Developing private long-term care insurance in Australia: Pricing analysis for Australian retirees

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Presentation Overview

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Need of private long-term care market in Australia

- Increasing emphasis globally on a well constructed system of long-term care (LTC)
- LTC needs are met from both government support and private individual savings
- More sustainable LTC system in Australia can be achieved by developing a private long-term care insurance (LTCI) market.

Global LTC systems

- Four types of LTC systems by Dyer et al. (2020)
  - Lowest access to LTC/ highest reliance on consumer spending (e.g., Poland, Singapore, the US)
  - Lowest access to LTC/ mid level reliance on consumer spending (e.g., England, Canada)
  - Highest access to LTC/ lowest reliance on consumer spending (e.g., Germany, Denmark)
  - Highest access to LTC/ mid-high level reliance on consumer spending (e.g., Australia, Japan, Switzerland)
- There exist active private LTCI markets internationally - e.g., US, France, Singapore, Japan, Germany.

Australian LTC system

- A hybrid system combining a tax-based universal model and means-tested system.
- It provides universal access to LTC based on assessments but requires co-payments determined by means testing.
- Differentiated from social insurance models financed by compulsory contributions (e.g., Japan, South Korea), the tax-based universal model (e.g., Denmark, Finland), or means-tested system (e.g., UK, US)
- Active LTCI market does not exist.

Need of reliable model for Australian population

- LTCI is considered expensive with high solvency capital costs due to uncertainties.
- To assess the uncertainties, we need to project LTC costs and price LTCI products based on a reliable actuarial model for the Australian population.

Research objective

- The objective of the research is to provide a detailed analysis of the pricing of a range of LTCI products for Australians.
  - A five-state Markov model of functional disability and illness estimated in our prior study (Park and Sherris, 2023) is applied for pricing and assessments.
  - To ensure international comparability, we considered product types and pricing assumptions found in other studies based on a systematic literature review of LTCI pricing methods and results.

Model specification and estimation from our prior study

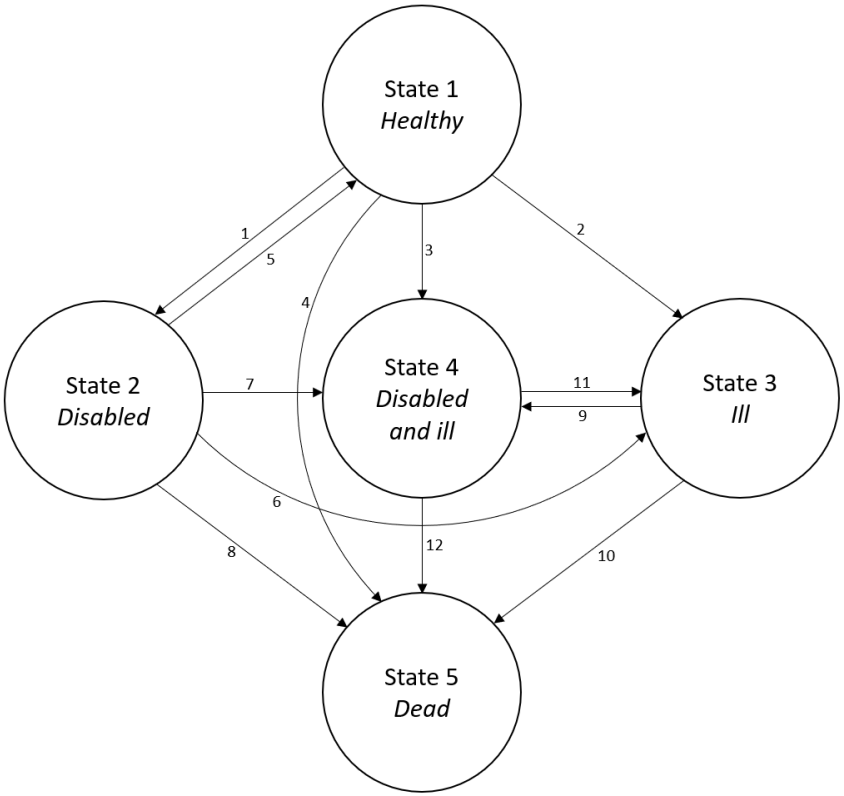


Figure: Five-state Markov model

Transition intensity for transition type s for individual k at time t, $\lambda_{k,s}(t)$, is expressed as follows based on proportional hazard specifications:

$$ln\{\lambda_{k,s}(t)\} = \beta_s + \gamma_s^{age} x_k(t) + \gamma_s^{female} F_k + \phi_s^{trend} t \quad (1)$$

Note we separately estimated **Static model** without trend factor as well as **Trend model** with trend factor.

Reference: Sherris and Wei (2021)

Model specification and estimation from our prior study

- Primary data used were the records from Survey of Disability, Ageing and Carers, Australia (SDAC) 1998, SDAC 2003, SDAC 2009, SDAC 2013, SDAC 2015 and SDAC 2018, from Australian Bureau of Statistics.
- These cross-sectional SDAC data sets provide the prevalence of disability and illness by age and sex in different years.
- We aimed to find the regression coefficients in the model that best explains the observed changes of the prevalence across time by tracking different age cohorts, using a numerical estimation procedure.

Method overview

- Simulations of health transitions for retirees
- Estimation of LTCI price as single upfront lump-sum premium comprising:
  - Expected present value of benefit payments and expenses
  - Solvency capital requirement (SCR) using a shock assessment
- Measurement of utility to understand demand
- Sensitivity analysis for uncertain factors with respect to utility

Simulations of health transitions for retirees

- We conducted simulations of health transitions for healthy retirees aged 65 in 2018 for their later lives until death or reaching the maximum age of 100.
- Monthly change of health state was randomly determined based on the transition probabilities found using the estimated model.
- There are four simulation sets for 2 genders x 2 model types, each set comprised of 10,000 independent runs.

Estimation of LTCI cost

- The LTCI cost is estimated as the mean of the present values for the insurer's spending found on each individual life path in a set of the simulations
- Cost components include disability benefit payment, annuity payment (if applicable), initial expense, annual expense, claim expense.
- Other assumptions include interest rate, value growth rate, inflation protection and waiting period for disability benefit payments.

Estimation of SCR

- The solvency capital requirement (SCR) has been estimated by taking the difference between:
  - Best-estimate expected present value (previous slide);
  - Expected present value of the cost given Solvency II mortality and disability rate shocks (shock assessment)
- For the shock assessment, new simulation sets were generated by modifying the transition rates.
  - Mortality rate: a permanent 20% decrease
  - Disability rate: a 35% increase for the first year and a permanent 25% in the following years

Measurement of utility

- Given estimated premiums, insured's utility (when the LTCI product is purchased or not purchased) was estimated using a numerical approximation of the recursive utility function (also known as Epstein-Zin model).

$$U_t|S_t = \left\{(1-(1+\beta)^{-\frac{1}{12}})(C_t|S_t)^{1-\rho} + (1+\beta)^{-\frac{1}{12}}(MU_{t+1})^{\frac{1}{\theta}}\right\}^{\frac{1}{1-\rho}},$$

$$MU_{t+1} = \left[\frac{\sum_i (U_{t+1,i}|S_t)^{1-\gamma} + \sum_j b^{\gamma}(W_{t+1,j}|S_t)^{1-\gamma}}{N}\right], \quad (2)$$

$$\theta = \frac{1-\gamma}{1-\rho}, \rho = \left(\frac{1}{\phi}\right)^{\frac{1}{12}}$$

Where U_t is the utility at time t, S_t is a specified series of health transitions to t, C_t is consumption exclusive of aged care cost at t, W_t is remaining wealth at t, MU_{t+1} is mean utility one month later than t, i's and j's are the cases in the simulation set with S_t and the state in the next month is not *Dead* and is *Dead*, respectively, N is the sum of the numbers of i's and j's, β is subjective annual discount rate, ϕ is EIS, b is strength of bequest motive, γ is relative risk aversion parameter.

Baseline input values

Variable	Value	Utility variable	Value
Interest rate	3%	Subjective discount rate	3%
Value growth rate	3%	EIS	0.5
Disability benefit	$3,000	Strength of bequest motive	2
Waiting period	3 months	Risk aversion	3
Annuity payment	$1,000	Monthly retirement income	$800
Initial expense	$2,000	Aged care cost	$3,000
Annual expense	$1,000	Consumption	$1,000
Disability claim expense	$3,000	Initial wealth	$1,000,000
Inflation protection	Yes		

Table: Baseline input values

Summary of simulations

Table: Averaged time spent in each state in years

	Static model		**Trend model**	
	Male	Female	Male	Female
Time spent in each state				
Healthy	10.66 (7.78)	11.91 (8.25)	9.89 (7.45)	11.36 (8.25)
Disabled	0.29 (1.19)	0.52 (1.63)	0.17 (0.71)	0.35 (1.10)
Ill	7.79 (6.85)	8.27 (7.23)	13.31 (9.07)	13.60 (9.33)
Disabled and ill	0.94 (1.54)	1.65 (2.20)	0.98 (1.56)	1.49 (2.03)
Total	19.77 (7.45)	22.43 (7.69)	24.42 (8.65)	26.87 (8.32)
Time spent in combined states				
Non-disabled	18.45 (7.30)	20.18 (7.37)	23.2 (8.55)	24.97 (8.19)
Non-ill	10.95 (8.06)	12.43 (8.76)	10.06 (7.59)	11.72 (8.53)

Note: Standard deviations are in parentheses.

Estimated premiums: Stand-alone LTCI

Table: Premium and cost components of stand-alone LTCI

	Static model		**Trend model**	
	Male	Female	Male	Female
Disability benefit	$44,860	$74,998	$40,961	$66,780
Expense	$5,473	$7,354	$5,553	$7,263
SCR	$22,143	$37,663	$23,386	$33,145
Premium	$72,475	$120,015	$69,900	$107,188
Loading % for SCR	30.55%	31.38%	33.46%	30.92%

Estimated premiums: LCA

- Pricing analysis was also conducted on life care annuity (LCA) which combines a stand-alone LTCI with a life annuity.

Table: Premium and cost components of LCA

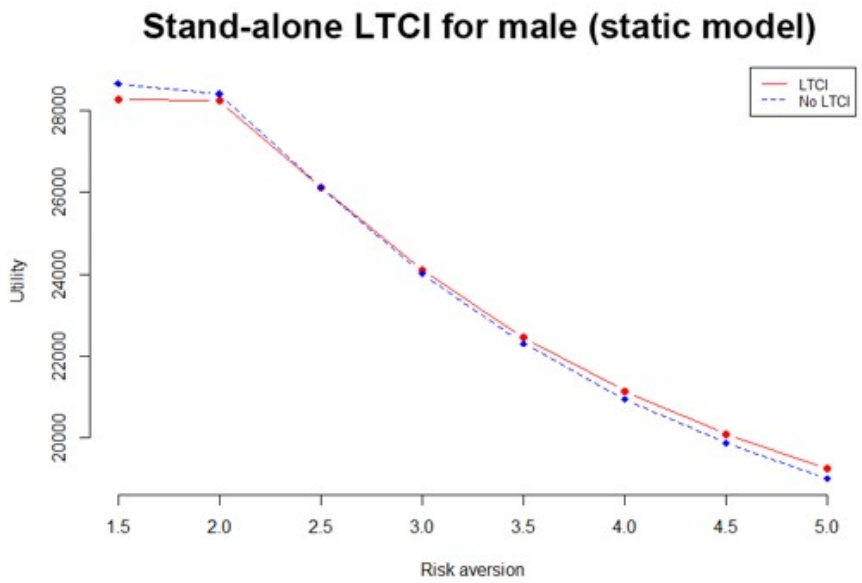
	Static model		**Trend model**	
	Male	Female	Male	Female
Annuity	$233,530	$265,243	$288,399	$319,692
Disability benefit	$44,860	$74,997	$40,961	$66,779
Expense	$24,397	$28,122	$29,274	$32,948
SCR	$31,341	$44,847	$29,566	$34,301
Premium	$334,128	$413,209	$388,201	$453,720
Loading % for SCR	9.38%	10.85%	7.62%	7.56%

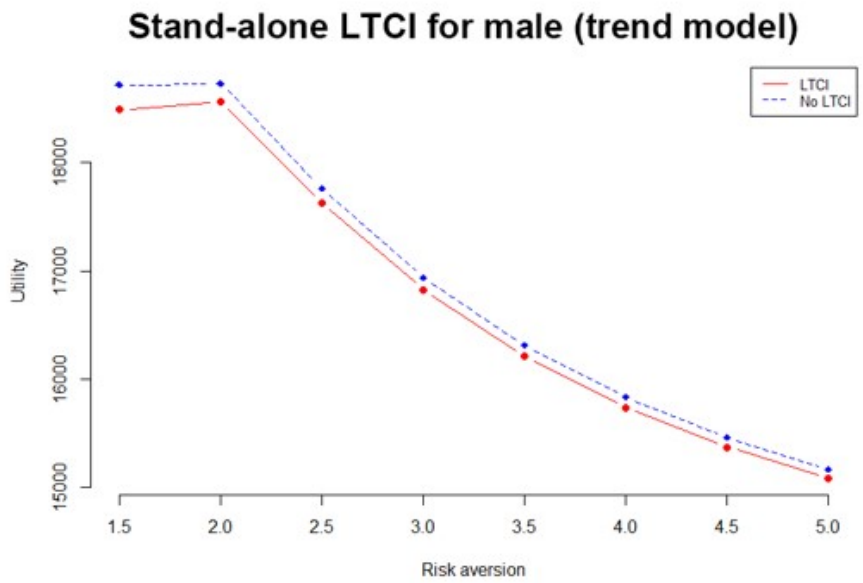
Measured utility

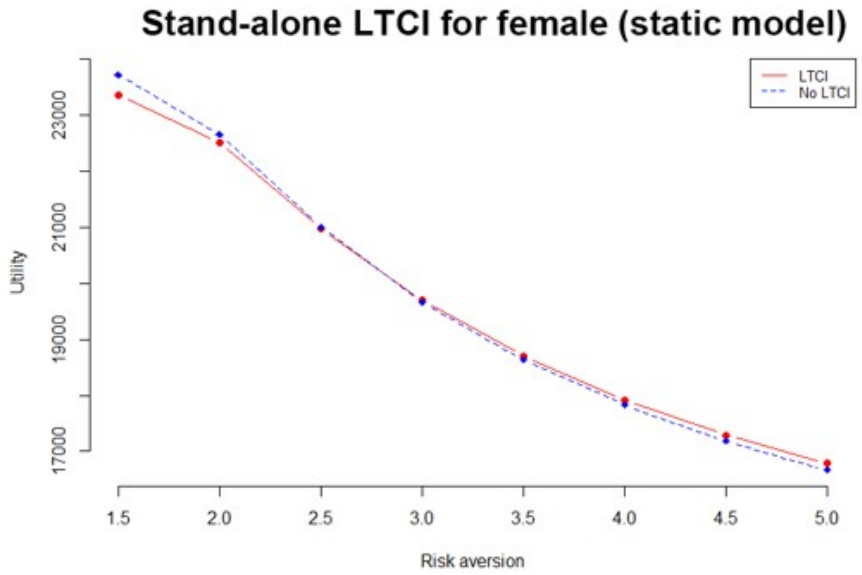
Table: Insured's utility for stand-alone LTCI and LCA

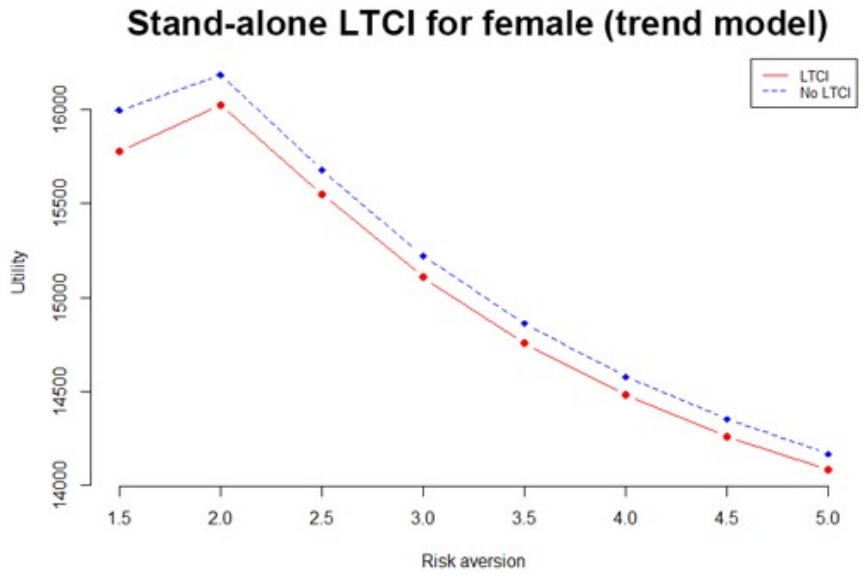
	Static model		**Trend model**	
	Male	Female	Male	Female
Stand-alone LTCI				
When taken	24,103	19,695	16,825	15,106
When not taken	24,010	19,663	16,937	15,220
LCA				
When taken	24,734	20,159	17,184	15,337
When not taken	24,010	19,663	16,937	15,220

Sensitivity test for risk aversion: stand-alone LTCI

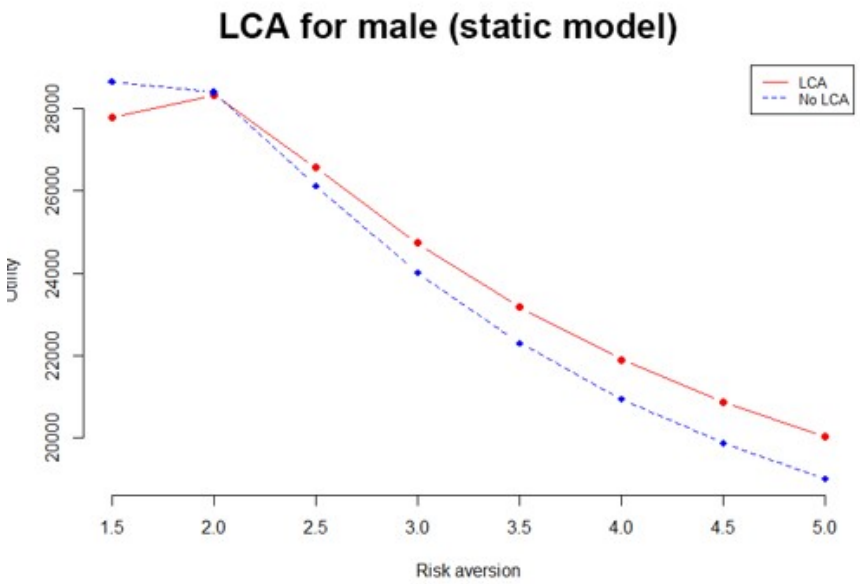


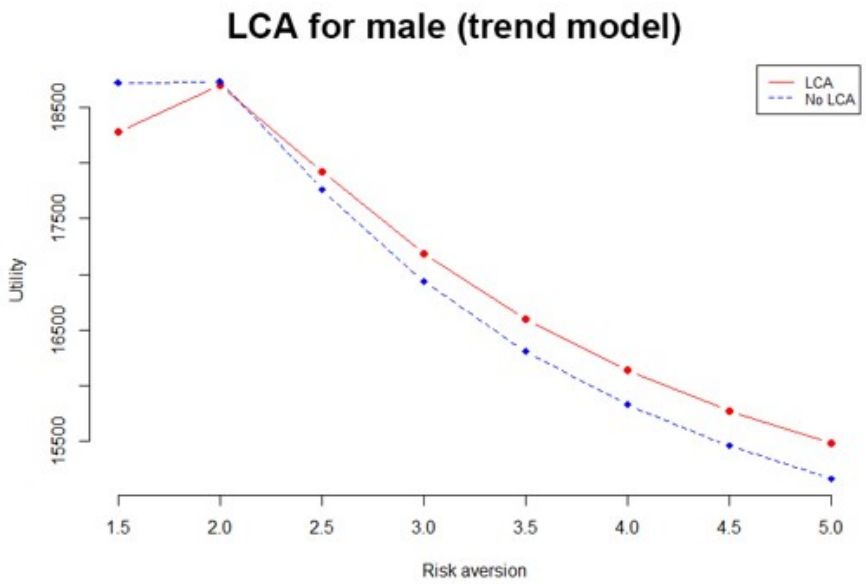


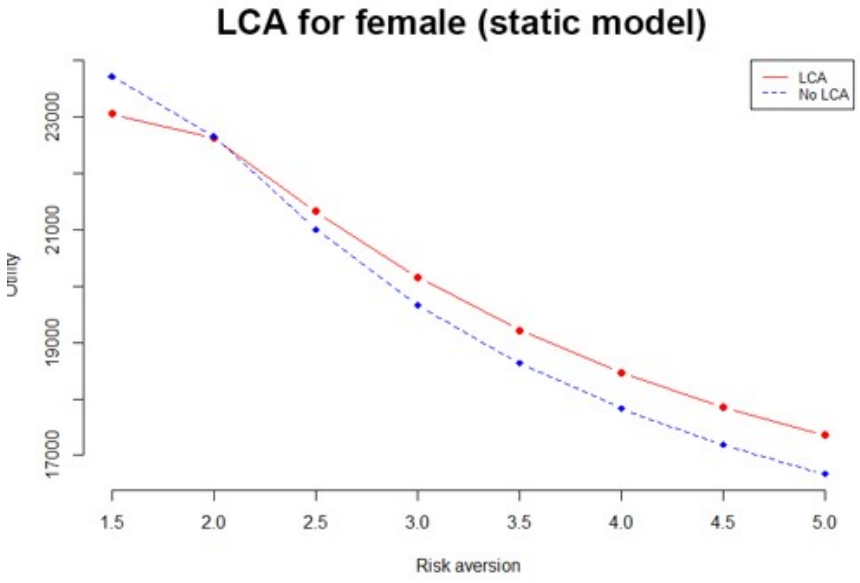


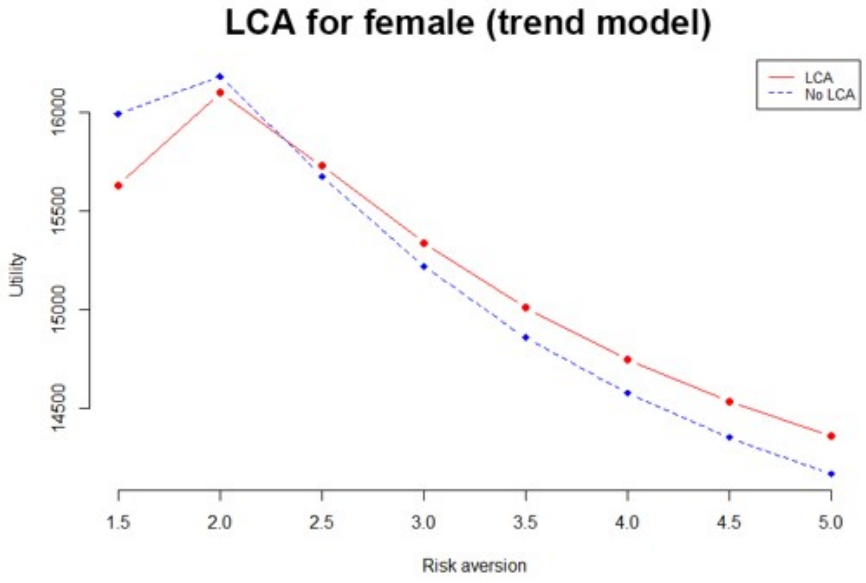


Sensitivity test for risk aversion: LCA

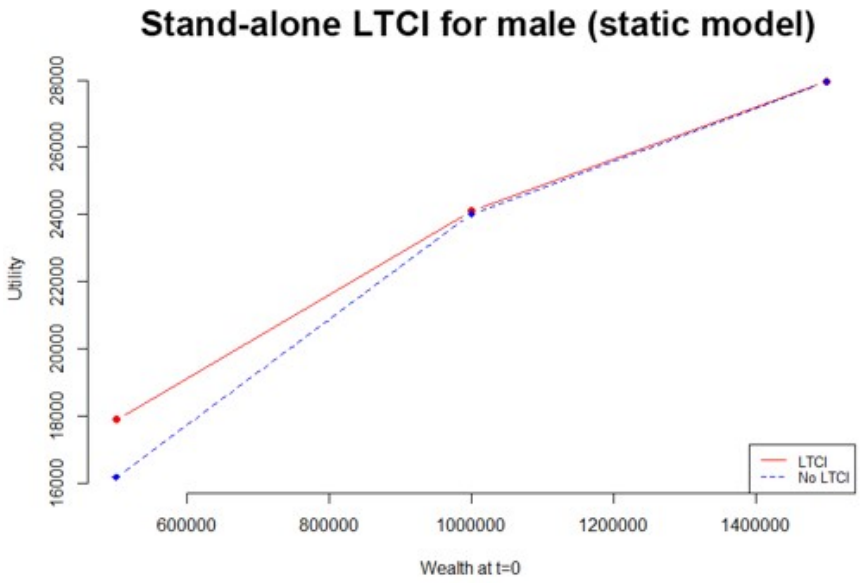


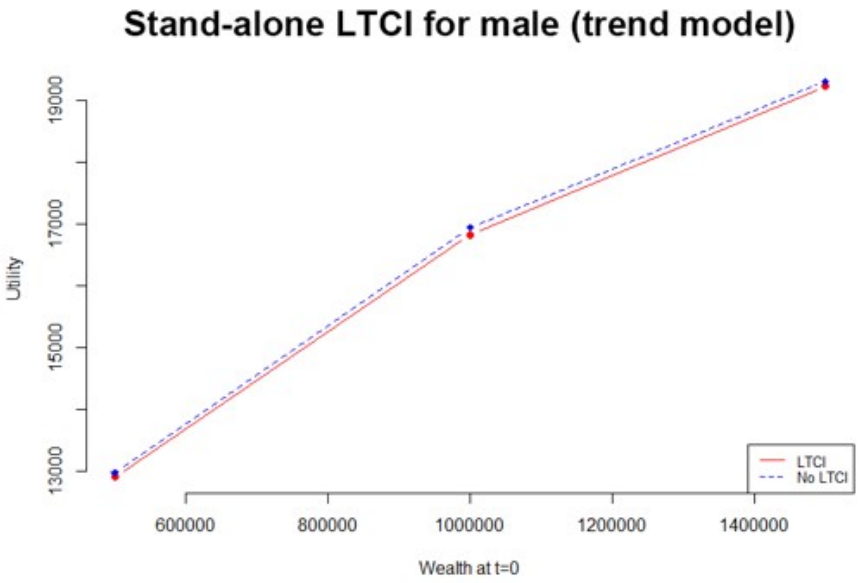


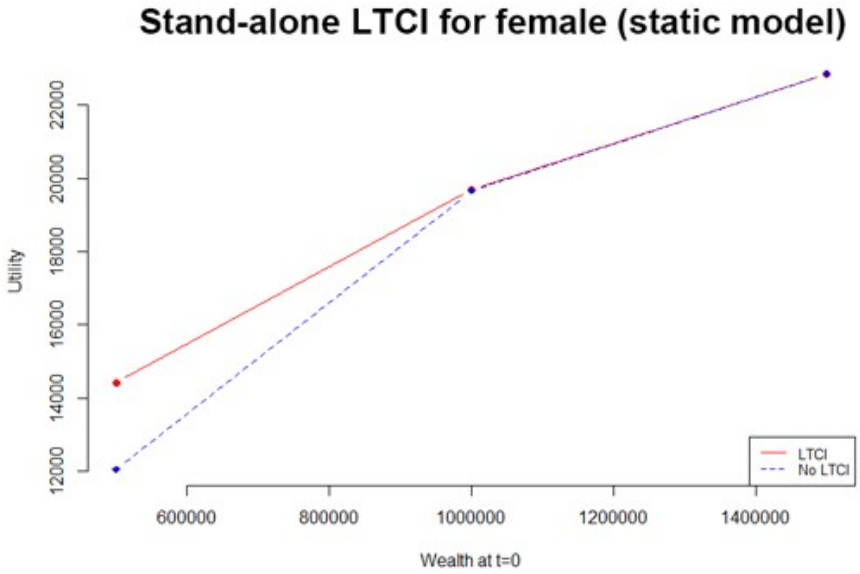


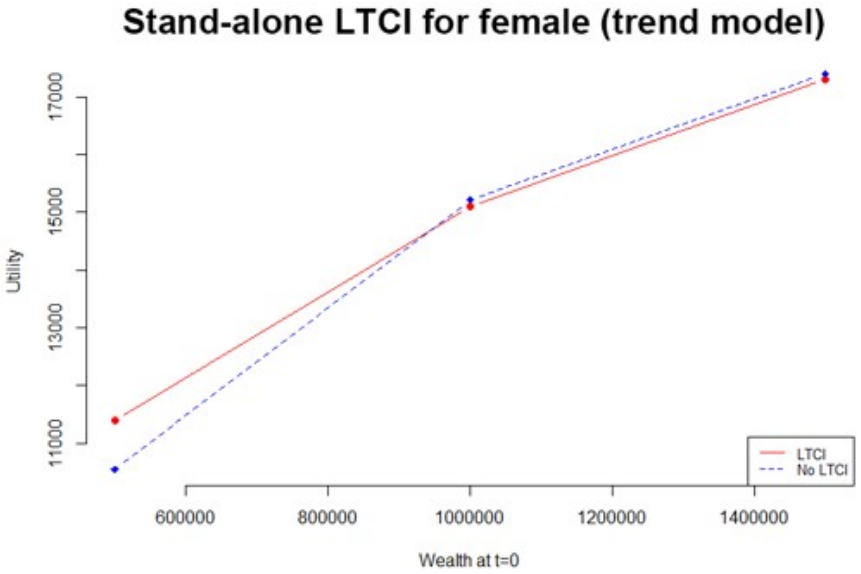


Sensitivity test for initial wealth: stand-alone LTCI

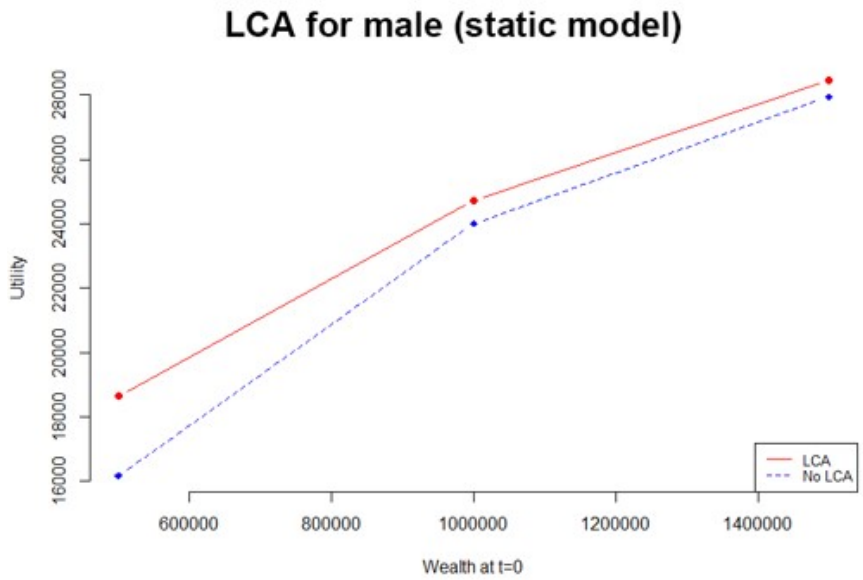


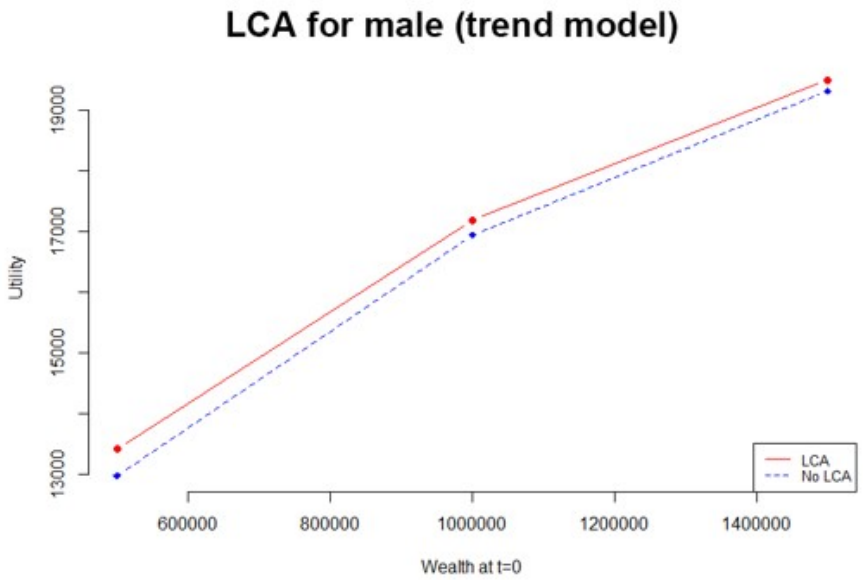


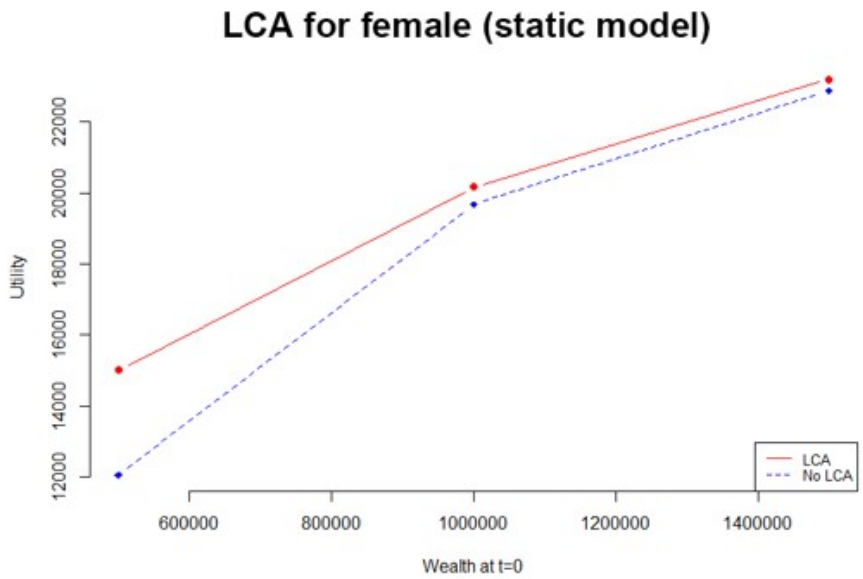


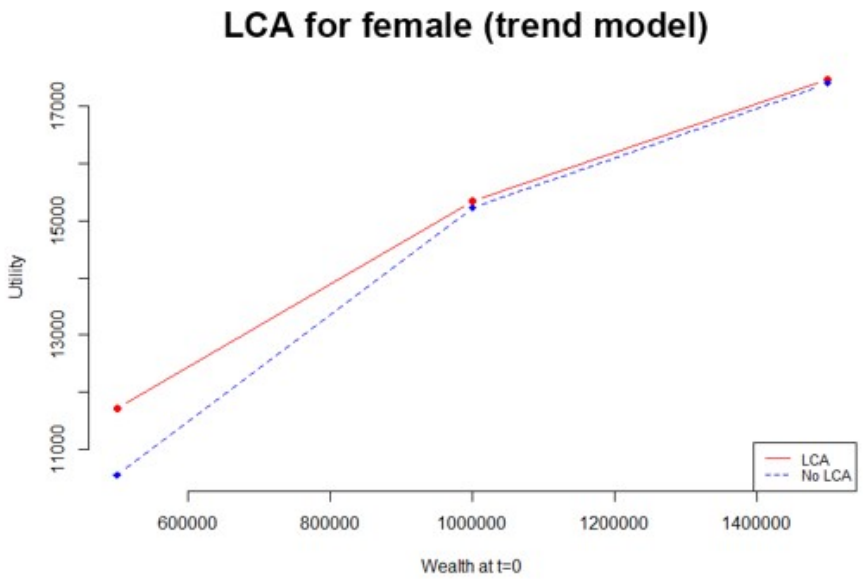


Sensitivity test for initial wealth: LCA









Conclusion

- This research provides for the first time a careful analysis of potential LTCI products for the Australian market.
- The estimated premiums reflected longer life expectancy of female than male and the trend of increasing life expectancy but decreasing time spent with disability observed during 20-year period to 2018 in Australia.
- The measured utilities show that a potential insured would be willing to purchase the LTCI products in most cases. The extent of preference was varied with assumptions including those for risk aversion and wealth levels.
- An Australian private LTCI market should be carefully developed considering the population structure and trend associated with ageing in Australia and determinants of consumer preferences such as risk aversion and wealth level.

References

Suzanne Dyer, Madeleine Valeri, Nimita Arora, Tyler Ross and Megan Winsall (2020)
Review of international systems of long-term care of older people
Royal Commission into Aged Care Quality and Safety

Kyu Park and Michael Sherris (2023)
Actuarial Modelling of Australian Population Retirement Risks: An Australian Functional Disability and Health State Model
Under review for publication

Michael Sherris and Pengyu Wei (2021)
A multi-state model of functional disability and health status in the presence of systematic trend and uncertainty
North American Actuarial Journal 25(1), 17 - 39.

Thank you very much

Questions? Comments?