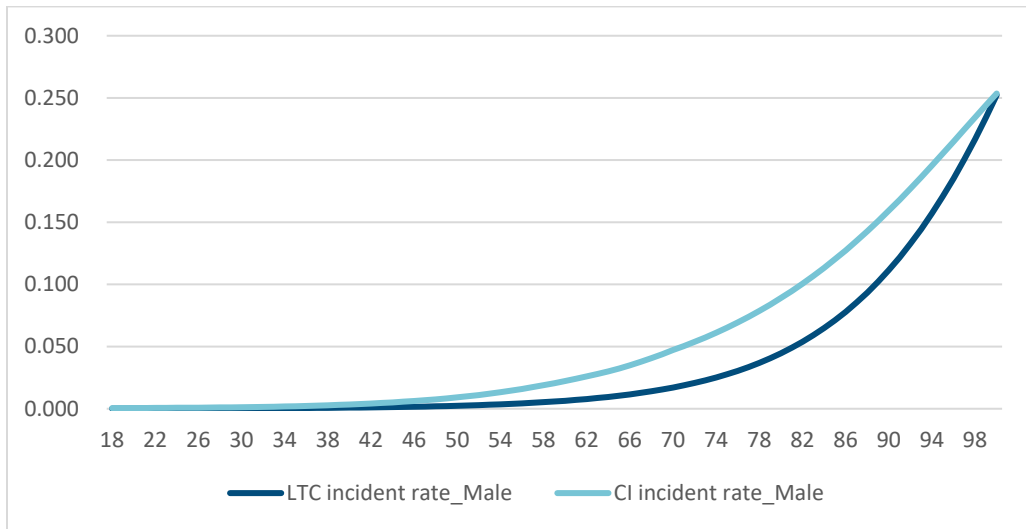
THE PREMIUM COMPARISON BETWEEN PRODUCT I AND II (SA=120,000²⁵, MALE)

PPP	BP	Age	Product I	Product II
			M	M
10	10	30	162	230
10	10	40	439	609
10	10	50	1,200	1,523
10	10	60	3,396	3,396
10	T80	30	5,509	4,571
10	T80	40	7,785	6,311
10	T80	50	11,050	9,196
10	T80	60	14,256	14,256
10	T100	30	9,388	7,548
10	T100	40	14,245	11,455
10	T100	50	22,639	19,080
10	T100	60	41,752	41,752

For shorter BP, the premium of product I is lower than the premium of product II while it exceeds the premium of product II when BP extends. This is due to significantly higher CI incidence rate for ages below 60. Therefore, in shorter BP, product II is more expensive. As the LTC incidence rate increases for old ages rapidly, the LTC liability increases accordingly. Besides, there are more CI decrement policies under product II and comparatively more survivors under product I with the absence of CI coverage for age 60 or above, leading to more LTC claims (Figure 6). It thus pushes up premiums for longer BP.

²⁵ The annual LTCI benefit pays SA. Here 120,000 SA is equivalent to monthly payout of 10,000.

Figure 6
THE INCIDENCE RATE COMPARISON: LTCI VS CI (MALE)



Premium comparison: male vs female, product I

Premiums of partial model points for product I are shown in the Table 18.

Table 18
PREMIUMS OF PRODUCT I FOR DIFFERENT GENDERS (SA=120,000)

PPP	BP	Age	Product I	
			M	F
10	10	30	162	81
10	10	40	439	260
10	10	50	1,200	836
10	10	60	3,396	2,754
10	T80	30	5,509	4,715
10	T80	40	7,785	6,647
10	T80	50	11,050	9,283
10	T80	60	14,256	11,910
10	T100	30	9,388	10,215
10	T100	40	14,245	15,572
10	T100	50	22,639	24,800
10	T100	60	41,752	44,286

For pure LTCI product I, premiums of male are higher than those of female when BP is shorter than to age 100. When BP is to age 100, the trend reverses. This is mainly caused by the incidence rate trend and the fact that the life expectancy of female is generally longer than male. For age under 74, the male incidence rate is higher while for age 75 and above, the female incidence rate exceeds the male incidence rate and keeps increasing rapidly (Figure 7-1 & Figure 7-2).

Figure 7-1
THE LTC INCIDENCE RATE OF AGE UNDER 74

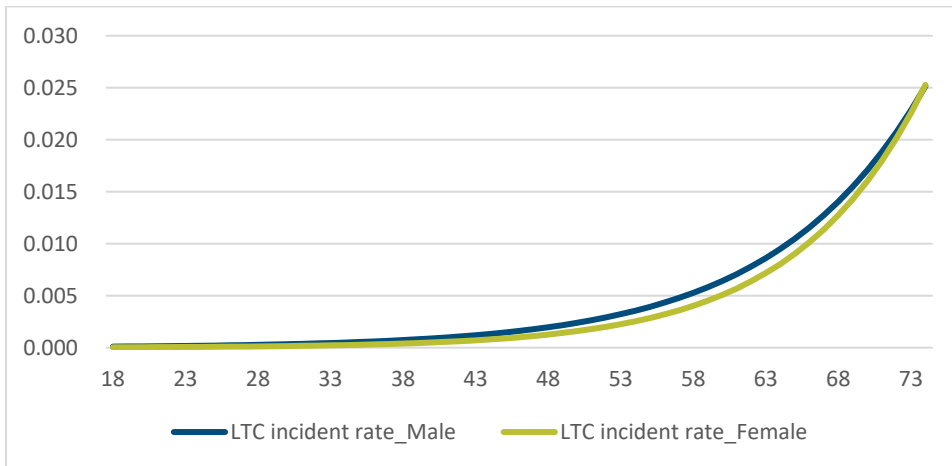
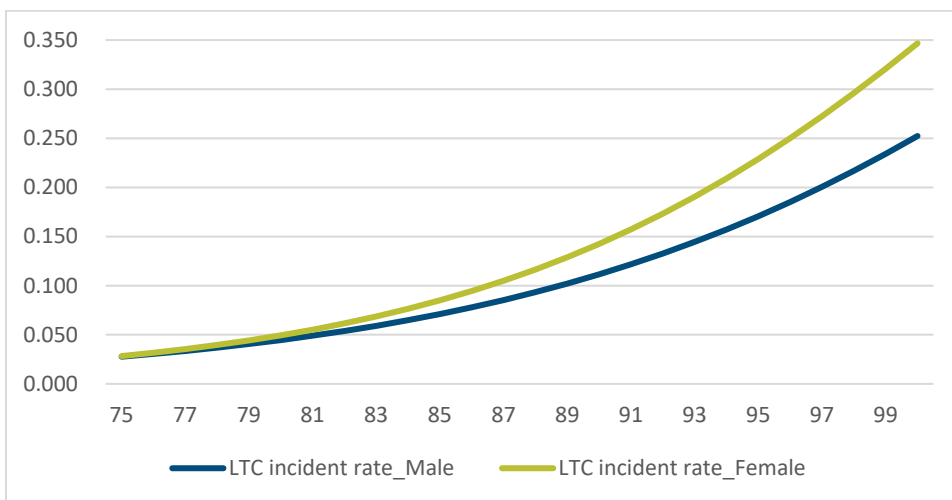


Figure 7-2
THE LTC INCIDENCE RATE OF AGE ABOVE 74



Premium comparison: male vs female, product II

Premiums of partial model points for product II are shown in the Table 19.

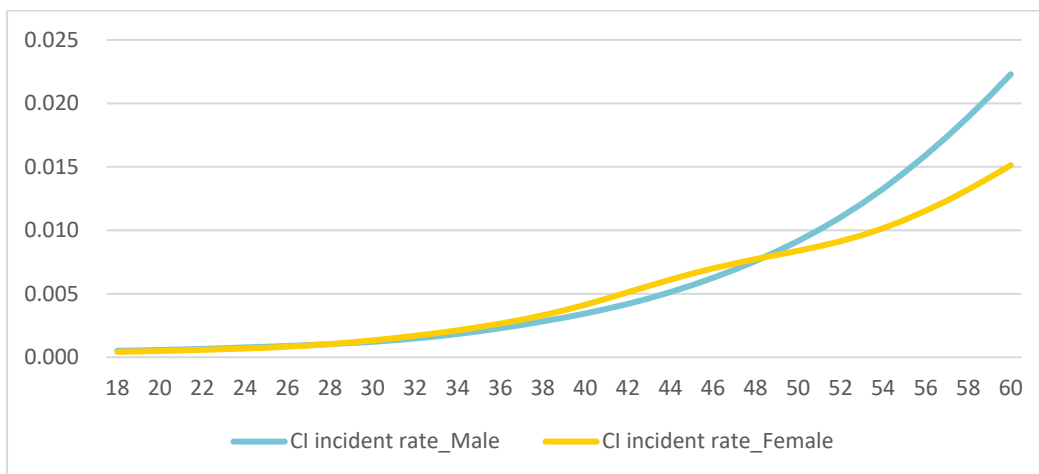
Table 19
PREMIUMS OF PRODUCT II FOR DIFFERENT GENDERS (SA=120,000)

PPP	BP	Age	Product II	
			M	F
10	10	30	230	326
10	10	40	609	851
10	10	50	1,523	1,375
10	10	60	3,396	2,754
10	T80	30	4,571	4,744
10	T80	40	6,311	6,259
10	T80	50	9,196	8,405
10	T80	60	14,256	11,910
10	T100	30	7,548	8,711

10	T100	40	11,455	13,337
10	T100	50	19,080	22,101
10	T100	60	41,752	44,286

For combined product II with BP shorter than to age 100, premiums of younger male are lower than younger female. As age increases, the premium gap narrows until the trend is reversed. When BP is to age 100, female premiums are always higher than male premiums. Except for the fact that the female incidence rate exceeds the male incidence rate for older ages, the male CI incidence rate is lower than that of the female for age 28-48 (Figure 8).

Figure 8
THE CI INCIDENT RATE COMPARISON FOR MALE AND FEMALE



2.2.2 EFFECT OF ALTERNATIVE DESIGN AND ASSUMPTION ON PREMIUMS

Recovery rate

As discussed above, determination of the recovery rate assumption is crucial but also difficult. To fully reflect the effect of the recovery rate, this study has tested premiums with different recovery rate assumptions (Table 20 & Table 21). When the recovery rate drops to 10%, premiums increases by approximately 40%. In the scenario where the recovery rate is 0%, premiums double dramatically. Besides, male and younger ages are more sensitive to the change in recovery rate than female and older ages respectively.

Again, the recovery rate assumption should be considered prudentially as it heavily affects premiums. In the long run with medical improvement, the recovery rate is likely to improve accordingly. It is recommended to consider the long-term trend at the same time.

Table 20
PREMIUMS UNDER DIFFERENT RECOVERY RATE ASSUMPTIONS (MALE)

Age	Male, T100, 10-year pay, SA=120,000, Product I				
	Premium under different recovery rate assumptions			Premium comparison	
	20% (Baseline)	10%	0%	10% / baseline	0% / baseline
30	9,388	13,065	22,233	139%	237%
40	14,245	19,678	32,587	138%	229%
50	22,639	30,833	48,948	136%	216%
60	41,752	55,368	82,294	133%	197%

Table 21
PREMIUMS UNDER DIFFERENT RECOVERY RATE ASSUMPTIONS (FEMALE)

Age	Female, T100, 10-year pay, SA=120,000, Product I				
	Premium under different recovery rate assumptions			Premium comparison	
	20% (Baseline)	10%	0%	10% / baseline	0% / baseline
20	6,873	9,326	15,138	136%	220%
30	10,215	13,848	22,323	136%	219%
40	15,572	21,046	33,446	135%	215%
50	24,800	33,267	51,493	134%	208%
60	44,286	58,460	86,585	132%	196%

Design of death benefits

Policyholders in Asia-Pacific markets are prone to the return of premiums, particularly for products with higher premiums. For example, mainstream CI products offer either a sum assured upon death or diagnosis of CI, or a separate endowment policy with maturity benefit or death benefit to ensure the return of premiums. If the insured dies and the insurance benefit is less than the paid premiums, policyholders are likely to have a sense of loss. Such a design would be less acceptable in Asia-Pacific markets and it would be challenging for agents. Therefore, sample products are designed to offer ROP as DB. As the product also offers CSV, the DB takes maximum of ROP and CSV as the final benefit to accurately quantify the cost of DB. Otherwise, the policyholder may surrender the policy for CSV rather than claim ROP as DB if CSV exceeds the total paid premiums when the insured dies. Alternatively, the product could offer guaranteed benefit payout duration to ensure ROP.

The study also quantifies the effect of different DB designs on premiums. Three proposals are involved: baseline DB, no DB payout and DB paying a lump sum of SA (Table 22).

It is obvious that less death benefit reduces premiums. Premiums of no DB payout seem attractive with approximately half of baseline premiums for older ages, but it would lead to a sense of loss for policyholders under certain circumstances such as accidental death without LTC benefit received yet. If the insurance company is confident that reducing DB is acceptable in the local market, then reducing DB is an effective design to decrease premiums and the company may offer DB as an optional rider.

The comparison of baseline DB design between DB paying a lump sum of SA is slightly more complicated. For model points with shorter BP or younger ages, baseline premiums are cheaper. Thus costs of ROP are lower than those of SA payment. As BP or age increases, baseline premiums increase accordingly and push up DB costs. Once total premiums exceed SA, the baseline premium becomes more expensive. For these model points, the SA payout fails to cover the total premium paid. Thus baseline DB is designed as ROP to reduce premiums for younger ages and avoid the sense of loss.

Table 22
PREMIUMS UNDER DIFFERENT DB PROPOSALS

Male, SA=120,000			Baseline DB	DB = 0		DB = lump sum of SA	
Product I				GP	GP	GP / Baseline	GP
Age	PPP	BP	GP	GP	GP / Baseline	GP	GP / Baseline
30	10	10	162	161	99%	303	187%
40	10	10	439	432	98%	768	175%
50	10	10	1,200	1,152	96%	1,959	163%
60	10	10	3,396	3,036	89%	5,109	150%
30	20	T100	5,709	3,146	55%	5,205	91%
40	20	T100	8,987	4,352	48%	7,240	81%
50	20	T100	15,765	6,000	38%	10,130	64%

2.2.1 PREMIUM COMPARISONS

Comparison between current LTCI products

Two LTCI products with similar eligibility criteria and payout designs from the market of Mainland China and Taiwan are used for comparisons (Table 23). Premiums of sample products are lower than these two existing LTCI products. Apart from the differences in pricing incidence rate, sample products offer fewer LTC benefits. Besides, average loadings of sample products are set lower than regular health insurance products to clearly reveal LTCI costs and reduce premiums. Insurers usually set higher loadings to pursue profits. For product II, the product offers a lump sum CI benefit rather than a consecutive LTCI benefit. It further helps to reduce premiums.

Table 23

PREMIUM COMPARISON OF SAMPLE PRODUCTS AND EXISTING LTCI PRODUCTS

Product		Product I	Product II	Taiwan product	Mainland China product
Benefit	DB	Max (ROP, CSV)		-	-
	LTC	SA p.a.	Age ≥ 60: SA p.a.	Lump sum of 600% SA	Minor LTC status: SA monthly
				SA monthly	Severe LTC status: 150% SA monthly
					Severe cognitive impairment: extra 30% SA monthly
	CI	-	Age < 60: lump sum of SA	-	-
	WOP	√	√	√	√
LTC benefit eligibility		3ADLs	3ADLs	3ADLs	Barthel index ≤ 60
LTC benefit cap		No limit	No limit	192 months	180 months
Insurance plan		40M / 10PPP / To age 100; Annual payment = 120,000			
GP		14,245	11,455	15,480	19,305 (T106)
GP comparison based on Product I		100%	80%	109%	136%
Insurance plan		40F / 10PPP / To age 100; Annual payment = 120,000			
GP		15,572	13,337	24,650	28,818 (T106)
GP comparison based on Product I		100%	86%	158%	185%

Comparison between CI products

Several typical CI products from the market of Mainland China and Hong Kong are used for comparisons (Table 24). Premiums of sample LTCI products are higher than those of CI products, but they are no more than 3 times for the male and 3.5 times for the female of premiums with the lowest premiums of existing CI products in comparison.

LTCI pays consecutively while the insured stays in LTC status and is alive while the core CI benefit is one-time. Although some CI products offer multiple CI options, the payment is restricted within specified diseases and the product usually requires a minimal one-year interval period. For the insured, as long as one survives more than 3 years since diagnosis of CI and then transitions to LTC status, the LTCI product outperforms. According to *The Statement Report of China Life Insurance Experienced Critical Illness Table*, the survival rate differs significantly with diseases. The five-year survival rate of CI such as coronary artery bypass grafting surgery and heart valve surgery reaches over 90%. The five-year survival rate of common LTC related CI such as paralysis and acute myocardial infarction is over 70%. The overall 5-year survival rate for 25 core CI diseases is approximately 59.1%. With medical improvement in the long term, the five-year survival rate is believed to rise.

In addition, the proposed LTCI product provides DB independent from the LTC benefit while the mainstream CI products provide CI benefit as an acceleration portion of DB. Therefore, the proposed products and sample CI products are not equally comparative in the aspect of DB. Even if the insured dies within 3 years since diagnosis of CI, the beneficiary is still entitled to DB under the proposed LTCI product while no DB is paid under the CI product.

Thus as long as LTCI premiums are controlled within a reasonable range compared to CI premiums, the overlap between LTCI and CI is reduced and thus leaves room to develop LTCI in the market.

Table 24
PREMIUM COMPARISON BETWEEN SAMPLE PRODUCTS AND CI PRODUCTS

Product		Product I	Product II	Mainland China I	Mainland China II	Mainland China III	Hong Kong I (multi-CI)	Hong Kong II
Benefit	DB	Max (ROP, CSV)		ROP (None if CI is paid)	SA (None if CI is paid)			-
	LTC	SA p.a.	Age ≥ 60: SA p.a.	-	-	-	-	-
	CI	-	Age < 60: lump sum of SA	SA	SA	Age 18-60: 150% SA	CI & others: SA, extra 50%/35% in first ten years Cancer: 5% SA monthly capped at 500%	CI & loss of independence (before age 65): SA
						Age 60+: 100% SA	Alzheimer lifetime annuity (before age 85): 6% SA p.a.	
Insurance plan		40M / 10PPP/ To age 100; SA= 120,000						
GP		14,245	11,455	4,884(WL)	7164(WL)	7956(WL)	8324(WL)	5856
Comparison		100%	80%	34%	50%	56%	58%	41%
Insurance plan		40F / 10PPP/ To age 100; SA= 120,000						
GP		15,572	13,337	4428(WL)	6492(WL)	6828(WL)	8533(WL)	5590
Comparison		100%	86%	28%	42%	44%	55%	36%

In conclusion, sample products are designed to offer ROP as DB to satisfy Asia-Pacific customer tastes to avoid the sense of loss. The premium is acceptable within the market level. Although premiums of LTCI products are higher, the insured who survives more than 3 years receives more benefits under LTCI products than CI products.

2.3 PROFIT TESTING RESULTS AND SENSITIVITY ANALYSIS

Profit margin (PM)²⁶ is used as the profit metric in this study. PM is a widely-used metric in most markets, and it is easy to understand and compare.

²⁶ PM = PV of distributable earnings / PV of premiums, discounting at investment income rate

2.3.1 PROFIT TESTING

Under the baseline scenario, profiting testing results are summarized in the Table 25 & Table 26.

Table 25
BASELINE PM FOR MALE, SA = 120,000, AGE =40

No.	BP	PPP	Product I	Product II
			PM	PM
1	10	5	-20.8%	-4.9%
2	To 80	5	10.8%	10.0%
3	To 100	5	9.7%	8.3%
4	10	10	-20.0%	-0.1%
5	To 80	10	16.1%	15.7%
6	To 100	10	15.4%	14.3%
7	To 80	20	13.5%	13.5%
8	To 100	20	12.9%	12.2%

Table 26
BASELINE PM FOR 10-YEAR PAY, COVERAGE TO AGE 80, SA = 120,000

No.	BP	PPP	Issue Age	Gender	Product I	Product II
					PM	PM
1	To 80	10	30	M	17.6%	16.6%
2	To 80	10	40	M	16.1%	15.7%
3	To 80	10	50	M	14.9%	15.1%
4	To 80	10	60	M	13.1%	13.1%
5	To 80	10	30	F	18.1%	16.2%
6	To 80	10	40	F	16.5%	15.5%
7	To 80	10	50	F	14.5%	14.7%
8	To 80	10	60	F	12.0%	12.0%

There are several features worth noting:

- For shorter BP, PM of product I is worse than that of product II while the trend reverses for longer BP;
- However, PM does not increase with longer BP since PM for coverage to age 80 is the highest. This might imply that PM for older ages is worse;
- For both products, 10-year BP generates negative PM. This is caused by high acquisition expenses in the front end and the difference of interest rate assumptions in product pricing and profit testing. BP covering 10 years is too short to amortize the cost leading to negative expense margin. In the part of product pricing, the interest rate is assumed to be level at 3.5% while in the part of profit testing, the interest rate of liability valuation assumption uses 750-day moving average treasury yield curve based on C-ROSS requirement which is lower than 3.5% in the early stage;
- PM decreases as age increases and gender is not a significantly sensitive factor;
- Product II generates lower overall profit. Lower baseline PM as the denominator would result in a more fluctuating rate of change in later analysis.

2.3.2 SENSITIVITY ANALYSIS

This study has completed sensitivity testing of main assumptions to better figure out the profit and risk drivers for LTCI products. In the analysis, sensitivity scenarios only change the best-estimate assumptions while liability valuation assumptions remain the same. Key results are summarized in the Table 27.

Table 27
SUMMARY OF KEY SENSITIVITY TESTING RESULTS (MALE, AGE 40, 10-YEAR PAY, TO AGE 80)

No.	Sensitivity scenario		Rate of change ²⁷ Product I	Rate of change Product II
1	Average SA	-50%	-21.2%	-25.7%
2	Mortality Rate 1	+10%	-0.8%	-0.6%
3	(from Health to Death)	-10%	0.8%	0.6%
4	Mortality Rate 2	+10%	0.5%	0.5%
5	(from LTC status to Death)	-10%	-0.5%	-0.5%
6	LTC incidence rate	+10%	-13.7%	-9.2%
7	CI incidence rate	+10%	-	-3.6%
8	Recovery rate	-10%	-10.8%	-6.3%
9	Lapse rate	+10%	-1.0%	-0.3%
10		-10%	1.0%	0.2%
11	Expenses	+10%	-6.2%	-6.7%
12	Liability discount rate	+50bps	0.0%	0.0%
13		-50bps	0.0%	0.0%
14	Investment income rate	+50bps	18.7%	19.3%
15		-50bps	-21.2%	-22.0%

From the summary table, average SA is an important factor. Other factors affecting profit ranked from the most significant to the least are: investment income rate, LTC incidence rate, recovery rate, expenses, CI incidence rate, lapse rate, mortality rate 1, mortality rate 2, and liability discount rate.

Average SA

The average SA in the baseline scenario is assumed to be 120,000, equivalent to a monthly payout of 10,000. Considering that premiums for SA 120,000 might be unaffordable for customers in second-tier cities or below, this study also tests the average SA 60,000 to cover 5,000 monthly expenses (Table 28).

When average SA decreases, PM drops dramatically. Since the product offers additional care services, expenses per policy are higher than regular insurance products. Thus average SA or average premium of the business becomes more important. Besides, shorter BP is prone to changes in average SA.

Table 28
PM RESULTS WITH LOWER AVERAGE SA (MALE, AGE 40)

No.	BP	PPP	Product I with SA = 60,000		Product II with SA = 60,000	
			PM	Rate of change	PM	Rate of change
1	10	5	-45.2%	-116.9%	-22.5%	-356.4%
2	To 80	5	7.4%	-31.3%	6.0%	-39.5%
3	To 100	5	7.6%	-21.5%	5.8%	-29.6%
4	10	10	-47.8%	-139.4%	-20.1%	-21569.5% ²⁸
5	To 80	10	12.7%	-21.2%	11.6%	-25.7%
6	To 100	10	13.4%	-13.4%	11.8%	-17.1%
7	To 80	20	9.7%	-27.9%	9.1%	-32.7%
8	To 100	20	10.7%	-17.2%	9.6%	-21.4%

²⁷ Rate of change = (sensitivity scenario – baseline scenario)/ absolute value of the baseline

²⁸ The rate of change is extremely high because the baseline PM is -0.1%, making the denominator of rate of change close to 0.

Mortality rate 1 (Mortality of the healthy)

Mortality rate is assumed to have two opposite effects on products: higher mortality increases DB payout; higher mortality reduces LTCI benefit payout.

From the summary table (Table 29 & Table 30):

- In general, lower mortality rate 1 improves PM for most model points;
- For BP shorter than age 100, lower mortality always increases the profit. However, PM decreases with lower mortality when BP is to age 100. This verifies previous findings that results for very old age are worse so that higher mortality improves PM;
- Older ages are more sensitive to the change of mortality.

Table 29
SENSITIVITY RESULTS OF MORTALITY RATE 1 (MALE, AGE 40)

No.	BP	PPP	Product I				Product II			
			Mortality: +10%		Mortality: -10%		Mortality: +10%		Mortality: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	10	5	-20.9%	-0.2%	-20.8%	0.2%	-5.0%	-0.4%	-4.9%	0.4%
2	To 80	5	10.7%	-1.1%	10.9%	1.1%	9.9%	-0.9%	10.1%	0.9%
3	To 100	5	9.7%	0.6%	9.6%	-0.6%	8.4%	1.1%	8.2%	-1.1%
4	10	10	-20.0%	-0.3%	-19.9%	0.3%	-0.1%	-25.7%	-0.1%	25.7%
5	To 80	10	16.0%	-0.8%	16.2%	0.8%	15.6%	-0.6%	15.8%	0.6%
6	To 100	10	15.5%	0.2%	15.4%	-0.2%	14.4%	0.5%	14.2%	-0.5%
7	To 80	20	13.3%	-1.3%	13.6%	1.4%	13.4%	-0.9%	13.7%	0.9%
8	To 100	20	12.9%	0.0%	12.9%	0.1%	12.2%	0.3%	12.1%	-0.3%

Table 30
SENSITIVITY RESULTS OF MORTALITY RATE 1 (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I				Product II			
			Mortality: +10%		Mortality: -10%		Mortality: +10%		Mortality: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	30	M	17.5%	-0.4%	17.7%	0.4%	16.6%	-0.3%	16.7%	0.3%
2	40	M	16.0%	-0.8%	16.2%	0.8%	15.6%	-0.6%	15.8%	0.6%
3	50	M	14.6%	-1.9%	15.2%	1.9%	14.9%	-1.4%	15.3%	1.4%
4	60	M	12.5%	-4.3%	13.7%	4.4%	12.5%	-4.3%	13.7%	4.4%
5	30	F	18.1%	-0.2%	18.2%	0.2%	16.2%	-0.2%	16.2%	0.2%
6	40	F	16.4%	-0.4%	16.5%	0.5%	15.4%	-0.4%	15.5%	0.4%
7	50	F	14.4%	-1.1%	14.7%	1.1%	14.6%	-0.8%	14.9%	0.8%
8	60	F	11.7%	-2.8%	12.4%	2.9%	11.7%	-2.8%	12.4%	2.9%

Mortality rate 2 (Mortality of the LTC)

The effect of mortality rate 2 is also assumed two-sided as mortality rate 1. In addition, as the benefit payout is not capped, lower mortality rate 2 indicates more LTCI benefit payouts. From the results (Table 31 & Table 32):

- Lower mortality of the LTC indicates lower profit level, as opposite to the mortality of the healthy;
- Longer BP is more sensitive;
- Older ages are more sensitive;
- Compared to mortality rate 1, PM is less sensitive to the change of mortality rate 2 due to lower level of on-claim policies in force.

Table 31
SENSITIVITY RESULTS OF MORTALITY RATE 2 (MALE, AGE 40)

No.	BP	PPP	Product I				Product II			
			Mortality: +10%		Mortality: -10%		Mortality: +10%		Mortality: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	10	5	-20.8%	0.2%	-20.9%	-0.2%	-4.9%	0.0%	-4.9%	0.0%
2	To 80	5	10.9%	0.9%	10.7%	-0.9%	10.1%	0.9%	9.9%	-0.9%
3	To 100	5	10.0%	3.4%	9.3%	-3.6%	8.6%	4.4%	7.9%	-4.7%
4	10	10	-19.9%	0.2%	-20.0%	-0.2%	-0.1%	0.0%	-0.1%	0.0%
5	To 80	10	16.2%	0.5%	16.0%	-0.5%	15.7%	0.5%	15.6%	-0.5%
6	To 100	10	15.7%	1.9%	15.1%	-2.0%	14.6%	2.3%	13.9%	-2.5%
7	To 80	20	13.5%	0.6%	13.4%	-0.6%	13.6%	0.5%	13.5%	-0.5%
8	To 100	20	13.1%	2.1%	12.6%	-2.2%	12.5%	2.5%	11.8%	-2.6%

Table 32
SENSITIVITY RESULTS OF MORTALITY RATE 2 (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I				Product II			
			Mortality: +10%		Mortality: -10%		Mortality: +10%		Mortality: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	30	M	17.7%	0.4%	17.5%	-0.4%	16.7%	0.4%	16.6%	-0.4%
2	40	M	16.2%	0.5%	16.0%	-0.5%	15.7%	0.5%	15.6%	-0.5%
3	50	M	15.0%	0.7%	14.8%	-0.7%	15.2%	0.6%	15.0%	-0.7%
4	60	M	13.2%	1.2%	12.9%	-1.2%	13.2%	1.2%	12.9%	-1.2%
5	30	F	18.2%	0.3%	18.1%	-0.3%	16.2%	0.2%	16.2%	-0.2%
6	40	F	16.5%	0.3%	16.4%	-0.3%	15.5%	0.3%	15.4%	-0.3%
7	50	F	14.6%	0.5%	14.5%	-0.5%	14.8%	0.4%	14.7%	-0.4%
8	60	F	12.2%	1.0%	11.9%	-1.0%	12.2%	1.0%	11.9%	-1.0%

LTC incidence rate

It is obvious that higher LTC incidence rate raises LTC benefit payouts. Therefore, the optimistic scenario with a decreasing incidence rate is beyond the scope of sensitivity testing. From the summary table (Table 33 & Table 34):

- Longer BP is in general more sensitive as its costs of benefit payout increases while BP covering to age 100 is relatively less sensitive due to higher DB margins contribution for old ages and higher interest margins arising from higher premiums;
- Older ages are more sensitive.

Table 33
SENSITIVITY RESULTS OF LTC INCIDENCE RATE (MALE, AGE 40)

No.	BP	PPP	Product I		Product II	
			Incidence rate : +10%		Incidence rate : +10%	
			PM	Rate of Change	PM	Rate of Change
1	10	5	-24.9%	-19.4%	-4.9%	0.0%
2	To 80	5	8.5%	-21.1%	8.5%	-15.3%
3	To 100	5	7.8%	-19.2%	6.8%	-18.2%
4	10	10	-24.6%	-23.4%	-0.1%	0.0%
5	To 80	10	13.9%	-13.7%	14.2%	-9.2%
6	To 100	10	13.7%	-11.5%	12.9%	-9.8%
7	To 80	20	11.1%	-17.4%	12.1%	-10.5%
8	To 100	20	11.0%	-14.3%	10.8%	-11.2%

Table 34
SENSITIVITY RESULTS LTC INCIDENCE RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I		Product II	
			Incidence rate: +10%		Incidence rate : +10%	
			PM	Rate of Change	PM	Rate of Change
1	30	M	15.6%	-11.1%	15.5%	-6.6%
2	40	M	13.9%	-13.7%	14.2%	-9.2%
3	50	M	12.5%	-15.7%	13.3%	-11.8%
4	60	M	10.6%	-18.9%	10.6%	-18.9%
5	30	F	16.2%	-10.6%	15.2%	-6.2%
6	40	F	14.2%	-13.6%	14.0%	-9.1%
7	50	F	12.0%	-17.3%	12.8%	-13.1%
8	60	F	9.2%	-23.7%	9.2%	-23.7%

Recovery rate

Lower recovery rate implies longer payout duration and thus increases insurance costs. From the results (Table 35&Table 36):

- Product II is less sensitive since it provides CI benefit for those aged below 60, leading to less significant PM fluctuation;
- Longer BP is in general more sensitive as the payout duration increases and thus the impact of recovery rate is enhanced while BP covering to age 100 is relatively less sensitive due to the offset effect of DB margins and interest margins similar to the discussion in LTC incidence rate;
- Older ages are more sensitive.

Table 35
SENSITIVITY RESULTS OF RECOVERY RATE (MALE, AGE 40)

No.	BP	PPP	Product I		Product II	
			Recovery rate: -10%		Recovery rate: -10%	
			PM	Rate of Change	PM	Rate of Change
1	10	5	-22.9%	-10.1%	-4.9%	0.0%
2	To 80	5	9.0%	-16.6%	9.0%	-10.5%
3	To 100	5	8.2%	-15.3%	7.1%	-13.5%
4	10	10	-22.4%	-12.3%	-0.1%	0.0%
5	To 80	10	14.3%	-10.8%	14.7%	-6.3%
6	To 100	10	14.0%	-9.1%	13.2%	-7.2%
7	To 80	20	11.6%	-13.7%	12.6%	-7.2%
8	To 100	20	11.4%	-11.1%	11.2%	-8.2%

Table 36
SENSITIVITY RESULTS RECOVERY RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product 1		Product 2	
			Recovery rate: -10%		Recovery rate: -10%	
			PM	Rate of Change	PM	Rate of Change
1	30	M	16.0%	-9.0%	15.9%	-4.5%
2	40	M	14.3%	-10.8%	14.7%	-6.3%
3	50	M	13.1%	-11.7%	13.9%	-8.0%
4	60	M	11.5%	-12.2%	11.5%	-12.2%
5	30	F	16.6%	-8.3%	15.5%	-4.2%
6	40	F	14.7%	-10.4%	14.5%	-6.2%
7	50	F	12.7%	-12.8%	13.4%	-8.8%
8	60	F	10.2%	-15.6%	10.2%	-15.6%

Expenses

It is clear that PM decreases when expenses increase. Note that expenses here refer to aggregated expenses including the acquisition, maintenance and TPA service. From the table below (Table 37 & Table 38):

- Shorter BP is more sensitive as expense amortization increases;
- Unlike other factors, younger ages are more sensitive since BP is implicitly longer. When BP extends, related expenses increase with longer periods due to inflation.

Table 37
SENSITIVITY RESULTS OF EXPENSES (MALE, AGE 40)

No.	BP	PPP	Product I		Product II	
			Expense: +10%		Expense: +10%	
			PM	Rate of Change	PM	Rate of Change
1	10	5	-24.1%	-15.5%	-7.5%	-51.8%
2	To 80	5	9.6%	-10.5%	8.8%	-11.9%
3	To 100	5	8.7%	-10.4%	7.2%	-12.6%
4	10	10	-23.4%	-17.2%	-2.7%	-2857.5%
5	To 80	10	15.1%	-6.2%	14.6%	-6.7%
6	To 100	10	14.6%	-5.5%	13.4%	-6.3%
7	To 80	20	12.5%	-7.1%	12.5%	-7.5%
8	To 100	20	12.1%	-6.2%	11.3%	-6.9%

Table 38
SENSITIVITY RESULTS OF EXPENSES (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I		Product II	
			Expense: +10%		Expense: +10%	
			PM	Rate of Change	PM	Rate of Change
1	30	M	16.4%	-6.7%	15.4%	-7.6%
2	40	M	15.1%	-6.2%	14.6%	-6.7%
3	50	M	14.0%	-5.8%	14.2%	-5.9%
4	60	M	12.3%	-6.0%	12.3%	-6.0%
5	30	F	16.8%	-7.1%	15.0%	-7.6%
6	40	F	15.4%	-6.4%	14.4%	-6.8%
7	50	F	13.6%	-6.2%	13.8%	-6.2%
8	60	F	11.2%	-6.7%	11.2%	-6.7%

Investment income rate

Due to the difference between pricing rate and investment income rate, the interest margin accounts for main profit source for most insurance products. LTCI is not an exception. A higher investment income rate generates better profit (Table 39 & Table 40). Moreover:

- Longer BP is more sensitive as the proportion of interest margin increases;
- Younger ages are more sensitive due to longer BP in essence.

Table 39
SENSITIVITY RESULTS OF INVESTMENT INCOME RATE (MALE, AGE 40)

No.	BP	PPP	Product I				Product II			
			Investment: +50bps		Investment: -50bps		Investment: +50bps		Investment: -50bps	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	10	5	-19.7%	5.5%	-22.0%	-5.7%	-4.2%	15.1%	-5.7%	-15.6%
2	To 80	5	14.2%	32.0%	6.8%	-36.5%	13.5%	35.0%	6.0%	-40.0%
3	To 100	5	14.6%	51.0%	3.8%	-61.2%	13.4%	62.5%	2.0%	-75.2%
4	10	10	-19.4%	2.7%	-20.5%	-2.7%	0.1%	211.2%	-0.3%	-215.9%
5	To 80	10	19.1%	18.7%	12.7%	-21.2%	18.7%	19.3%	12.2%	-22.0%
6	To 100	10	19.8%	28.6%	10.2%	-34.1%	18.9%	32.2%	8.8%	-38.5%
7	To 80	20	15.9%	18.5%	10.7%	-20.8%	16.0%	18.2%	10.8%	-20.5%
8	To 100	20	16.8%	30.8%	8.2%	-36.5%	16.2%	33.5%	7.3%	-39.8%

Table 40
SENSITIVITY RESULTS OF INVESTMENT INCOME RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I				Product II			
			Investment: +50bps		Investment: -50bps		Investment: +50bps		Investment: -50bps	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	30	M	21.3%	21.3%	13.2%	-25.0%	20.3%	22.2%	12.3%	-26.1%
2	40	M	19.1%	18.7%	12.7%	-21.2%	18.7%	19.3%	12.2%	-22.0%
3	50	M	17.0%	14.5%	12.5%	-15.9%	17.3%	14.6%	12.6%	-16.1%
4	60	M	14.4%	10.2%	11.7%	-10.8%	14.4%	10.2%	11.7%	-10.8%
5	30	F	22.1%	21.7%	13.5%	-25.6%	19.7%	21.6%	12.1%	-25.3%
6	40	F	19.7%	19.4%	12.8%	-22.1%	18.4%	18.8%	12.1%	-21.4%
7	50	F	16.9%	16.1%	12.0%	-17.7%	17.0%	15.5%	12.2%	-17.0%
8	60	F	13.5%	12.1%	10.5%	-12.8%	13.5%	12.1%	10.5%	-12.8%

Lapse rate

The effect of lapse rate is also opposite: higher lapse rate reduces future benefit payouts but it also implies less premium income and leads to fewer policies in force to amortize expenses. From the sensitivity testing (Table 41 & Table 42):

- For BP shorter than age 100, a lower lapse rate increases PM while the pattern reverses when BP is to age 100;
- Younger ages are lapse-supportive while PM for older ages decreases with a higher lapse rate. This is again due to longer BP for younger ages.

Table 41
SENSITIVITY RESULTS OF LAPSE RATE (MALE, AGE 40)

No.	BP	PPP	Product I				Product II			
			Lapse: +10%		Lapse: -10%		Lapse: +10%		Lapse: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	10	5	-21.3%	-2.3%	-20.4%	2.3%	-5.2%	-5.3%	-4.7%	5.2%
2	To 80	5	10.6%	-1.5%	10.9%	1.6%	9.9%	-0.8%	10.1%	0.8%
3	To 100	5	9.9%	2.0%	9.5%	-2.2%	8.6%	3.6%	7.9%	-3.9%
4	10	10	-20.8%	-4.4%	-19.1%	4.4%	-0.4%	-303.1%	0.2%	294.9%
5	To 80	10	15.9%	-1.0%	16.2%	1.0%	15.6%	-0.3%	15.7%	0.2%
6	To 100	10	15.7%	1.4%	15.2%	-1.6%	14.6%	2.5%	13.9%	-2.7%
7	To 80	20	13.1%	-2.7%	13.8%	2.7%	13.4%	-1.4%	13.7%	1.3%
8	To 100	20	12.9%	0.5%	12.8%	-0.7%	12.4%	1.9%	11.9%	-2.1%

Table 42
SENSITIVITY RESULTS OF LAPSE RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product 1				Product 2			
			Lapse: +10%		Lapse: -10%		Lapse: +10%		Lapse: -10%	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	30	M	17.6%	0.2%	17.6%	-0.2%	16.7%	0.6%	16.5%	-0.7%
2	40	M	15.9%	-1.0%	16.2%	1.0%	15.6%	-0.3%	15.7%	0.2%
3	50	M	14.5%	-2.4%	15.3%	2.5%	14.9%	-1.3%	15.3%	1.3%
4	60	M	12.5%	-4.1%	13.6%	4.2%	12.5%	-4.1%	13.6%	4.2%
5	30	F	18.2%	0.6%	18.0%	-0.6%	16.3%	0.5%	16.1%	-0.6%
6	40	F	16.4%	-0.6%	16.6%	0.6%	15.4%	-0.2%	15.5%	0.2%
7	50	F	14.2%	-2.1%	14.9%	2.1%	14.6%	-1.1%	14.9%	1.1%
8	60	F	11.5%	-4.2%	12.6%	4.3%	11.5%	-4.2%	12.6%	4.3%

Other factors

The effect of CI rate is limited and only effective on product II for age below 60. As expected, the increasing rate erodes the profit.

The effect of the discounting rate is also limited since the sensitivity testing is completed by the change of best-estimation assumptions while liability valuation assumptions remain the same. As expected, a lower discounting rate has a positive effect on the profit.

See Appendix C for more details.

2.3.3 SUMMARY

In general, the product I generates a slightly higher baseline profit margin.

For both products, coverage to age 80 generates the highest profit while the profit for age 80-100 is worse due to higher risks for very old ages. The BP is thus recommended to be limited to age 80.

Average SA, investment income, LTC incidence rate and recovery rate are the most significant and sensitive profit testing factors. Insurers should treat these assumptions more prudentially, keep frequent reviews, and adjust assumptions if necessary.

The insureds of different ages are exposed to different risk scenarios. In most cases, older ages are more sensitive. Therefore, an appropriate age proportion is also a key to keeping profit stabilized.

For undeveloped markets, it is difficult to determine assumptions of LTC incidence rate and recovery rate due to a lack of related research. From the sensitivity analysis, the performance of product II is more stabilized due to the coverage partition for those aged below 60. Therefore, it might be a solution to the lack of experience data by designing diversified insurance benefits and using more reliable assumptions to reduce the uncertainty caused by less reliable assumptions.

Section 3: Conclusions and recommendations

LTCI is challenging for most insurance companies. Compared with regular insurance products, more assumptions are involved and it may require intensive modeling modification due to more status transitions and assumptions. In some markets, assumptions such as recovery rate are less accessible and

less reliable. The claim assessment is also difficult. It is closely related to the benefit eligibility and the claim investigation costs are higher than regular insurance products if subsequent assessment reviews are needed. Since the elderly prefer family or home care, most existing LTCI products in the Asia-Pacific are designed as cash payouts. However, the frequent cash payout increases the incentive for the insured to defraud the benefit and thus the moral hazard risk should not be underestimated.

From the market review and pricing results discussed above, several suggestions could be concluded if an insurance company considers to developing an LTCI product.

Before the product development, it is recommended to analyze the social LTC system in the local market. A universal, stable and sustainable social LTC system not only promotes the necessity of LTC including LTCI to the public, but also provides a foundation for commercial LTCI development with more reliable assessment results, experience data and underwriting support. For a market with the absence of a widely-covered social LTC system, the development of commercial LTCI could be more difficult.

For a market where CI insurance dominates, it is crucial to segment the line of business of CI and LTCI. The customer needs for CI insurance and LTCI are not strictly distinguished in such a market, and thus the dominated CI insurance may squeeze out the market opportunity of LTCI. LTCI requiring pre-defined illness overlaps with the coverage of CI insurance in the view of policyholders. Unless such a product is cheap enough compared to CI insurance, otherwise it is less likely to succeed. From the experience in the Asia-Pacific, LTCI products offering diversified and enriched coverage are more attractive to policyholders. Combined benefits with partitioned CI coverage or pension annuity are recommended as examples.

For detailed product design, the following recommendations are highlighted.

- Product feature
 - The benefit term is recommended to extend to longer than 10 years but no more than age 100 to balance high acquisition expenses and risks of very old ages.
 - The premium pattern could be either level premium or ART premium with a certain guaranteed renewal period. But for products with ART premium, the risk known as the death spiral arises. Then the management of persistency becomes critical.
 - The payout form depends on the market condition. The cash benefit payout usually enables more flexible choices for the insured but also increases moral hazard risk.
 - Since premiums of typical LTCI usually seem higher than regular health insurance products, the product should avoid the situations where benefits are even less than paid premiums. It is recommended to offer DB with ROP or provide a guaranteed payout duration. If the company is confident about convincing customers with reduced benefits in exchange for lower premiums, then reducing DB is an effective way to control premiums and full DB could be offered as an optional rider policy.
 - To mitigate risks, the maximum payout duration and deferment period should be incorporated.
- Important assumptions:
 - Recovery rate is critical but often less accessible and less reliable. The determination of the recovery rate should consider the balance of assessment review practice and costs, and the actual experience.
 - If the insurance company plans to offer related services, then it is recommended to manage the expense overrun risk. Unlike regular insurance products, expenses of LTCI attached with care services are higher. Moreover, care service expenses could rise faster than expected. In the case where both the incidence rate and service expenses keep increasing, the resulting

double effect could erode the profit rapidly. Therefore, expense control should not be ignored.

- Similar to regular health insurance, investment rate and incidence rate are important assumptions. As the product duration is usually long, the asset allocation should match the long duration feature.
- Business mix
 - Different issue age groups are exposed to different risks and thus the age composition is an important factor. In general, older ages are more sensitive to sensitivity scenarios while younger ages produce more stable profit results in most scenarios. It is recommended to attract younger policyholders.
 - Average SA/premiums is also a sensitive factor as it is closely related to per policy expense amortization. For LTCI products, SA is usually linked to local care costs, indicating that improvement of SA may be difficult for economically undeveloped markets.
- Corporations with TPA
 - Insurance companies may consider corporations with TPAs. TPAs are more experienced in assessment and care service supply with existing service networks. By allying the benefits of both parties, the difficulty of claim assessment could be reduced as well as artificial claims with the support from TPAs. In the meantime, insurance companies are recommended to evaluate the sustainability of the TPA in the long run to mitigate the counterparty risk and reputational risk arising from the TPA.

Section 4: Acknowledgments

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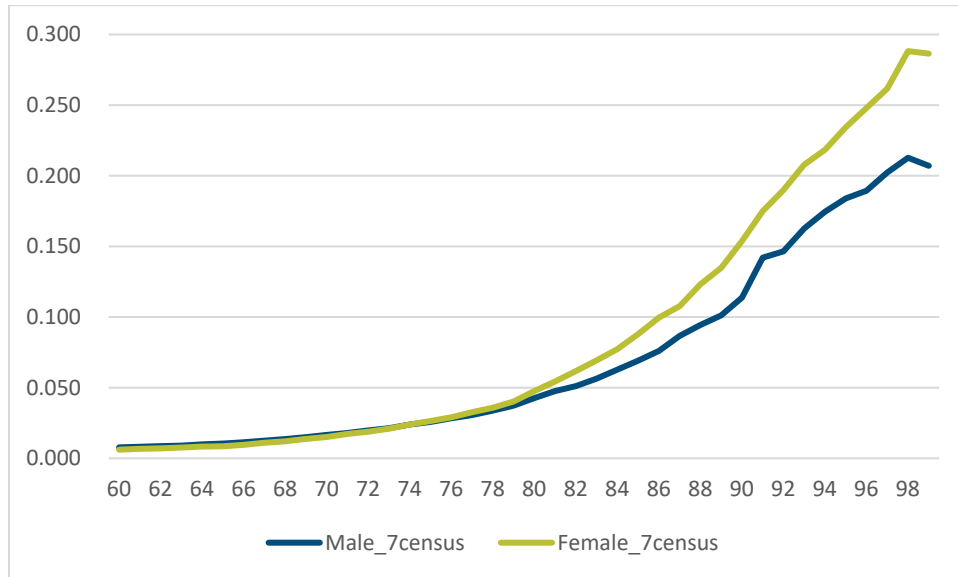
Appendix A: Derivation of LTC incident rate

Step 1: We use original data from China Population Census Yearbook 2020 Table 8-2. It contains the population aged 60-99 and the number of respondents with self-reported disability with 1 ADL loss. The incidence rate q_x^{LTC} (Figure A1) can be derived as:

$$q_x^{LTC} = \frac{l_x^{LTC}}{l_x^{total\ population}}$$

Figure A1

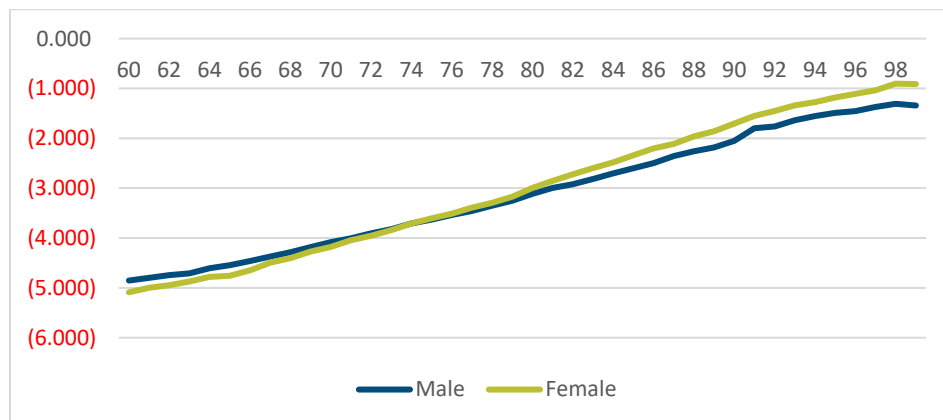
LTC INCIDENT RATE OF CHINA POPULATION CENSUS YEARBOOK 2020 AGED 60-99



Step2: The original data lacks information for age 18-59 and age 100. To derive the incidence rate of these ages, we use the CBD extrapolation method and transform it into a logit function $\ln \frac{q_x^{LTC}}{1-q_x^{LTC}}$, which is proven to be linear (Figure A2). Then we can assume $\ln \frac{q_x^{LTC}}{1-q_x^{LTC}} = a + bx + \varepsilon_t$.

Figure A2

LINEARITY OF THE LOGIT TRANSFORMATION



Step3: we then use MLE method to estimate the values of a and b. Estimation results are:

$$\text{Male: } -10.9754 + 0.0989x + \varepsilon_t$$

$$\text{Female: } -12.2452 + 0.1161x + \varepsilon_t$$

The fitness of model (Table A1 & Table A2) is considered acceptable.

Table A1
FITNESS OF MODEL

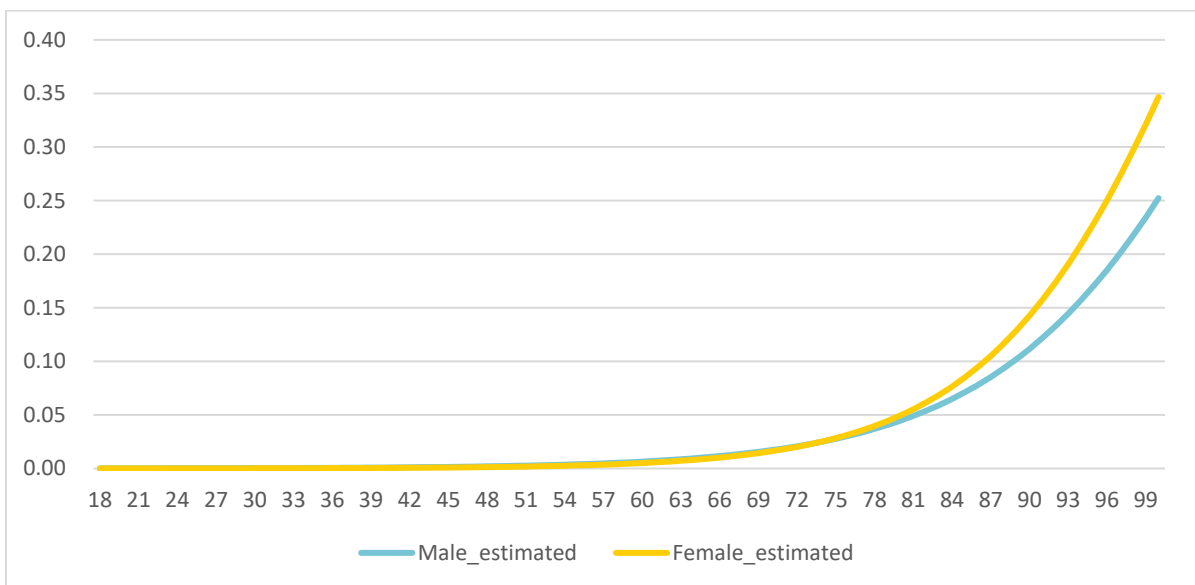
	Multiple R	R Square	Adjusted R Square	standard error	number of observations
Male	0.997620	0.995246	0.995121	0.080942	40
Female	0.998272	0.996547	0.996456	0.080953	40

Table A2
REGRESSION MODEL COEFFICIENT TABLE

Model		Coefficients	standard error	t Stat	P-value
Male	Intercept	-10.9754	0.0891	-123.2294	4.54802E-51
	X Variable 1	0.0989	0.0011	89.1970	9.40671E-46
Female	Intercept	-12.2452	0.0891	-137.4660	7.2027E-53
	X Variable 1	0.1161	0.0011	104.7170	2.17064E-48

Step4: Use equations in step 3 to derive the estimated values of LTC incident rate in Figure A3.

Figure A3
THE ESTIMATED LTC INCIDENT RATE



Appendix B: Assumptions summary

Users interested in detailed assumptions can find the assumption summary in an Excel file (Appendix B_Assumption Summary.xlsx) available to download where this report is published.

Table B1 gives the listed assumption content. Table B2-4 gives incidence rate assumptions for death, CI and LTC respectively.

Table B1
LIST OF ASSUMPTION SUMMARY

Category	Assumptions
Pricing	
Benefit	Incidence rate for DB
	Incidence rate for LTC
	Incidence rate for CI
Expense loading	5/10/15/20 PPP
Interest rate	Pricing yield
	CSV yield
	Statutory reserve yield
Profit testing	
Best estimated assumptions	
Benefit	Incidence rate for DB
	Incidence rate for LTC
	Incidence rate for CI
Commission	5/10/15/20 PPP
Expense	Acquisition Per Commission
	Acquisition Per Policy
	Acquisition Per AFYP
	Maintenance Per Premium
	Maintenance Per Policy
	Extra Service Fee Per Premium
	Extra Service Fee Per Policy
	Inflation Rate
Lapse	Inflation Base Year
	Lapse rate for regular pay
Economic assumption	lapse rate for paid-up
	Discount Rate
Tax	Investment Yield
	Tax Rate
PFAD assumption	
Benefit	Tax Exemption Proportion
	Incidence rate for DB
	Incidence rate for LTC
Expense	Incidence rate for CI
	Maintenance Per Premium
Lapse	Maintenance Per Policy
	Lapse rate for regular pay
Risk Margin Diversification Factor	
lapse rate for paid-up	

Table B2
CHINA LIFE INSURANCE MORTALITY TABLE (2010-2013) LIFE TABLE 1&2 (PER 1,000 POPULATION)

Attained Age	Male	Female	Attained Age	Male	Female	Attained Age	Male	Female
0	0.867	0.620	36	1.196	0.489	72	34.832	20.432
1	0.615	0.456	37	1.290	0.530	73	39.105	23.303
2	0.445	0.337	38	1.395	0.577	74	43.796	26.528
3	0.339	0.256	39	1.515	0.631	75	48.921	30.137
4	0.280	0.203	40	1.651	0.692	76	54.506	34.165
5	0.251	0.170	41	1.804	0.762	77	60.586	38.653
6	0.237	0.149	42	1.978	0.841	78	67.202	43.648
7	0.233	0.137	43	2.173	0.929	79	74.400	49.205
8	0.238	0.133	44	2.393	1.028	80	82.220	55.385
9	0.250	0.136	45	2.639	1.137	81	90.700	62.254
10	0.269	0.145	46	2.913	1.259	82	99.868	69.880
11	0.293	0.157	47	3.213	1.392	83	109.754	78.320
12	0.319	0.172	48	3.538	1.537	84	120.388	87.611
13	0.347	0.189	49	3.884	1.692	85	131.817	97.754
14	0.375	0.206	50	4.249	1.859	86	144.105	108.704
15	0.402	0.221	51	4.633	2.037	87	157.334	120.371
16	0.427	0.234	52	5.032	2.226	88	171.609	132.638
17	0.449	0.245	53	5.445	2.424	89	187.046	145.395
18	0.469	0.255	54	5.869	2.634	90	203.765	158.572
19	0.489	0.262	55	6.302	2.853	91	221.873	172.172
20	0.508	0.269	56	6.747	3.085	92	241.451	186.294
21	0.527	0.274	57	7.227	3.342	93	262.539	201.129
22	0.547	0.279	58	7.770	3.638	94	285.129	216.940
23	0.568	0.284	59	8.403	3.990	95	309.160	234.026
24	0.591	0.289	60	9.161	4.414	96	334.529	252.673
25	0.615	0.294	61	10.065	4.923	97	361.101	273.112
26	0.644	0.300	62	11.129	5.529	98	388.727	295.478
27	0.675	0.307	63	12.360	6.244	99	417.257	319.794
28	0.711	0.316	64	13.771	7.078	100	446.544	345.975
29	0.751	0.327	65	15.379	8.045	101	476.447	373.856
30	0.797	0.340	66	17.212	9.165	102	506.830	403.221
31	0.847	0.356	67	19.304	10.460	103	537.558	433.833
32	0.903	0.374	68	21.691	11.955	104	568.497	465.447
33	0.966	0.397	69	24.411	13.674	105	1000.000	1000.000
34	1.035	0.423	70	27.495	15.643			
35	1.111	0.454	71	30.965	17.887			

Table B3

CHINA LIFE INSURANCE EXPERIENCED CRITICAL ILLNESS TABLE (2020) CI4 (PER 1,000 POPULATION)

Attained Age	Male	Female	Attained Age	Male	Female	Attained Age	Male	Female
0	0.438	0.352	36	1.522	1.762	72	35.868	22.742
1	0.381	0.331	37	1.694	1.967	73	38.252	24.478
2	0.330	0.298	38	1.880	2.200	74	40.779	26.354
3	0.286	0.261	39	2.081	2.464	75	43.457	28.374
4	0.251	0.227	40	2.299	2.758	76	46.294	30.541
5	0.225	0.199	41	2.538	3.077	77	49.297	32.857
6	0.208	0.180	42	2.803	3.411	78	52.473	35.322
7	0.201	0.171	43	3.096	3.748	79	55.829	37.939
8	0.203	0.170	44	3.421	4.076	80	59.373	40.708
9	0.211	0.177	45	3.778	4.385	81	63.111	43.629
10	0.225	0.187	46	4.168	4.666	82	67.051	46.703
11	0.241	0.200	47	4.593	4.920	83	71.197	49.929
12	0.259	0.213	48	5.054	5.151	84	75.556	53.305
13	0.275	0.224	49	5.555	5.368	85	80.129	56.828
14	0.289	0.235	50	6.101	5.587	86	84.920	60.492
15	0.302	0.245	51	6.699	5.823	87	89.928	64.289
16	0.313	0.256	52	7.354	6.092	88	95.149	68.210
17	0.326	0.269	53	8.070	6.407	89	100.580	72.241
18	0.340	0.285	54	8.852	6.777	90	106.209	76.365
19	0.358	0.304	55	9.698	7.205	91	112.027	80.565
20	0.380	0.328	56	10.610	7.689	92	118.017	84.818
21	0.407	0.355	57	11.584	8.225	93	124.159	89.100
22	0.439	0.386	58	12.619	8.806	94	130.431	93.386
23	0.474	0.419	59	13.713	9.428	95	136.805	97.646
24	0.511	0.457	60	14.865	10.086	96	143.253	101.851
25	0.551	0.500	61	16.075	10.779	97	149.738	105.969
26	0.592	0.552	62	17.343	11.510	98	156.224	109.970
27	0.637	0.614	63	18.673	12.282	99	162.668	113.818
28	0.687	0.690	64	20.067	13.104	100	169.027	117.481
29	0.745	0.779	65	21.531	13.985	101	175.250	120.922
30	0.812	0.882	66	23.280	14.937	102	181.287	124.107
31	0.891	0.999	67	25.141	15.970	103	187.081	126.999
32	0.985	1.127	68	27.124	17.097	104	192.573	129.560
33	1.095	1.266	69	29.240	18.328	105	197.700	131.754
34	1.222	1.416	70	31.498	19.674			
35	1.364	1.580	71	33.620	21.143			

Table B4
DERIVED LTC INCIDENCE RATE (PER 1,000 POPULATION)

Attained Age	Male	Female	Attained Age	Male	Female	Attained Age	Male	Female
18	0.101	0.039	46	1.616	1.003	74	25.150	25.268
19	0.112	0.044	47	1.783	1.126	75	27.691	28.291
20	0.124	0.049	48	1.968	1.265	76	30.482	31.664
21	0.137	0.055	49	2.172	1.420	77	33.544	35.424
22	0.151	0.062	50	2.398	1.595	78	36.902	39.613
23	0.166	0.069	51	2.646	1.791	79	40.583	44.274
24	0.184	0.078	52	2.921	2.011	80	44.613	49.456
25	0.203	0.088	53	3.223	2.258	81	49.023	55.209
26	0.224	0.098	54	3.557	2.535	82	53.844	61.588
27	0.247	0.111	55	3.925	2.846	83	59.110	68.651
28	0.273	0.124	56	4.332	3.196	84	64.856	76.457
29	0.301	0.139	57	4.780	3.588	85	71.118	85.070
30	0.332	0.157	58	5.274	4.028	86	77.935	94.554
31	0.367	0.176	59	5.819	4.522	87	85.344	104.974
32	0.405	0.198	60	6.420	5.075	88	93.387	116.394
33	0.447	0.222	61	7.082	5.697	89	102.103	128.879
34	0.494	0.249	62	7.813	6.394	90	111.533	142.486
35	0.545	0.280	63	8.618	7.175	91	121.715	157.270
36	0.602	0.314	64	9.505	8.052	92	132.688	173.279
37	0.664	0.353	65	10.483	9.034	93	144.488	190.548
38	0.733	0.396	66	11.560	10.135	94	157.147	209.104
39	0.809	0.445	67	12.746	11.369	95	170.693	228.955
40	0.893	0.500	68	14.053	12.751	96	185.151	250.095
41	0.986	0.561	69	15.491	14.298	97	200.537	272.497
42	1.088	0.631	70	17.073	16.031	98	216.862	296.113
43	1.201	0.708	71	18.815	17.969	99	234.126	320.874
44	1.326	0.795	72	20.730	20.137	100	252.322	346.684
45	1.464	0.893	73	22.836	22.560			

Appendix C: Sensitivity testing results for CI morbidity rate and discounting rate

CI incidence rate (Table C1 & Table C2)

Table C1
SENSITIVITY RESULTS OF CI INCIDENCE RATE (MALE, AGE 40)

No.	BP	PPP	Product I		Product II	
			Morbidity: +10%		Morbidity +10%	
			PM	Rate of change	PM	Rate of Change
1	10	5	-	-	-8.3%	-69.0%
2	To 80	5	-	-	9.5%	-5.2%
3	To 100	5	-	-	8.2%	-0.9%
4	10	10	-	-	-4.0%	-4162.8%
5	To 80	10	-	-	15.1%	-3.6%
6	To 100	10	-	-	14.2%	-0.8%
7	To 80	20	-	-	12.8%	-5.3%
8	To 100	20	-	-	11.9%	-1.8%

Table C2
SENSITIVITY RESULTS OF CI INCIDENCE RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I		Product II	
			Morbidity: +10%		Morbidity +10%	
			PM	Rate of change	PM	Rate of Change
1	30	M	-	-	16.1%	-3.5%
2	40	M	-	-	15.1%	-3.6%
3	50	M	-	-	14.6%	-3.1%
4	60	M	-	-	13.1%	0.0%
5	30	F	-	-	15.4%	-5.0%
6	40	F	-	-	14.7%	-5.0%
7	50	F	-	-	14.2%	-3.6%
8	60	F	-	-	12.0%	0.0%

Discounting rate (Table C3 & Table C4)

Table C3
SENSITIVITY RESULTS OF DISCOUNTING RATE (MALE, AGE 40)

No.	BP	PPP	Product I				Product II			
			Discounting rate: +50bps		Discounting rate: -50bps		Discounting rate: +50bps		Discounting rate: -50bps	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	10	5	-20.8%	0.0%	-20.8%	0.0%	-4.9%	-0.1%	-4.9%	0.1%
2	To 80	5	10.8%	0.0%	10.8%	0.0%	10.0%	-0.1%	10.0%	0.1%
3	To 100	5	9.7%	-0.1%	9.7%	0.1%	8.3%	-0.1%	8.3%	0.1%
4	10	10	-20.0%	0.0%	-19.9%	0.0%	-0.1%	-8.5%	-0.1%	8.5%
5	To 80	10	16.1%	0.0%	16.1%	0.0%	15.7%	0.0%	15.7%	0.0%
6	To 100	10	15.4%	0.0%	15.4%	0.0%	14.3%	0.0%	14.3%	0.0%
7	To 80	20	13.5%	0.0%	13.5%	0.0%	13.5%	0.0%	13.5%	0.0%
8	To 100	20	12.9%	0.0%	12.9%	0.0%	12.1%	0.0%	12.2%	0.0%

Table C4
SENSITIVITY RESULTS OF DISCOUNTING RATE (10-YEAR PAY, TO AGE 80)

No.	Issue Age	Gender	Product I				Product II			
			Discounting rate: +50bps		Discounting rate: -50bps		Discounting rate: +50bps		Discounting rate: -50bps	
			PM	Rate of change	PM	Rate of change	PM	Rate of Change	PM	Rate of change
1	30	M	17.6%	0.0%	17.6%	0.0%	16.6%	0.0%	16.6%	0.0%
2	40	M	16.1%	0.0%	16.1%	0.0%	15.7%	0.0%	15.7%	0.0%
3	50	M	14.9%	0.0%	14.9%	0.0%	15.1%	0.0%	15.1%	0.0%
4	60	M	13.1%	-0.1%	13.1%	0.1%	13.1%	-0.1%	13.1%	0.1%
5	30	F	18.1%	0.0%	18.1%	0.0%	16.2%	0.0%	16.2%	0.0%
6	40	F	16.5%	0.0%	16.5%	0.0%	15.4%	0.0%	15.5%	0.0%
7	50	F	14.5%	0.0%	14.5%	0.0%	14.7%	0.0%	14.7%	0.0%
8	60	F	12.0%	-0.1%	12.0%	0.1%	12.0%	-0.1%	12.0%	0.1%

Appendix D: Model

Users interested in the results in more modeling detail can find the pricing and profit testing model in an Excel file (Appendix D_LTCL the First Principle Model.xlsx) available to download where this report is published.

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