

Online Appendix for: *Long-Term Care Insurance: Information Frictions and Selection*

M. Martin Boyer
HEC Montréal

Philippe De Donder
TSE and CNRS

Claude Fluet
Université Laval

Marie-Louise Leroux
ESG UQAM

Pierre-Carl Michaud
HEC Montréal and NBER

October 2019

A Lapsing

We use data from the [Long Term Care Intercompany Experience Study 2000-2011](#) from the Society of Actuaries to compute annual lapsing probabilities. This study gathers information on lapsing from 22 insurance companies. Lapsing can occur due to death or other reasons. Given the definition we use in the paper, we want the probability of lapsing conditional on survival. We use definition 2 of voluntary lapsing, which excludes companies where more than 25% of terminations were of unknown cause. In the table below we report estimates of the lapsing probability by age and gender. Because there is no clear pattern with age and differences by gender are small, we use a uniform probability of lapsing of 1.8%.

Age	Females	Males
<50	0.056	0.070
50-59	0.023	0.025
60-69	0.013	0.015
70-79	0.011	0.011
80+	0.027	0.022
Total	0,018	0,018

Table A.1: Lapsing probabilities by age and gender. Source: Society of Actuaries Long-Term Care Intercompany Experience Study

B Demand Estimation

The model presented in equations ??,?? and ?? has a number of parameters to estimate which we can collect in a vector $\theta = (\beta, \gamma, \delta, \psi, \sigma_\nu, \sigma_\eta, \sigma_\epsilon)$. For ease of notation, define $\mathbf{X}_{i,t} = (\mathbf{x}_i, \mathbf{z}_{i,t}, p_{i,t})$. Let $I_{q_{i,t}>0}$ be a dummy variable indicating whether demand is positive (1) or zero (0). Also let the index be denoted by

$$\pi(\mathbf{X}_{i,t}, \nu_i, \eta_i) = -\alpha(\mathbf{x}_i, \mathbf{z}_{i,t}, \eta_i)p_{i,t} + \mu(\mathbf{x}_i, \mathbf{z}_{i,t}, \nu_i). \quad (\text{B.1})$$

The probability of observing one particular $q_{i,t}$ conditional on $\mathbf{X}_{i,t}$ and η_i, ν_i is given by:

$$\Pr(q_{i,t}|\mathbf{X}_{i,t}, \eta_i, \nu_i) = \left(\frac{1}{\sigma_\epsilon} \phi \left(\frac{q_{i,t} - \pi(\mathbf{X}_{i,t}, \nu_i, \eta_i)}{\sigma_\epsilon} \right) \right)^{I_{q_{i,t}>0}} \left(1 - \Phi \left(\frac{\pi(\mathbf{X}_{i,t}, \nu_i, \eta_i)}{\sigma_\epsilon} \right) \right)^{1-I_{q_{i,t}>0}} \quad (\text{B.2})$$

where $\phi(\cdot)$ is the standard normal pdf (density) and $\Phi(\cdot)$ is the standard normal cdf (cumulative distribution function).

Because the $\epsilon_{i,t}$ are independent, we have that

$$\Pr(\mathbf{q}_i|\mathbf{X}_i, \eta_i, \nu_i) = \prod_{t=1}^T \Pr(q_{i,t}|\mathbf{X}_{i,t}, \eta_i, \nu_i) \quad (\text{B.3})$$

where $\mathbf{q}_i = (q_{i,1}, \dots, q_{i,T})'$ and $\mathbf{X}_i = (X_{i,1}, \dots, X_{i,T})'$.

Since $\nu_i \sim N(0, \sigma_\nu^2)$ and $\eta_i \sim N(0, \sigma_\eta^2)$, an unbiased simulator of the probability $\Pr(\mathbf{q}_i|\mathbf{X}_i) = \mathbf{E}_{(\eta_i, \nu_i)} \Pr(\mathbf{q}_i|\mathbf{X}_i, \eta_i, \nu_i)$ is given by

$$\tilde{\Pr}(\mathbf{q}_i|\mathbf{X}_i) = \frac{1}{S} \sum_{s=1}^S \Pr(\mathbf{q}_i|\mathbf{X}_i, \tilde{\eta}_{i,s}, \tilde{\nu}_{i,s})$$

where $\tilde{\nu}_{i,s}$ is a draw s (out of S draws) from the $N(0, \sigma_\nu^2)$ and $\tilde{\eta}_{i,s}$ from the $N(0, \sigma_\eta^2)$.

We can estimate the parameters θ by maximum simulated likelihood (MSL):

$$\hat{\theta}_{MSL} = \arg \max_{\theta} \frac{1}{N} \sum_{i=1}^N \log \tilde{\text{Pr}}(\mathbf{q}_i | \mathbf{X}_i) \quad (\text{B.4})$$

The MSL is consistent and asymptotically efficient for $N \rightarrow \infty$ and $S \rightarrow \infty$ (?). For fixed S , it is biased but the bias is generally small with a large S (the bias is due to taking a log and then expectations in the ML criteria). In estimation, we use $S = 50$ and the Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm to find the optimum. We compute standard errors using a numerical estimate of the outer-product of the gradient of the MSL likelihood.

Upon estimation, it is possible to recover an unbiased predictor of the individual effects as $\hat{\eta}_i = E(\eta_i | \mathbf{q}_i, \mathbf{X}_i)$ and $\hat{\nu}_i = E(\nu_i | \mathbf{q}_i, \mathbf{X}_i)$. To do this, we can use Bayes Rule and compute using draws from the distribution of η_i and ν_i by computing

$$\hat{\eta}_i = \frac{1}{S} \sum_{s=1}^S \tilde{\eta}_{i,s} \frac{\text{Pr}(\mathbf{q}_i | \mathbf{X}_i, \tilde{\eta}_{i,s}, \tilde{\nu}_{i,s})}{\tilde{\text{Pr}}(\mathbf{q}_i | \mathbf{X}_i)} \quad (\text{B.5})$$

and similarly for ν_i (with the same draws)

$$\hat{\nu}_i = \frac{1}{S} \sum_{s=1}^S \tilde{\nu}_{i,s} \frac{\text{Pr}(\mathbf{q}_i | \mathbf{X}_i, \tilde{\eta}_{i,s}, \tilde{\nu}_{i,s})}{\tilde{\text{Pr}}(\mathbf{q}_i | \mathbf{X}_i)}. \quad (\text{B.6})$$

C Questionnaire

Long-Term Care Insurance Survey (Paper Version of Questionnaire for Internet Survey)

Introduction

For purposes of this survey, when we use the term ‘long-term care,’ we are referring to assistance with personal care needs such as dressing, bathing, getting in and out of bed, using the bathroom or eating. A long-term care home or assisted living facility refers to a facility that offers board, meals and other basic care services for persons who need long-term care. The facility also offers medical services. It is therefore distinct from a retirement home, where no or limited care is offered.

Section 1: Long-Term Care Insurance

Q1 This survey is going to ask you questions about long-term care insurance. Which of the following best describes your current knowledge about this type of insurance?

- 1 A lot
- 2 A little
- 3 None at all

Q2 For purposes of this survey, we define long-term care insurance as a type of insurance that helps to pay for extended stays in a long-term care home or assisted living facility, or for personal or medical care in your home. It is typically separate from your health insurance and requires paying separate premiums. Do you have a long-term care insurance policy?

- 1 Yes
- 2 No
- 3 Don't Know

IF Q2==3 (Don't know) GOTO Q6

ELSE IF Q2==2 (No)

Q3a Why don't you have a long-term care insurance policy? Choose the main reason.

- 1 I have never thought about buying one, and I have never been offered one (for instance by a financial advisor).
- 2 I have thought about buying one, but I have not (yet) made a decision.
- 3 I used to have such a policy, but I let it lapse.
- 4 Such insurance policies are too expensive for me.
- 5 Such insurance policies do not cover my needs.
- 6 I do not think I will need such a policy.
- 7 I don't know what that is.
- 8 Other, open...

GOTO Q6

ELSE IF Q2==1 (Yes)

Q3b How did you come to purchase that insurance policy?

- 1 I was offered a long-term care policy
- 2 I searched myself for a long-term care policy
- 3 Other, open ...

Q4 What is the monthly premium on that policy, including taxes?

Numeric

9999 Don't know

IF Q4==9999
Q4a Is it more than \$200 1 Yes 2 No 8888888 Refuse to answer
IF Q4a==1
Q4b Is it less than \$400 1 Yes 2 No 8888888 Refuse to answer
ELSE IF Q4a==2
Q4c Is it more than \$100 1 Yes 2 No 8888888 Refuse to answer
END IF

END IF

Q5 What is the amount of the benefit the insurance would pay out (monthly)?

Numeric

9999 Don't know

IF Q5==9999

Q5a Is it more than \$2,500 1 Yes 2 No 8888888 Refuse to answer

IF Q5a==1

Q5b Is it less than \$3,500 1 Yes 2 No 8888888 Refuse to answer

ELSE IF Q5a==2

Q5c Is it more than \$1,500 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

END IF

Q6 Do you have life insurance for which you currently pay a premium (or that is in force)?

1 Yes

2 No

3 Don't Know

Section 2: Background

Q7 At the present time, do you smoke cigarettes daily, occasionally or not at all?

1 Daily

2 Occasionally

3 Not at all

IF Q7==1 GOTO Q8

ELSE IF Q7==2,3

Q7a Have you ever smoked cigarettes daily?

1 Yes

2 No

IF Q7a==1 GOTO Q8

ELSE IF Q7a==2

Q7b Have you smoked 100 cigarettes or more in your life?

1 Yes

2 No

IF Q7b==1 GOTO Q8

ELSE IF Q7b==2

Q7c Have you ever smoked a whole cigarette?

1 Yes

2 No

END IF

END IF

END IF

Q8 What is the highest degree, certificate or diploma you have obtained?

1 Less than high school diploma or its equivalent

2 High school diploma or a high school equivalency certificate

3 Trade certificate or diploma

4 College, CEGEP or other non-university certificate or diploma (other than trades certificates or diplomas)

5 University certificate or diploma below the bachelor's level

6 Bachelor's degree (e.g. B.A., B.Sc., LL.B.)

7 University certificate, diploma, degree above the bachelor's level

Q9 What is your marital status?

1 married

2 living common-law

3 widowed

4 separated

5 divorced

6 single, never married

Q10 Do you have children?

1 Yes

2 No

IF Q10==1

Q10a How many children do you have?

Numeric (>0)

END IF

Q11 For 2016, what is your best estimate of the total income received by all members of your household, from all sources, before taxes and deductions?

Numeric

9999999 Don't know or prefer not to say

IF Q11==9999999

Q11a Is it more than \$60,000 1 Yes 2 No 8888888 Refuse to answer

IF Q11a==1

Q11b Is it less than \$120,000 1 Yes 2 No 8888888 Refuse to answer

ELSE IF Q11a==2

Q11c Is it more than \$30,000 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

Q12 Do you consider yourself retired?

1 Yes

2 No

IF Q12==2

Q12a What is your best estimate of what total income received by all members of your household will be once you are fully retired, as a fraction of your current income?

Numeric (0%-200%)

9999999 Don't know

IF Q12a==9999999

Q12b Is it more than 50%? 1 Yes 2 No 8888888 Refuse to answer

IF Q12b==1

Q12c Is it less than 75%? Yes 2 No 8888888 Refuse to answer

ELSE IF Q12b==2

Q12d Is it more than 25%? 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

END IF

Q13 Do you own your primary residence?

1 Yes

2 No

IF Q13==1

Q13a What is the current market value of your residence?

Numeric

9999999 Don't know

IF Q13a==9999999

Q13b Is it more than \$300,000? 1 Yes 2 No 8888888 Refuse to answer

IF Q13b==1

Q13c Is it less than \$600,000? 1 Yes 2 No 8888888 Refuse to answer

ELSE IF Q13a==2

Q13d Is it more than \$150,000? 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

Q14 How much do you still carry as a mortgage, as a proportion of the current market value of your residence?

1 Less than 20%

2 Between 20 and 40%

3 Between 40 and 60%

4 More than 60%

5 Don't know

END IF

Q15 – We are interested in your pension plan and its nature, if you have one. Do you currently contribute to, or receive benefits from, an employer provided pension plan?

1 Yes

2 No

3 Don't Know

IF Q15==1

Q15a Is your pension plan a defined-benefit or a defined-contribution plan? A defined-benefit plan is one where you receive fixed income in retirement for as long as you live and you don't

get to decide how much is contributed and how it is invested. A defined contribution plan is one where you decide how the contributions are invested and you receive at retirement the amount accumulated from your contributions.

- 1 Defined-benefit
- 2 Defined-contribution
- 3 Other
- 4 Don't Know

END IF

Q16 What is your best estimate of how much you have accumulated in Registered Retirement Savings Plans (RRSPs), Tax-Free Savings Accounts (TFSAs) and other savings accounts?

Numeric

9999999 Don't know or prefer not to say

IF Q16==9999999

Q16a Is it more than \$50,000? 1 Yes 2 No 8888888 Refuse to answer

IF Q16a==1

Q16b Is it less than \$200,000? 1 Yes 2 No 8888888 Refuse to answer

ELSE IF Q16a==2

Q16c Is it more than \$10,000? 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

Q17 Looking at the following list of health conditions, has a doctor ever told you you had:

[Check any of:]

- 1 Heart disease
- 2 Stroke
- 3 Lung disease
- 4 Diabetes
- 5 Hypertension
- 6 Depression or other mental health problems
- 7 Cancer

Section 3: Risk Perception

Q18 On a scale of 0 to 100, where 0 is absolutely no chance and 100 is absolutely certain, what do you believe is the percent chance you will live to age 85 or more?

Numeric (0-100)

9999999 Don't know

Q19 On a scale of 0 to 100, where 0 is absolutely no chance and 100 is absolutely certain, what do you believe is the percent chance you will live more than 1 year during your lifetime with two or more limitations in activities of daily living? Activities of daily living include eating, bathing, getting dressed, walking about one's home and getting in and out of bed.

Numeric (0-100)

9999999 Don't know

IF Q19>0

Q19a 2 or more years?

Numeric (Range 0 – Answer to Q19)

9999999 Don't know

IF Q19a>0

Q19b 4 or more years?

Numeric (Range 0 – Answer to Q19a)

9999999 Don't know

END IF

END IF

Q20 Of course nobody wishes to go to a long-term care home, but sometimes this becomes necessary. On a scale of 0 to 100, what do you believe is the percent chance that you will have to move to a long-term care home because of important limitations in your activities of daily living?

Numeric (0-100)

9999999 Don't know

Q21 On a scale of 0 to 100, what do you believe is the percent chance that your family would take up the responsibility of taking care of you if you had important limitations in activities of daily living?

Numeric (0-100)

9999999 Don't know

Formal care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives. Please keep these definitions in mind for the following questions.

Q22 **Formal** care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives.

Do you agree with the following statements? (Answers: 1 Strongly Agree; 2 Agree; 3 Disagree; 4 Strongly Disagree; 5 Don't know)

Q22a It is the responsibility of the family, when feasible, to take care of elderly parents

Q22b Parents should set aside money to leave to their children or heirs once they die, even when it means somewhat sacrificing their own comfort in retirement

Q22c It is children's duty to provide their parents with informal long-term care or to pay for their formal long-term care, should the need arise.

Q23 **Formal** care refers to that provided by qualified caregivers who are usually paid and unrelated to the person receiving care; **informal** care refers to that usually provided for free by relatives.

If you found yourself in a situation where you needed long-term care, which type of care would you prefer to receive: formal or informal?

1 Formal

2 Informal

3 Don't know

Section 4: Literacy and Knowledge

Now we would like to ask some questions about your familiarity and comfort with financial concepts. Please answer these questions the best you can.

Q24 Suppose you have \$100 in a savings account, the interest rate is 2% per year and you never withdraw money. After 5 years, how much will you have in this account in total?

- 1 More than \$110
- 2 Exactly \$110
- 3 Less than \$110
- 4 Don't know

Q25 True or false? You should invest most of your money in a single stock that you select rather than in lots of stocks or in mutual funds.

- 1 True
- 2 False
- 3 Don't know

Q26 Suppose the chances of someone aged 50 living to age 85 are 60%. What do you think the chances are that this same person will live to age 60?

- 1 Fewer than 60%
- 2 More than 60%
- 3 Don't know

Q27 Which of the following statements comes closest to describing the amount of financial risk that you are willing to take when you save or make investments?

- 1 I am willing to take substantial financial risks expecting to earn substantial returns
- 2 I am willing to take above average financial risks expecting to earn above average returns
- 3 I am willing to take average financial risks expecting to earn average returns
- 4 I am willing to take under average financial risks expecting to earn under average returns

IF PROV = QC

Q28 In 2016, what is the average monthly cost of staying in a private, unsubsidized long-term care home (CHSLD) if you are uninsured (for a private room)? This would include the cost of room and board as well as that of all personal and nursing care.

Numeric

9999999 Don't know

IF Q27==9999999

Q27a Is it more than \$3,000? 1 Yes 2 No 8888888 Refuse to answer

IF Q27a==1

Q27b Is it less than \$5,000? 1 Yes 2 No 8888888 Refuse to answer

ELSE IF Q27a==2

Q27c Is it more than \$1,000? 1 Yes 2 No 8888888 Refuse to answer

END IF

END IF

END IF

TEXT

IF PROV = QC: \$HOME = subsidized long-term care homes (CHSLD)

IF PROV = ON: \$HOME = long-term care homes

Q29 Are [\$HOME] free to the user?

- 1 Yes

2 No

IF Q29==2

Q29a In 2016, what is the monthly fee that you think you would have to pay in [\$HOME] for a private room?

Numeric

9999999 Don't know

Q29b Is there a reduced user contribution if you have low personal resources (income and assets)?

1 Yes

2 No

Q29c If you receive benefits from a long-term care insurance, how does that affect the user contribution you have to pay in [\$HOME] if you have low personal resources?

1 It increases my fee

2 It decreases my fee

3 It does not affect my fee

4 Don't know

END IF

Q30 Is there a waiting period to obtain a room in a [\$HOME]?

1 Yes

2 No

IF Q30==1

Q30a On average, how many months do you think the wait is in your province?

Numeric (>0)

9999 Don't know

END IF

Q31 If you purchase a long-term care insurance policy and you stop paying premiums after having paid them for several years, do you generally get reimbursed for what you already paid?

1 Yes

2 No

3 Don't know

Section 5: Preferences for Insurance Products

We are going to show you some simple insurance policies and ask you to rate those. You can assume that if you were to have two or more limitations in activities of daily living, the insurance company offering you this product would pay the benefits no matter what the circumstances. Once you receive benefits, you do not pay any premiums.

Each product has three attributes:

a) a monthly premium you have to pay;

b) a monthly benefit if you have 2 or more limitations in activities of daily living, starting 3 months after your limitations have been verified; and

c) a payout to your survivors if you die before age 85.

Assume that if you are healthy and you stop paying premiums for 3 consecutive months, the contract is cancelled and you lose coverage.

The premium cannot increase once you have purchased the product. Finally, the benefits are adjusted for inflation (indexed).

Randomization scheme

Parameters:

Benefit_ltc = [2000,3000,4000] with probability [0.33,0.33,0.33]

Benefit_life = [0,10000,25000] with probability [0.6,0.2,0.2]

With these benefits we will provide EPremium (3 x 3 = 9 data points; see table attached) which is the fair premium by age and sex.

The premium for the contract is given by (please round to nearest dollar):

prem = EPremium * Load where Load [0,0.6,0.8,1.0,1.2,1.4] with probability [0.2,0.2,0.2,0.2,0.2]

Randomize both Benefits and Load independently (9 x 5 possibilities) for 5 plans (each respondent gets 5 draws of Benefit_ltc, Benefit_life and Load).

Present each plan following...

Example:

[Scenario]

<i>While healthy...</i>	<i>Once you have at least 2 limitations in your activities of daily living...</i>	<i>When you pass away...</i>
You pay \$[prem] per month	You receive \$[benefit_ltc] per month	Your survivors will receive \$[benefit_life] once

Q32-36

[Scenario]

What are the chances, 0% meaning no chance and 100% for sure, that you would purchase the policy if it were offered to you by a trusted insurance company?

Numeric (0-100)