

ここで、 j はリスク期間($t_1 < t_2 < \dots < t_j < \dots < t_D$)に対する添え字、 D_j はあるリスク期間 t_j で事故発生した標本 i をあらわす指標のセット、 d_j は D_j に含まれる標本の数、 R_j はリスク期間が $t_k > t_j$ であるような標本 k に対応する指標のセットである。言い換えると、 t_j は第 1 子出生年齢もしくは 2004 年 1 月 1 日現在の年齢、 D_j はある年齢で初めて出生した女性につけられたサンプル番号のリスト、 d_j がリストの長さで、 R_j は t_j 歳までには出産を経験していない女性につけられたサンプル番号のリストである。基底ハザード推定量 $\{\hat{\lambda}_0(t_j)\}_{j=1, \dots, D}$ は、対数尤度関数の最大化によって得られた推定量 $\hat{\beta}_L$ を用いて、

$$\sum_{k \in D_j} \frac{\exp(x'_k \hat{\beta}_L)}{1 - \lambda_0(t_j)^{\exp(x'_k \hat{\beta}_L)}} = \sum_{i \in R_j} \exp(x'_i \hat{\beta}_L)$$

を解くことで得られる。この基底ハザード推定量によって、ある属性 x の女性 i の t_j 歳での第 1 子出生ハザードの予測値は、 $\hat{\lambda}(t_j | c, \hat{\beta}_L) = \hat{\lambda}_0(t_j) \exp(x'_i \hat{\beta}_L)$ によって得ることができる。なお、 x にコーホートグループのインディケータ c が含まれることに注意せよ。

一般化積率法 (generalized method of moments, 以下 GMM) は次のようなモーメント制約が得られるとき、一般に用いることができる手法である。

$$E[\psi(\beta | t, x)] = 0 \text{ for } \beta = \beta_0$$

ここで、 K 次元列ベクトル β_0 は母集団においてパラメータがとる真の値、また $M (\geq K)$ 次元列ベクトル $\psi(\cdot | t, x)$ はデータとパラメータの関数で予測誤差と呼ばれることがある。例えば、最尤推定量 ($E\left[\frac{\partial \ln L}{\partial \beta}\right] = 0$)、古典的線形・非線形回帰モデル ($E[\varepsilon | x] = 0$)、操作変

数モデル $E[z\varepsilon] = 0$ 、など多くのモデルを統一的なフレームワークで取り扱うことができる。また、Hansen (1982) 以来、漸近的性質が明らかにされているため非常に便利な手法である。GMM 推定量は次の最小化問題の解として与えられる。

$$\hat{\beta} = \arg \min_{\beta} \left[\frac{1}{N} \sum_{n=1}^N \psi(\beta | t_{j(n)}, x_n) \right]' W_n \left[\frac{1}{N} \sum_{n=1}^N \psi(\beta | t_{j(n)}, x_n) \right]$$

W_n は少なくとも次元が K の非負値定符号行列であり、各モーメント制約の寄与をウェイト付ける。 $t_{j(n)}$ はリスク期間サンプルすべてを並べたものと理解されたい。各モーメント制約が保持している情報量の最適なウェイト付けは予測誤差の共分散行列の逆行列 (M 次正方行列) $E\left[\psi(\beta_0 | t, x)\psi(\beta_0 | t, x)'\right]^{-1}$ によって与えられることが知られており、このとき GMM 推定量は次のような漸近的正規性をもつ。(Newey-McFadden, 1994: Thm3.4, 5.2)

$$\sqrt{N}(\hat{\beta}_G - \beta_0) \Rightarrow N(0, V), V = \left\{ \left[E \frac{\partial \psi}{\partial \beta'}(\beta_0 | t, x) \right]' E\left[\psi(\beta_0 | t, x)\psi(\beta_0 | t, x)'\right]^{-1} \left[E \frac{\partial \psi}{\partial \beta'}(\beta_0 | t, x) \right] \right\}^{-1}$$

なお、 $E \frac{\partial \psi}{\partial \beta'}(\beta_0 | t, x)$ はモーメント制約の一次微分係数(β_0 で評価)であり、 $(M \times K)$ 次行列である。本文中の推定量は、対数部分尤度関数最大化のための一次必要条件(K 次 Score vector)と標本から予測されたハザード関数が母集団ハザードに収束すること(母集団ハザード制約のもとでの比例ハザードモデルの一致性)を $(M-K)$ 本のモーメント制約として用いたものである。⁽⁷⁾ 具体的には、

$$\psi(\beta | t_{j(n)}, x_n) = \begin{bmatrix} \frac{\partial \ln L}{\partial \beta}(\beta | t_{j(n)}, x_n) \\ \lambda^*(t_{j(n)}, c) - \lambda(t_{j(n)}, c | \beta) \end{bmatrix}$$

最尤推定量を GMM 推定量と解釈する際、スコアベクトルがもっとも効率的なモーメント制約であること(Newey-McFadden, 1994: Thm5.1)は標準的な理解となっている。また、二番目のようなモーメント制約を用いた GMM 推定量が効率的であることは、Imbens-Lancaster(1994, Thm1)によって示されている。

W_n による大標本特性は一致性を満たす漸近的分散共分散行列を用いる限り、どのようなものでも効率的であることに違いない。しかしながら、有限標本による分散共分散行列の推定値は母集団で値と必ずしもマッチしないため、推定値の標準誤差は下限に到達しない可能性がある。本稿の推定は Hansen-Heaton-Yaron(1996)の逐次更新一般化積率法(Continuous Updating GMM)によった。CUGMM は予測誤差をパラメータの関数として記述し、最適なウェイト行列をパラメータ推定と同時に解く手法である。すなわち、

$$\hat{\beta}_{CG} = \arg \min_{\beta} \left[\frac{1}{N} \sum_{n=1}^N \psi(\beta) \right]' \left\{ \frac{1}{N} \sum_{n=1}^N \psi(\beta) \psi(\beta)' \right\}^{-1} \left[\frac{1}{N} \sum_{n=1}^N \psi(\beta) \right]$$

最適化は Broyden-Fletcher-Goldfarb-Shanno 法として知られる準ニュートン法を用いた。この手法は二階微分可能な関数の最適化問題を非常に効率的に解くが、大局的な解を見つけることはできないため、適切な初期値を与えることが非常に重要である。本稿では、まず(母集団モーメント制約をおかない)部分尤度推定を行い、推定値 $\hat{\beta}_L$ を GMM 二段階推定の初期値とした。そして、二段階推定によって得た効率的な推定値 $\hat{\beta}_G$ を CUGMM の初期値としてすることで $\hat{\beta}_G$ の近傍で $\hat{\beta}_{CG}$ を解いた。

(1) 最後に行った学校を中学校、高校、短大、高専、大学以外の「その他」と回答している場合も不詳として対象サンプルから除いている。学歴別にハザードを比較すると不詳やその他のものにはハザードが高い(低い)若年に偏っている(いない)といった明確な傾向は見出せないため結果には影響しないものと考えられる。

(2) カーネル平滑では、ある年齢で両サイドに同じウェイトを与え荷重するため、片側にしか標本がないような縁ではバイアスを持つことに留意されたい。また、例えば 1973-77 年生まれ世代については 27 歳から右センシングによって標本が徐々に欠落していくため、標本自体が粗くなってしまわざるをえない。図 2-2 でも 1967-68~1971-72 コーホートのハザード

は 34 歳以上で上世代のものとクロスしているのは右センサリングによって若い世代から順に欠落していくことによるものと考えられる。

(3) 比例ハザードモデルについても補論 2 で簡単に解説される。ここで用いられているような全サンプルに単一の基底ハザードを仮定することは必要ではないが、一般的な統計パッケージで簡単に推定が行えるため、最も頻繁に想定される代表的モデルである。そのため、母集団制約をおくことでどのような効果が得られるかについて最も関心の持たれるモデルであると考えた。また、1973-77 年コーホートで（たまたま）母集団ハザードとちょうど同程度のハザード予測値が得られていることは、モデルの比例性(proportionality)の恩恵によるものと考えられる。ただし、このように比例的にハザードをならすことによって教育など他のパラメータ推定値にバイアスを及ぼす可能性があることに注意が必要である。

(4) なお、残念ながら現在の分析枠組みは、モデル定式が正しいとしてもデータの歪みに対してもバイアス無しの（一致）推定量は約束しない。実際、もし比例ハザードモデルが正しくデータにゆがみがないなら、(*)式を満たし（したがって(*)式から分析者が得る情報は漸近分散の縮小のみになっ）ていなければならないが、表 2-3 に示されているように自由度 6 (=M-K) のカイニ乗分布をなす CUGMM ワールド統計量は(*)式が成立しているという帰無仮説を棄却している。これは PLL 推定量が CUGMM 推定量と統計的に有意に異なっていることを示すと同時に母集団ハザードがパラメータ推定に対し有用な情報を提供しており、結局 PLL 推定値は、(*)式も含めた一般的なモデルでの推定量に対し、バイアスを持っていた可能性を示唆するものである。

(5) たとえば、Heckman-Walker(1989)は、マイクロモデルによって TFR が予測できるのかという研究を行っている。ただし、彼らにはマクロデータをマイクロモデル推定に利用するという関心はない。母集団制約がより有効となるのは、標本が限られている場合であり、地域出生分析などが重要な応用領域となるが、地域出生力では逆に母集団ハザードを構築することが困難になる。そのため、パリティー・プログレッションを予測するモデルに期間出生力を制約として用いることが有用な方向である可能性がある。

(6) 生存時間分析の代表的なテキストには Kalbfleisch-Prentice(2002)が、また Hayashi (2000) は一般化積率法を統一的なフレームワークと捉えた計量経済学のテキストである。大標本特性について Newey-McFadden(1994)が代表的テキストである。

(7) 正確には、比例ハザードモデルの予測そのものではなく、人口動態統計から得られるハザードと整合的なように、年齢各歳の区間でハザードが一定となるように累積したものをを用いている。具体的には、 a_j 歳における予測生存率を $\hat{S}(a_j)$ と書くと、 $a \in [a_j, a_{j+1})$ 歳における第 1 子

出生ハザードは、 $\hat{\lambda}(a) = 1 - \hat{S}\left(\sup_{a \in [a_j, a_{j+1})} a\right) / \hat{S}(a_j)$ によって近似している。

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第Ⅲ部 「結婚と家族に関する国際比較調査
第2次調査」 関連資料

資料 1 「英語版 G G S 第二回調査票」

**Generations and Gender Survey
Core Questionnaire for Wave 2**

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Interviewer Instruction: Write in the time and date when the interview starts.

001. Interview started at _____ on _____

Interviewer Instruction: Read the following text.

This survey is a continuation of the Generations and Gender Survey in which you participated three years ago. It is part of an international programme co-ordinated by the UN Economic Commission for Europe. An interesting feature of our research is that it tries to follow the lives of people over a long period of time.

The aim of this research is to learn more about the everyday life, circumstances, and opinions of people and families. We want to gather information about the factors that influence the formation of new families, childbearing and preparation for old age. We also want to gather information about the lives of the young, middle-aged and old generations. This survey will show how people's life and family circumstances have changed over time, which will improve understanding of impediments of family life and relations of generations and help to develop policies for the future.

Each person's answer is very important to us, because each person who was visited and questioned represents a particular group of our society. Therefore, although they were randomly selected, the participants of this survey proportionally represent all of the inhabitants of this country. That is why it is important to question the same people again this time.

We will hold the information you give us in the strictest confidence, and use it only for statistical processing. If possible, it would be better if we could have this interview without others being present.

Interviewer Instruction: Write who else is present when the interview starts.

002. Other persons present at the start of interview

1. HOUSEHOLD

Respondent Check

101. Sex of respondent.

Select M/F in Household Grid.

102. Now I'd like to ask you a few questions about yourself. In what month and year were you born?

Write R's month and year of birth and age in Household Grid.

Interviewer Check:

Check that the month and year of birth match with the data on the address card. See Address Card.

yes → go to 104

no → continue ↓

103. Were you interviewed by { National Institute } three years ago?

1 – yes ↓

2 – no → *give up the interview!*

104. Which of the items on the card best describes what you are mainly doing at present?

Show Card 104: Activity. Write answers in Household Grid.

Other Household Member

105. I would like to ask you about all persons who live in this household. Who are they? To help me keep track of your answers, please tell me their first names and how they are related to you.

Show Card 105: Relationship to R. Write answers in Household Grid.

0 – R lives alone → *go to 112*

106. Are there any other household members who usually live here but are now away on business, at school, at boarding school, at university, in hospital or somewhere else?

1 – yes ↓

2 – no → *go to introductory text before 107*

b. Please tell me their first names and how they are related to you.

Write the names and relationships in Household Grid, tick mark in Column 'Temporarily Away'.

Now I would like to ask you a few questions about the people who live together with you in this household.

Interviewer Instruction: Ask 107 and 108 about each household member and write answers in the Household Grid.

107. Can I just check, that [name] is male/female?

108. a. How old is he/she?

b. In what month and year was he/she born?

Interviewer Instruction: Ask 109 about each household member who is at least 14 years old. See Household Grid for the age.

109. Which of the items on the card best describes what [name] is mainly doing at present?

Show Card 104 and write in Household Grid.

Interviewer Instruction: Ask 110 about each non-biological child in the household (codes 4–6 in relationship with R).

110. In what month and year did you and [name] first start living in the same household?

Write in Household Grid.

111. a. Is any member of your household limited in his/her ability to carry out normal everyday activities, because of a physical or mental health problem or a disability?

1 – yes ↓

2 – no → go to 112

b. Who are these persons?

Tick mark in Column 'Disability' in Household Grid.

Education, first paid job

112. What is the highest level of education you have successfully completed?

Show Card 112 [Country-specific list to be compatible with ISCED]

113. What was the main subject matter of these studies?

Write exact answer.

114. In what month and year did you reach that level?

month **year**

115. Have you ever worked for a period of at least 6 consecutive months?

1 – yes ↓

2 – no → go to introductory text before 117

116. When did you start working at this first paid job or business?

month **year**

Dwelling Unit

Now I would like to ask you some questions about your accommodation.

Interviewer Check:

Has R's address changed between the waves? See Address Card.

yes → continue ↓

no → go to 118

117. In what month and year did you start living in this [type of accommodation]?

month |__|__| year |__|__|

118. How many rooms are there in the dwelling where you live, NOT counting kitchens, bathrooms and toilets? Exclude also rooms used solely for business, hallways and utility rooms.

Number of rooms _____

119. Does your household own or rent this accommodation or does it come rent-free?

- 1 – owner
- 2 – tenant or subtenant, paying rent
- 3 – accommodation is provided rent-free
- 4 – other

120. How satisfied are you with your dwelling? On a scale from 0 to 10 where 0 means 'not at all satisfied' and 10 means 'completely satisfied' and 5 means 'about average', what number best represents your satisfaction with your dwelling? Please use this card and tell me the value on the scale.

Show Card 120: Satisfaction Scale.

Value from Satisfaction Scale _____

121. Do you intend to move within the next three years?

- 1 – definitely not.....→ **go to Interviewer Check before 201**
- 2 – probably not→ **go to Interviewer Check before 201**
- 3 – probably yes.....→ continue with 122
- 4 – definitely yes→ continue with 122

122. Would that be to another country, to another municipality or within the same municipality?

- 1 – to another country
- 2 – to another municipality
- 3 – within the same municipality
- 4 – within the country, but cannot say about municipality

2. CHILDREN

Childcare

Interviewer Check:

**Does R have any children younger than 14 in the household?
See Household Grid for codes 2–6 in 'Relationship to R' and 'Age' < 14.**

yes → continue ↓

no → go to 206

201. a. I'm going to read out various tasks that have to be done when one lives together with children. Please tell me, who in your household does these tasks? Choose your answer from the card.

Is there a partner in the household? See Household Grid.

yes



Hand out Card 201-1
[Comment: This card includes all
alternatives from the table head]

no



Hand out Card 201-2
[Comment: This card does not include the partner-
related alternatives]

Start asking item by item from the table below.

If the answer is 6 "Always or usually other person in R's household", ask question 201b before proceeding to the next item.

b. Could you just tell me which of the other household member?

Write the reference number of the household member from the Household Grid into the table below.

	al- ways R	usu- ally R	R and P about equally	usu- ally P	al- ways P	always or usually other per- son in the household	always or usually someone not living in the house- hold	chil- dren do it them- selves	not appli- cable
a. dressing the children or seeing that the children are properly dressed	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99
b. putting the children to bed and/or seeing that they go to bed	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99
c. staying at home with the children when they are ill	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99
d. playing with the children and/or taking part in leisure activities with them	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99
e. helping the children with homework	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99
f. taking the children to/from school, day care centre, babysitter or leisure activities	1	2	3	4	5	6 Ref. # in Hh. Grid:	7	8	99

Interviewer Check:

Is there a partner in the household? See Household Grid.

yes → *continue* ↓

no → *go to 203*

202. How satisfied are you with the way childcare tasks are divided between you and your partner/spouse? Please use this card and tell me the value on the scale.

Show Card 120: Satisfaction Scale.

Value from Satisfaction Scale: _____

203. a. Do you get regular help with childcare from a day care centre, a nursery, or pre-school, an after school care-centre, a self organised childcare group, a babysitter, or from some other institutional or paid arrangement?

1 – yes ↓

2 – no → **go to 204**

- b. Please name all the alternatives from the card that are regularly used.

Show Card 203: Professional childcare providers [Comment: A country-specific list that covers all institutional arrangements. All the arrangements on the card should also be mentioned in the question text], and tick mark mentioned arrangements in the table below.

Ask 203c for each care mode mentioned in 203b.

- c. How frequently do you make use of [mentioned arrangement]?

Write in the table.

	tick mark if mentioned	frequency of use			
		W= week; M= month; Y= year			
1 – babysitter (nanny)		_____ times per	W	M	Y
2 – day care centre		_____ times per	W	M	Y
3 – nursery or pre-school		_____ times per	W	M	Y
4 – after-school care-centre		_____ times per	W	M	Y
5 – self-organised childcare group		_____ times per	W	M	Y
6 – other institutional arrangement		_____ times per	W	M	Y

204. a. Do you (also) get regular help with childcare from relatives or friends or other people for whom caring for children is not a job?

1 – yes ↓

2 – no → **go to 205**

- b. From whom do you get this help?

Code up to 5 persons in the table below using the List of Providers and Receivers.

Ask 204c for each person mentioned in 204b.

- c. How frequently does [mentioned person] help to look after your children?

Write in the table.

Code from the List of Providers and Receivers	Frequency of use			
	W= week; M= month; Y= year			
	_____ times per	W	M	Y
	_____ times per	W	M	Y
	_____ times per	W	M	Y
	_____ times per	W	M	Y
	_____ times per	W	M	Y

205. How much does your household usually pay per month for childcare, if anything?

_____ € per W M Y

0 – does not pay for childcare

206. a. Over the last 12 months, have you given regular help with childcare to other people?

If it is R's job to provide childcare, consider only the help outside his/her job.

1 – yes ↓

2 – no → **go to Interviewer Check before 207**

		Persons who receive help from R				
		1	2	3	4	5
b. Whom have you helped? <i>Record up to 5 persons in this row. Code using the List of Providers and Receivers.</i>	List of Providers and Receivers					
c. Did this person live in the same household with you at that time?	1 – yes 2 – no					

Non-Resident Children

Interviewer Check:

Does R have children in the household?

yes →

207. We already talked about those children who currently live in your household. In addition to them, have you given birth to/ fathered any other children or have you ever adopted any other children? Do not include stepchildren, that is, children belonging to your current or prior partner/spouse. I will ask you about those children later.

no →

207. Have you given birth to/ fathered any children or have you ever adopted any children? Do not include stepchildren, that is, children belonging to your current or prior partner/spouse. I will ask you about those children later.

1 – yes → continue with 208 ↓

2 – no → **go to 221**

Interviewer Instruction: First, fill in answers to 208 and 209 for all mentioned children, then continue by asking all the other questions about the first non-resident child, then about the second, and so on.

	1	2	3	4	5	6	7	8
208. To help me to keep track, please tell me the names of all children, starting with the oldest. You do not need to mention those children who live in your household and were already mentioned at the beginning of the interview. Write in.	Name ...							
209. a. Sometimes it happens that one loses a child. Are all your children alive? b. Please mention those children who are not alive any more.	1 – yes 2 – no ↓ tick mark deceased children							
Interviewer Instruction: Use past tense when asking about a deceased child.								
210. Now I would like to ask a few questions about each of your children who do not currently live in your household. Can I just check, that [name] is male/female?	1 – male 2 – female							
211. Is [name] your biological child or an adopted child?	1 – biological → go to 213 2 – adopted 3 – foster							
212. In what month and year did he/she start living in your household? Go to 214	month ... year ... 9999 – never lived in R's household							
213. Is this child also the biological child of your current partner/spouse?	1 – yes 2 – no							
214. a. Skip a in case of a deceased child. How old is he/she? b. In what month and year was he/she born?	age ... month ... year ...							
Interviewer Check: If the child is alive (see 209) go to 216 . If the child is deceased continue ↓								
215. In what month and year did [name] die?	month ... year ...							
Go to 210 for the next child. If no more children go to 221								

		1	2	3	4	5	6	7	8
216.	In what month and year did you and [name of child] stop living in the same household?	month ... year ...	LLL	LLL	LLL	LLL	LLL	LLL	LLL
217.	How long does it take to get from your home to where [name] is living at present?	hour ... min ...	---	---	---	---	---	---	---
Interviewer Instruction: Ask the next question about each child who is younger than 14. If older go to 219 !									
218.	How often do you look after [name]?	times per W M Y	---	---	---	---	---	---	---
	W= week M= month Y= year	0 – never	---	---	---	---	---	---	---
219.	How often do you see [name]?	times per W M Y	---	---	---	---	---	---	---
	W= week M= month Y= year	0 – never	---	---	---	---	---	---	---
220.	How satisfied are you with your relationship with [name]? Please use this card and tell me the value on the scale.	Value from Card 120: Satisfaction Scale	---	---	---	---	---	---	---
Go to 210 for the next child. If no more children continue ↓									

221. (In addition to the children we already talked about,) have you ever had any foster-children?

1 – yes → go back to 208 and repeat the table for all foster children, using the word 'foster-children' instead of children. Code 3 at 211 without asking.

2 – no ↓