On Sandwiches and Club-Sandwiches: Institutions, Longevity and Fertility

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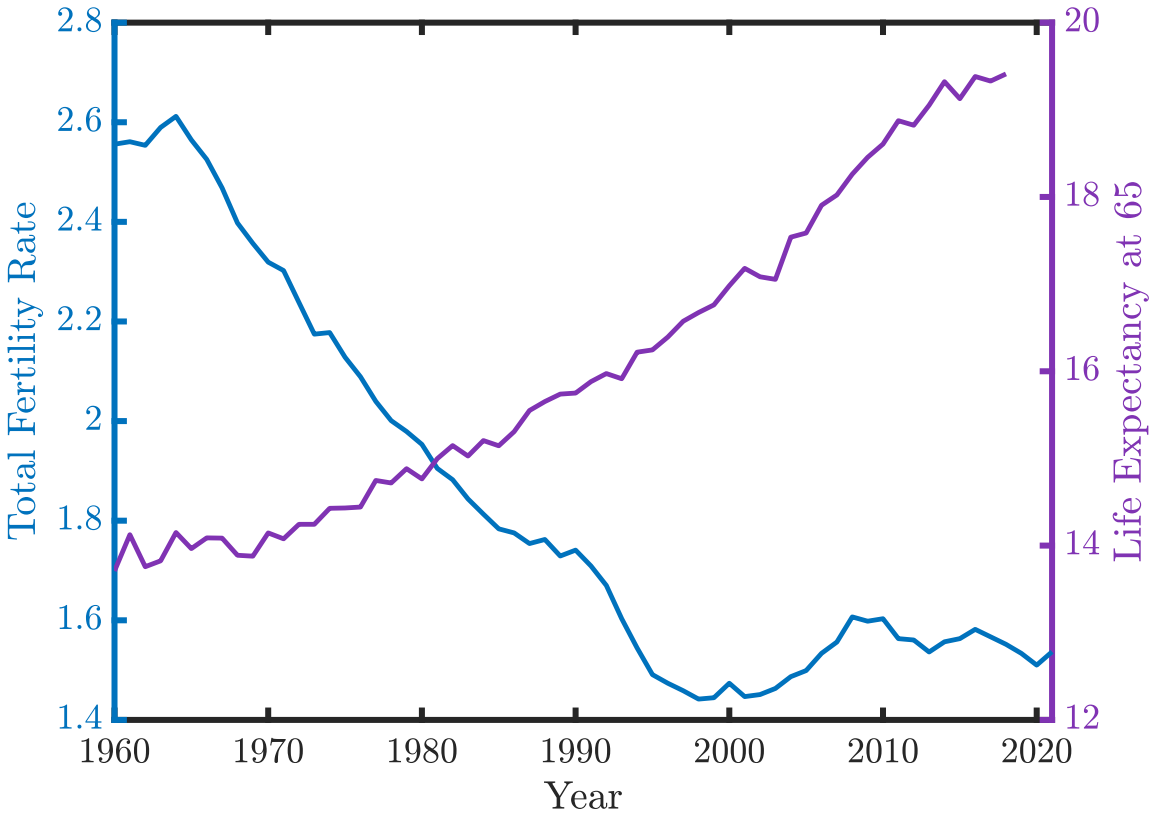
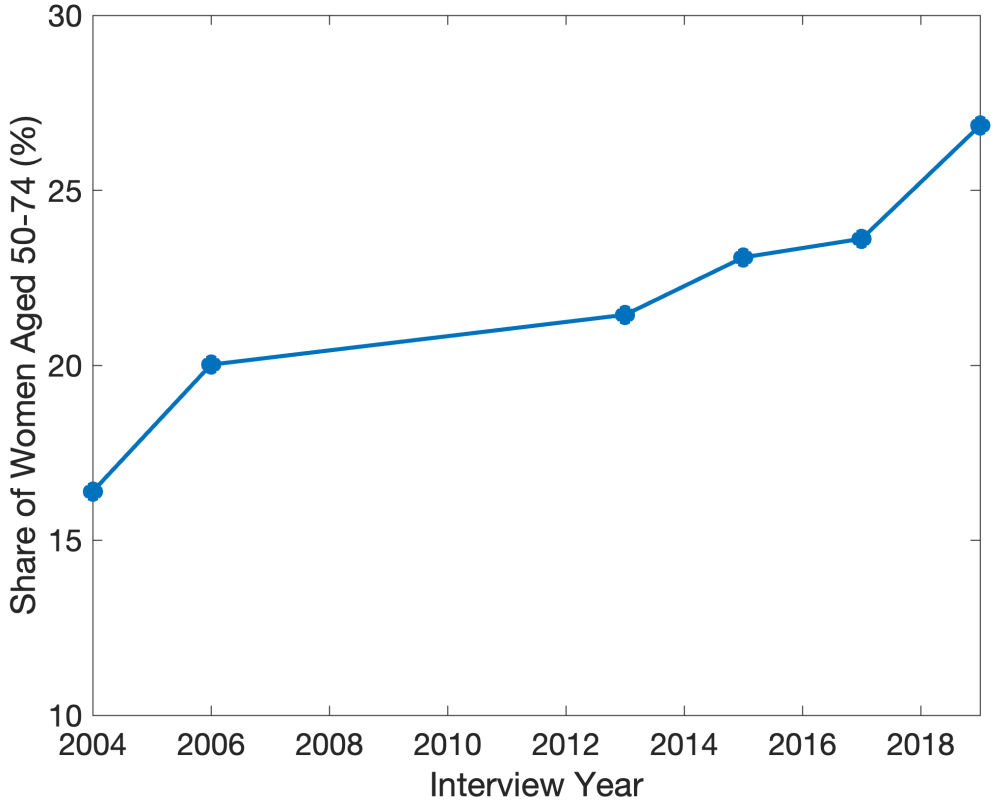
Fertility & Life Expectancy



Source: OECD Data for EU

- Falling fertility rates (left scale)
- Increasing remaining life expectancy at age 65 (right scale)

Share of Four-Generation Families



Source: SHARE.

- Increasing share of middle-aged women w/ parents & grandchildren alive

▸ By country group and care system

Research Questions

1. Feedback effect: aging populations on fertility through intergenerational care?
2. Quantitative evaluation of past & future fertility trends. Role of
   - increasing survival chances to old age (75+)
   - prices of formal care / familiarism

Approach

1. **Empirical analysis** to support mechanism:
   - Analysis of SHARE data
   - Respondents: women aged 50-74
   - Relation between # elderly & care provision & fertility
2. Quantitative **overlapping generations model**:
   - Partial equilibrium
   - Time-varying survival risk
   - 4 generations: parents & grandparents, children & great-grandparents
   - Endogenous fertility
   - Institutions change price of care
   - Calibrate model to European data

Related Literature

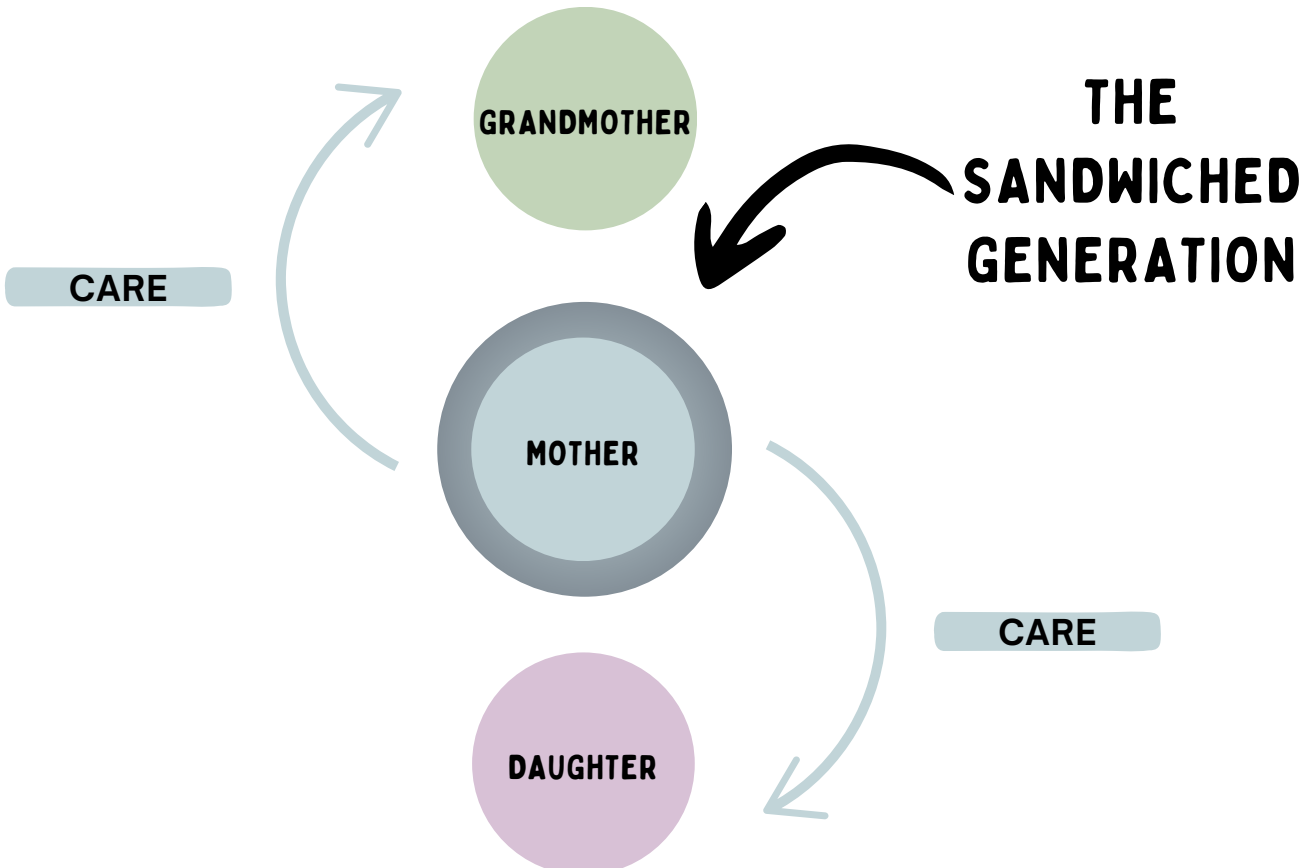
- Models of intergenerational care:
  - Care to grandchildren:
    - Exogenous fertility: Cardia and Ng (2003),Dimova and Wolff (2011)
    - Endogenous fertility: García-Morán and Kuehn (2017),Bick (2016)
  - Care to elderly:
    - Skira (2015),Barczyk and Kredler (2018), Mommaerts (2023)
  - Care to children & elderly:
    - Korn and Wrede (2013)
- Main contribution:
  - Endogenous provision of two-sided care by grandmothers

Empirical: Grandchildren care | Empirical: Elderly care | Empirical: Elderly and grandchildren care

Structural: Grandchildren care | Structural: Elderly care | Structural: Children and Elderly care

Conventional View

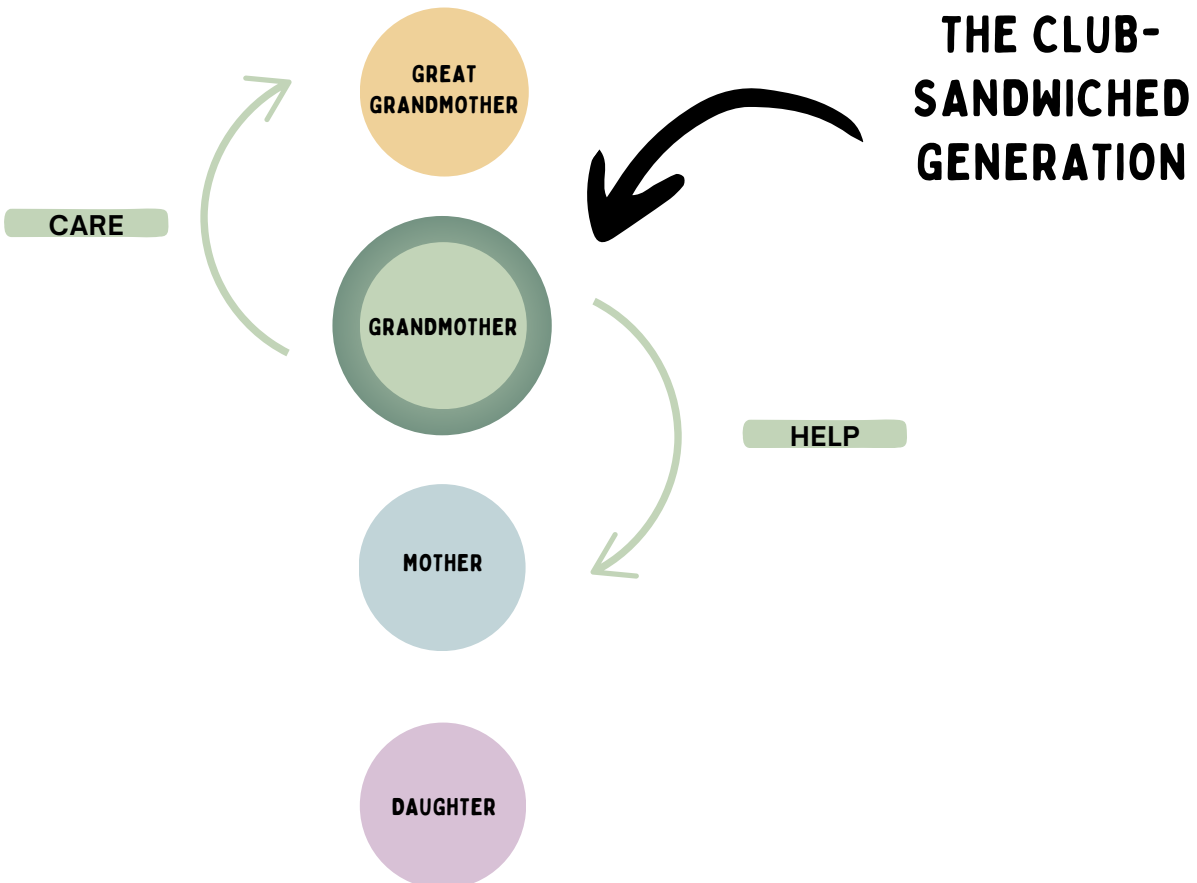
- From the 3-generations setup ...



Term introduced by Miller (1981) and Brody (1981)

Longevity & Care

- ... To the 4-generations setup



Data

- Survey of Health, Aging and Retirement in Europe (SHARE)
- Average every two years between 2004 and 2019
- Non-immigrant women aged 50-74
- Generational structure:
  - **G**reat-**g**randmothers (GG, also GGP): parents of respondents
  - **G**randmothers (G, also GP): respondents themselves
  - **M**others (M, also C): children of respondents
  - **D**aughters (D, also GC): grandchildren of respondents

Heterogeneity

1. **Countries categorized by:**
   - **Northern**: Denmark, Sweden
   - **Southern:** Greece, Italy, Spain
   - **Western:** Austria, Belgium, France, Germany, Netherlands, Switzerland

2. **Countries categorized by the caregiving system:**
   (Esping-Andersen, 1999)
   - **Family-based**: Spain, Italy
   - **Market-based**: Switzerland, Germany
   - **Government-based**: Sweden, Denmark

▸ Demographic Indicators ▸ Demographic Indicators by Group & Type ▸ Projected Life Expectancy

Descriptive Statistics By Region

	Northern	Western	Southern	Average
Elderly Care				
Caregiver (%)	36.42	30.15	22.33	27.79
Intensive caregiver [daily] (%)	1.7	3.23	4.16	3.44
N	9050	17706	9946	36702
Grandchild Care				
Caregiver (%)	73.71	64.68	55.73	62.5
Intensive caregiver [daily] (%)	2.26	9.06	24.98	13.85
N	10166	16957	9325	36448
Employed (%)	44	38.35	26.06	34.25
N	18292	34610	21253	74155
Usual hours (only employed)	32.86	32.24	34.34	32.9
N	7283	10936	4549	22768

▸ By Caregiving System

Childcare and Elderly Care Correlation

What's the correlation between elderly care and childcare? ▸ Go

Childcare and Elderly Care Correlation

What's the correlation between elderly care and childcare? Go

	P(childcare)	P(weekly childcare)	P(daily childcare)
P(elderly care)	**0.0520*****		
	(0.0131)		
P(weekly elderly care)		**0.0779*****	
		(0.0152)	
P(daily elderly care)			0.0180
			(0.0169)
Individual FE	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes
Mean DV	0.420	0.220	0.056
R^2	0.752	0.691	0.669
Observations	8,289	8,289	8,289

Clustered SE at individual level in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Providing elderly care increases the likelihood of any childcare by 5.2 p.p.
- Weekly elderly care increases weekly childcare by 7.8 p.p.
- Family solidarity is more prevalent in Southern and Western Europe Go

Empirical Strategy

What are the effects of $\uparrow$ elderly care needs on care provision and fertility?

Empirical Strategy

What are the effects of ↑ elderly care needs on care provision and fertility?

Model

$$Y_{i,w} = \alpha_0 + \alpha_1 P_{i,w} + X'_{i,w}\Gamma + \theta_i + \theta_w + \epsilon_{i,w}$$

- $Y_{i,w}$: outcome of interest for woman i in wave w
  - elderly care provision (to own GGP, spouse's GGP, or both)
  - childcare provision
  - # grandchildren / probability of having a new GC
- $P_{i,w}$: # of alive GGP (own and partner): Proxy for EC requirement
- $X_{i,w}$: age, age^2, own health and education, marital status, # siblings and children
- θ_i, θ_w: individual and wave fixed effects

Effect of Parental Survival on Provision of Elderly Care

	P(elderly care)	P(elderly care, in-laws)	P(elderly care, any)
Living parents ($P_{i,w}$)	**0.1445*****	**0.0265*****	**0.1561*****
	(0.0079)	(0.0047)	(0.0085)
Individual FE	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes
Mean DV	0.113	0.024	0.136
R^2	0.606	0.525	0.605
Observations	26,361	25,806	25,358

Clustered SE at individual level in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Effect is strongest in Northern/Government-based system
- When considering **intensive margin** (daily care), picture reverses

▸ Heterogeneous by Country ▸ Heterogeneous by Care System
▸ Daily Heterogeneous by Country ▸ Daily Heterogeneous by Care System

Effect of Parental Survival on Grandchild Care

	P(any childcare)	P(weekly childcare)	P(daily childcare)
Living parents ($P_{i,w}$)	**-0.0240*****	**-0.0154***	-0.0079
	(0.0091)	(0.0079)	(0.0050)
Individual FE	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes
Mean DV	0.461	0.250	0.073
R^2	0.697	0.647	0.608
Observations	23,852	23,852	23,852

Clustered SE at individual level in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Effects strongest in Western/Market-based system

▸ Heterogeneous by Country ▸ Heterogeneous by Care System

Effect of Parental Survival on Fertility Outcomes

	# grandchildren	P(new grandchild)
Living parents ($P_{i,w}$)	**-0.0647*****	-0.0143
	(0.0242)	(0.0110)
Individual FE	Yes	Yes
Wave FE	Yes	Yes
Mean DV	2.684	0.241
R^2	0.934	0.449
Observations	26,873	20,803

Clustered SE at individual level in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

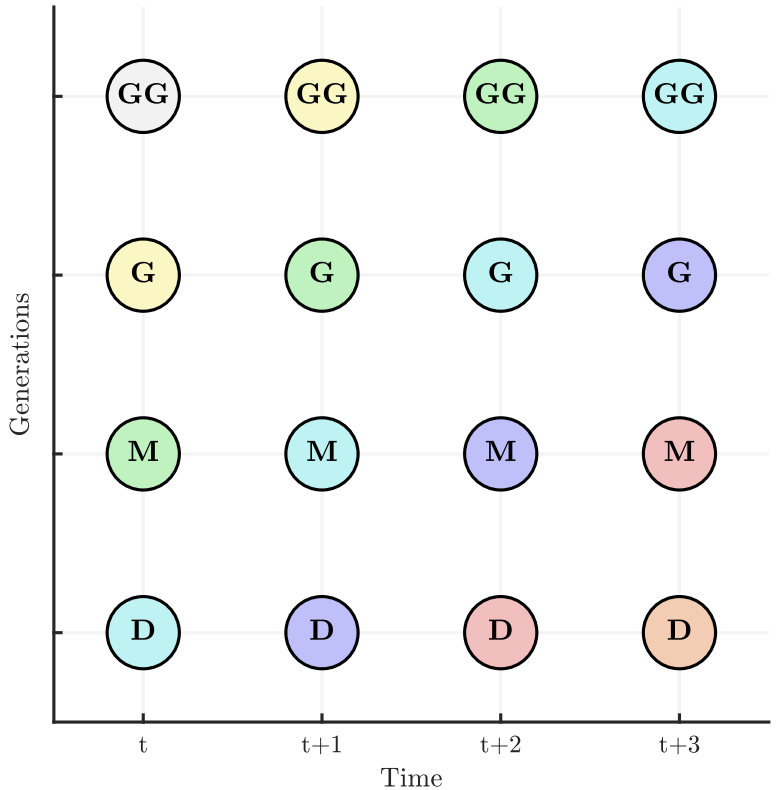
- Driven by Western Europe / Market-based care systems

▸ Heterogeneous by Country ▸ Heterogeneous by Care System

Main Empirical Takeaways

- **Parental survival (elderly alive):**
  - ↑ elderly care: +15 p.p. probability of caring for parents / in-laws
  - ↓ childcare: –2.4 p.p. for any, –1.5 p.p. for weekly care
  - ↓ fertility: fewer grandchildren (–0.06), no effect on new births
- **No evidence of a tradeoff within caregivers:**
  - Those providing elderly care are more likely to also provide childcare
- **Heterogeneous effects across Europe:**
  - Western/Market-based: strongest reductions in childcare and fertility
  - Southern/Family-based & Northern/Government: weaker or no impact
  - No (+) cond. correlation on two-sided care for Northern/Government

Generational Structure of OLG Model



- Each period, four generations *D*,*M*,*G*,*GG* overlap
- Decision makers: *M* & *G*
- Passive care receivers: *D* & *GG*

Main Ingredients of the Model

- Deterministic wages and prices
- All individuals are female
- Heterogeneous labor productivity η (same among siblings)
- η is drawn by generation M before giving birth
- Exogenous driver: demographic change
- No growth via tech progress; steady-state = stationary economy

Decisions & State Variables

▸ Plot

- **Generation D** No decisions, needs care
- **Generation M**
- **Generation G**
- **Generation GG**

Decisions & State Variables

▸ Plot

- **Generation D**
- **Generation M**
  - **Choice variables**:
    - Consumption: c
    - Labor supply: ℓ
    - Fertility: $k(M)$
    - Informal childcare: $h^D(M)$
    - Formal childcare: z^D
  - **State variables:**

$$X(M) = \left[\eta(M) > 0, k(G) \geq 0, \mathbb{E}\left[h^D(G) \mid X(M)\right], \mathbb{E}\left[m(G) \mid X(M)\right]\right]$$

- **Generation G**
- **Generation GG**

Decisions & State Variables

▸ Plot

- **Generation D**
- **Generation M**
- **Generation G**
  - **Choice variables**:
    - Consumption: c
    - Labor supply: ℓ
    - Childcare for granddaughters: $h^D(G)$
    - Financial support to daughters: m
    - Informal long-term care for mothers: h^{GG}
    - Formal long-term care provided to mothers: z^{GG}
  - **State variables**, all daughters identical:

$$X(G) = [\eta(G) > 0, k(G) \geq 0, \eta(M) > 0, k(M) \geq 0, \mathbb{I}(GG), k(GG) \geq 0]$$

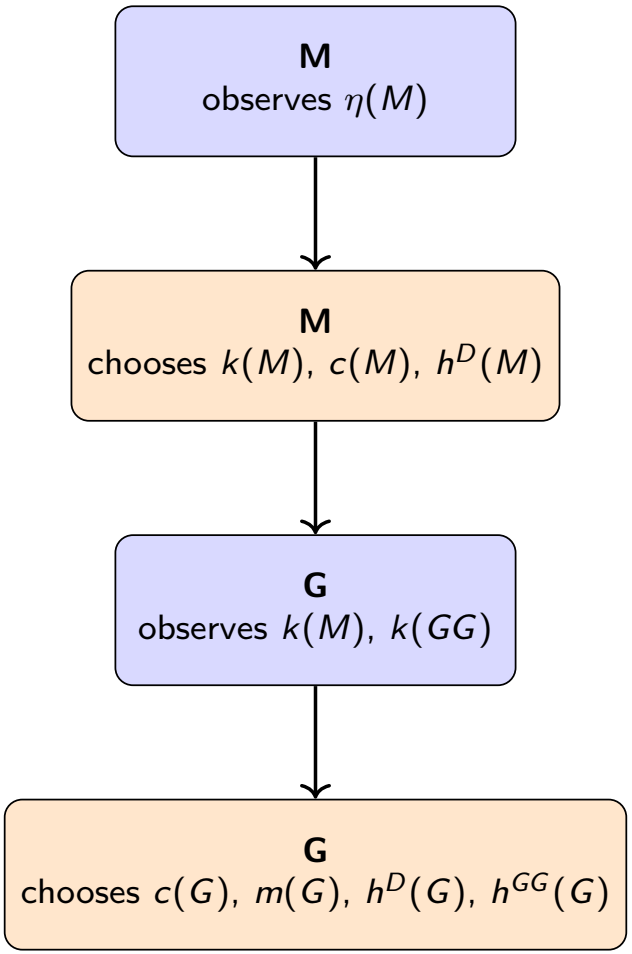
- **Generation GG**

Decisions & State Variables

▸ Plot

- **Generation D**
- **Generation M**
- **Generation G**
- **Generation GG** No decisions, needs care

Timing of Decisions Across Generations



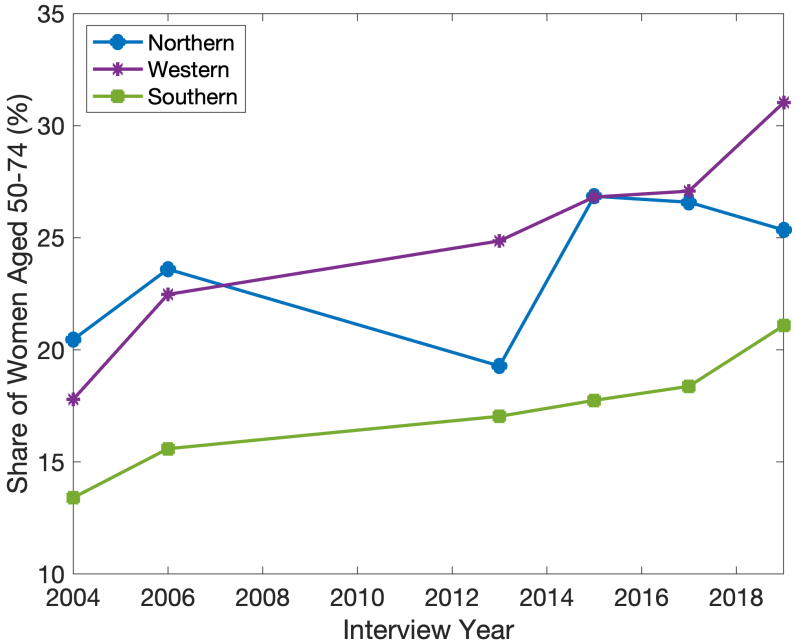
▸ Problem G ▸ Problem M

Summary of Findings and Next Steps

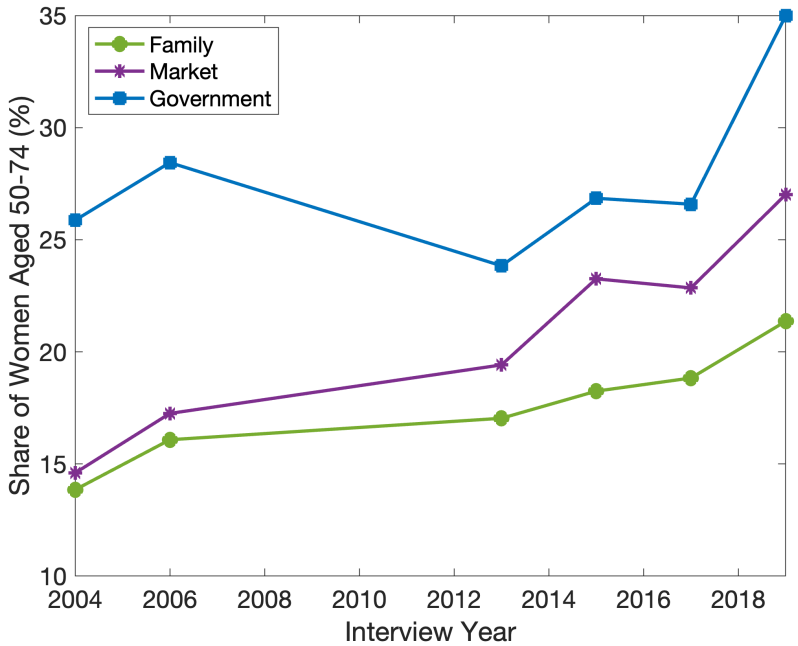
- **Motivation:** Longer life expectancy increases multi-generation families, raising intergenerational care needs
- **Empirics:**
  - More elderly alive $\rightarrow$ more care for parents, less grandchild care, fewer grandchildren
  - Large heterogeneity by country: interplay of institutions, familialism, and demographics
- **Goal of the model:** quantify how longevity and care costs shape fertility via these care trade-offs

Share of Four-Generation Families

Heterogeneity By Country Group and Care System



By Country Group



By Care System

- **Northern**: Denmark, Sweden
- **Southern**: Greece, Italy, Spain
- **Western**: Austria, Belgium, France, Germany, Netherlands, Switzerland

- **Family**: Spain, Italy
- **Market**: Switzerland, Germany
- **Government**: Sweden, Denmark

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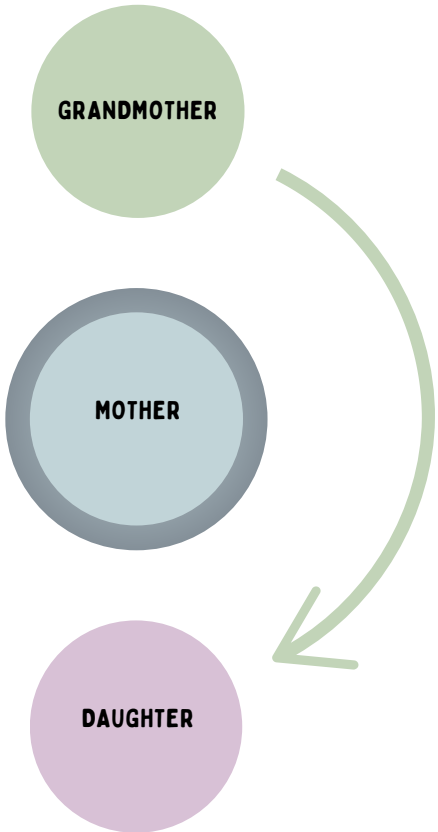
Literature Review

Providing Grandchildren Care...



- **↑ fertility and LS of their children**

  Del Boca (2002); Hank and Kreyenfeld (2003); Kaptijn et al. (2010); García-Morán and Kuehn (2017); Pessin et al. (2022)

- **↓ LS for grandmothers but not for grandfathers**

  Rupert and Zanella (2018); Backhaus and Barslund (2021)

- **More likely if younger grandparents and/or grandchildren**

  Coall et al. (2014); Luo et al. (2012); Silverstein and Marenco (2001)

- **↓ propensity to care if health limitations**

  Hank and Buber (2009)

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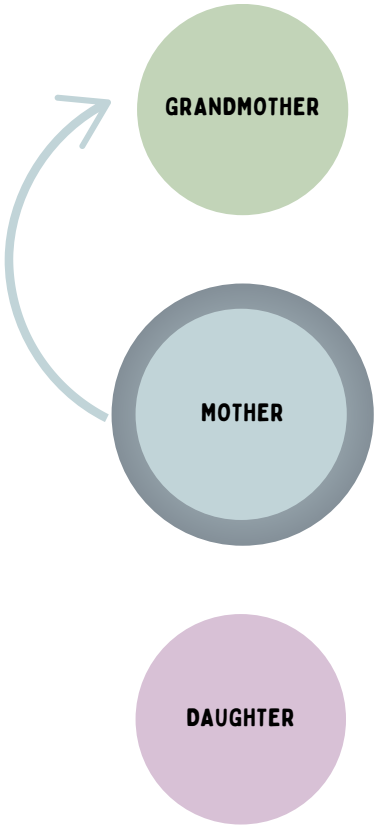
Literature Review

Providing Elderly Care ...



- **↓ FLFP**

  Ettner (1995); Pavalko and Artis (1997); Heitmueller (2007); Bolin et al. (2008); Leigh (2010); Ciani (2012); Van Houtven et al. (2013); Crespo and Mira (2014); Schmitz and Westphal (2017); Heger and Korfhage (2020); Simard-Duplain (2022); Frimmel et al. (2023)

- **↓ FLFP stronger if intensive care**

  Ettner (1995); Carmichael and Charles (2003); Heitmueller (2007); Lilly et al. (2010); Casado-Marín et al. (2011)

- **↓ hours worked ?**
  - NO: Casado-Marín et al. (2011); Wolf and Soldo (1994); Bolin et al. (2008)
  - YES: Ettner (1995); Pavalko and Artis (1997); Johnson and Lo Sasso (2000); Spiess and Schneider (2003); Leigh (2010); Van Houtven et al. (2013); Schmitz and Westphal (2017); Heger and Korfhage (2020); Casella and Mazzone (2023)

- **Wage penalty**

  Carmichael and Charles (2003); Heitmueller (2007); Van Houtven et al. (2013)

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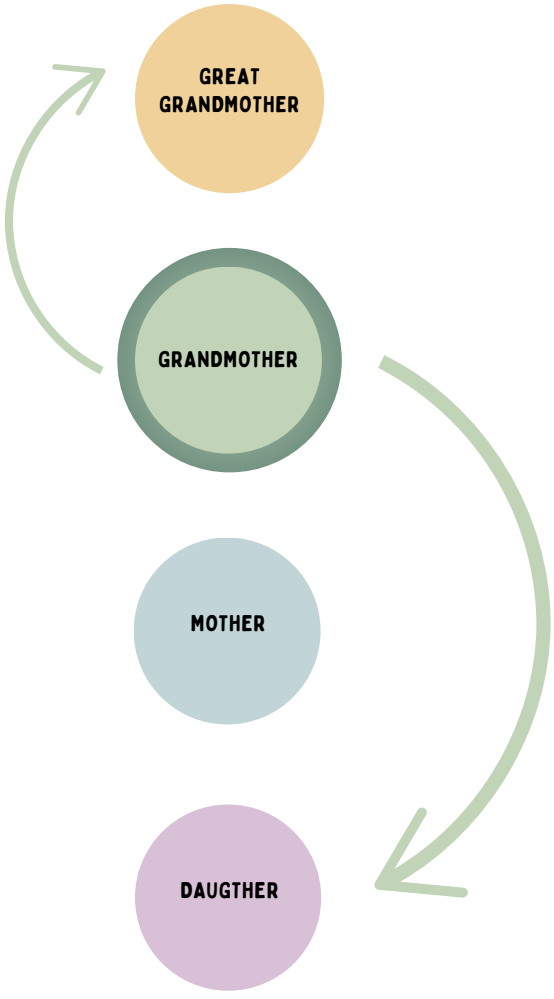
Literature Review

Providing Both Elderly and Grandchildren Care ...



- **Complementarity in family solidarity**

  Grundy and Henretta (2006); Železná (2018); Herlofson and Brandt (2020); Vlachantoni et al. (2020)

- **Does not aggravate further the psychological strain**

  Huvent-Grelle et al. (2015); Luna et al. (2021); Xu (2019)

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Intergenerational Care Models (No Sandwiched Generation)

Providing Grandchildren Care

Exogenous fertility

- Cardia and Ng (2003): 2-period OLG, one-sided altruism. Grandparents provide time/transfers. Calibrated to US. Time transfers increase young generation's lifetime utility.
- Dimova and Wolff (2011): Private transfers model. Grandparents give care/gifts. Positive effect on daughters' labor force participation (LFP). No formal childcare in model.

Endogenous fertility

- García-Morán and Kuehn (2017): Residence choice, fertility, and FLFP. Proximity to parents reduces wage offers accepted by women.
- Bick (2016): Life-cycle model with fertility, FLFP, and childcare. Non-maternal, unpaid care crucial to match German data.

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Intergenerational Care Models (No Sandwiched Generation)

Elderly Care Only

Exogenous fertility

- Skira (2015): Dynamic discrete choice model. Caregiving reduces women's LFP and wages, with low reentry probabilities post-caregiving.
- Barczyk and Kredler (2018): Heterogeneous-agent OLG with intra-family bargaining over informal care. Key for evaluating LTC policy.
- Mommaerts (2023): Dynamic model of LTC decisions between elderly parent and adult child. Informal care reduces insurance demand and Medicaid spending.

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Intergenerational Care Models with Sandwiched Generation

Child & Elderly Care

- Korn and Wrede (2013): 2-period household model of labor supply, fertility, and care. Women choose number of children and allocate care between children and elderly parents. LTC price changes affect both fertility and labor supply.
- **Gap:** No structural model of grandmothers providing both childcare and eldercare.

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Demographic Indicators by Country Group

Country	TFR	AFB	ASB	LE Women 65	LE Men 65
Northern Europe					
Denmark	1.72	30.0	32.2	20.7	18.2
Sweden	1.67	31.2	32.0	21.9	19.6
Southern Europe					
Greece	1.48	29.9	32.9	20.9	17.8
Italy	1.25	31.7	33.0	21.9	19.0
Spain	1.19	31.6	33.5	23.2	19.2
Western Europe					
Austria	1.48	29.9	31.8	21.1	18.0
Belgium	1.60	29.5	31.6	21.6	18.7
France	1.80	29.1	31.6	23.0	19.2
Germany	1.58	29.9	32.2	20.8	17.6
Netherlands	1.62	30.3	32.4	20.8	18.7
Switzerland	1.51	31.2	33.1	22.6	20.0

Notes: TFR = Total Fertility Rate; AFB = Age at First Birth; ASB = Age at Second Birth; LE = Life Expectancy at 65. Data from OECD and EUROSTAT.

▸ Back to Heterogeneity

Demographic Indicators by Country Group and Caregiving System

Country Group	TFR	AFB	ASB	LE Women 65	LE Men 65
Northern Europe	1.70	30.6	32.1	21.3	18.9
Southern Europe	1.31	31.1	33.1	22.0	18.7
Western Europe	1.60	30.0	32.1	21.6	18.7

Caregiving Type	TFR	AFB	ASB	LE Women 65	LE Men 65
Family-based	1.22	31.7	33.3	22.6	19.1
Market-based	1.55	30.6	32.6	21.7	18.8
Government-based	1.70	30.6	32.1	21.3	18.9

Notes: TFR = Total Fertility Rate; AFB = Age at First Birth; ASB = Age at Second Birth; LE = Life Expectancy at 65. Data from OECD and EUROSTAT.

▸ Back to Heterogeneity

Expected Life Expectancy at 65 in 2100

Country	Men	Women
Northern Europe (Avg: 26.0 / 29.1)		
Denmark	25.9	29.0
Sweden	26.1	29.2
Southern Europe (Avg: 26.3 / 29.4)		
Greece	26.3	29.2
Italy	26.2	29.4
Spain	26.4	29.6
Western Europe (Avg: 26.1 / 29.1)		
Austria	26.0	29.0
Belgium	26.0	29.2
France	26.4	29.7
Germany	25.9	28.9
Netherlands	26.0	28.9
Switzerland	26.4	29.4

Source: EUROSTAT projections.

Back to Heterogeneity

Descriptive Statistics By Caregiving System

	Family	**Market**	**Government**	Other	Average
Elderly Care					
Caregiver (%)	22.4	31.86	37.82	28.78	27.79
Intensive caregiver [daily] (%)	4.23	3.35	.97	3.01	3.44
N	7617	6152	6285	16648	36702
Grandchild Care					
Caregiver (%)	55.44	58.54	72.63	70.6	62.5
Intensive caregiver [daily](%)	25.15	9.08	1.79	9.09	13.85
N	7105	4929	7204	17210	36448
Employed (%)	26.28	41.02	49.22	34.77	34.25
N	15939	11481	12680	34055	74155
Usual hours (only employed)	34.14	31.07	36.35	33.1	32.9
N	3446	4674	5525	9123	22768

Back to Descriptives

Childcare and Elderly Care Tradeoff (?)

- Goal: analyze whether there is a childcare and elderly care tradeoff
- Sample: **at least one alive GGP**

$$P(CC)_{i,w} = \alpha\, P(EC)_{i,w} + H_{i,w}^{GGP} + \gamma' X_{i,w} + \theta_i + \theta_w + \varepsilon_{i,w}$$

- $P(EC)_{i,w}$: indicator if GP provides care to at least one GGP
- $P(CC)_{i,w}$: indicator if GP provides care to at least one GC
- $H_{i,w}^{GGP}$: combined health status of both GGP
- $X_{i,w}$: GP age, age^2, own health, education, marital status, total # siblings and children
- θ_i, θ_w: individual and wave fixed effects
- α measures the partial correlation between **elderly care** and **childcare provision**, net of health and family controls

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Childcare and Elderly Care Correlation

Heterogeneity by Country Group

	Northern Europe	Southern Europe	Western Europe
Dependent Variable: P(childcare)			
P(elderly care)	0.0316	**0.0618****	**0.0561*****
	(0.0259)	(0.0273)	(0.0179)
Dependent Variable: P(weekly childcare)			
P(weekly elderly care)	0.0299	**0.0925*****	**0.0873*****
	(0.0289)	(0.0348)	(0.0203)
Dependent Variable: P(daily childcare)			
P(daily elderly care)	0.0242	0.0402	0.0040
	(0.0345)	(0.0403)	(0.0168)
Individual FE	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes
Mean DV (childcare)	0.508	0.293	0.442
Mean DV (weekly)	0.147	0.231	0.243
Mean DV (daily)	0.009	0.130	0.043
R^2 (childcare)	0.753	0.723	0.755
R^2 (weekly)	0.620	0.701	0.706
R^2 (daily)	0.475	0.683	0.649
Observations	1,710	1,938	4,641

Clustered SE at individual level in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Family solidarity is more prevalent in Southern and Western Europe

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Effect of Parental Survival on Provision of Elderly Care

Heterogeneous Effects by Country Group

Dependent Variables:	P(elderly care)	P(elderly care, in-laws)	P(elderly care)	P(elderly care, in-laws)	P(elderly care)	P(elderly care, in-laws)
	Northern Europe		Southern Europe		Western Europe	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
$P_{i,w}^{tot}$	0.2152***	0.0324***	0.0988***	0.0193***	0.1488***	0.0292***
	(0.0190)	(0.0104)	(0.0121)	(0.0062)	(0.0118)	(0.0078)
individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	0.13546	0.02817	0.08319	0.01772	0.11814	0.02611
R^2	0.59695	0.52417	0.57222	0.49408	0.62278	0.53701
Observations	5,463	5,361	6,804	6,771	14,094	13,674

Clustered SE at individual level in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

- Strongest effect in Northern Europe

▸ Back to Main

Effect of Parental Survival on Provision of Elderly Care

Daily Care - Heterogeneous Effects by Country Group

	Northern Europe		Southern Europe		Western Europe	
Dep. Vars.: :	P(daily)	P(daily, in laws)	P(daily)	P(daily, in laws)	P(daily)	P(daily, in laws)
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
$P^{tot}_{i,w}$	0.0028	0.0024	0.0352***	0.0070**	0.0265***	0.0032
	(0.0061)	(0.0028)	(0.0084)	(0.0031)	(0.0070)	(0.0024)
individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	0.00897	0.00112	0.03380	0.00502	0.02519	0.00388
R^2	0.43499	0.35976	0.49484	0.43957	0.47603	0.47492
Observations	5,463	5,361	6,804	6,770	14,094	13,674

Clustered (individual) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

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Effect of Parental Survival on Provision of Elderly Care

Heterogeneous Effects by Type of Care System

	Family		Government		Market	
Outcome:	P(elderly care)	P(elderly care, in-laws)	P(elderly care)	P(elderly care, in-laws)	P(elderly care)	P(elderly care, in-laws)
$P_{i,w}^{tot}$	0.1115***	0.0223***	0.2152***	0.0324***	0.1251***	0.0402***
	(0.0149)	(0.0082)	(0.0190)	(0.0104)	(0.0223)	(0.0148)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	0.091	0.022	0.135	0.028	0.130	0.031
R^2	0.567	0.501	0.597	0.524	0.611	0.546
Observations	5,050	5,019	5,463	5,361	3,843	3,751

Clustered SE at individual level in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Effects are largest in government-based systems, followed by market-based systems

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Effect of Parental Survival on Provision of Elderly Care

Daily Care - Heterogeneous Effects by Type of Care System

	Family		Government		Market	
Dep. Vars.:	P(daily)	P(daily, in-laws)	P(daily)	P(daily, in-laws)	P(daily)	P(daily, in-laws)
Variables						
$P^{tot}_{i,w}$	0.0371***	0.0061*	0.0028	0.0024	0.0244**	0.0060
	(0.0101)	(0.0037)	(0.0061)	(0.0028)	(0.0121)	(0.0055)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	0.0366	0.0062	0.0090	0.0011	0.0245	0.0061
R^2	0.4804	0.4519	0.4350	0.3598	0.4884	0.5210
Observations	5,050	5,018	5,463	5,361	3,843	3,751

Clustered (individual) standard errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

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Effect of Parental Survival on Grandchild Care

Heterogeneous Effects by Country Group

	P(childcare)	P(weekly childcare)	P(daily childcare)
Northern Europe			
$P_{i,w}^{tot}$	-0.036*	-0.014	-0.011*
	(0.021)	(0.015)	(0.006)
Num. Obs	4972	4972	4972
Individual F.E.	X	X	X
Wave F.E.	X	X	X
Southern Europe			
$P_{i,w}^{tot}$	0.008	0.013	0.000
	(0.017)	(0.015)	(0.012)
Num. Obs	6175	6175	6175
Individual F.E.	X	X	X
Wave F.E.	X	X	X
Western Europe			
$P_{i,w}^{tot}$	-0.044***	-0.036***	-0.013**
	(0.013)	(0.011)	(0.006)
Num. Obs	12705	12705	12705
Individual F.E.	X	X	X
Wave F.E.	X	X	X

Clustered SE at individual level in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Negative effects mainly driven by Western Europe
- No significant effect in Southern Europe

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Effect of Parental Survival on Grandchild Care

Heterogeneous Effects by Type of Care System

	P(childcare)	P(weekly childcare)	P(daily childcare)
Family-based			
$P_{i,w}^{tot}$	0.021	0.024	0.015
	(0.019)	(0.017)	(0.014)
Num. Obs	4488	4488	4488
Individual F.E.	X	X	X
Wave F.E.	X	X	X
Market-based			
$P_{i,w}^{tot}$	-0.048**	-0.047**	-0.010
	(0.023)	(0.018)	(0.011)
Num. Obs	3456	3456	3456
Individual F.E.	X	X	X
Wave F.E.	X	X	X
Government-based			
$P_{i,w}^{tot}$	-0.036*	-0.014	-0.011*
	(0.021)	(0.015)	(0.006)
Num. Obs	4972	4972	4972
Individual F.E.	X	X	X
Wave F.E.	X	X	X
Other			
$P_{i,w}^{tot}$	-0.036***	-0.026**	-0.017**
	(0.014)	(0.013)	(0.007)
Num. Obs	10936	10936	10936
Individual F.E.	X	X	X
Wave F.E.	X	X	X

Clustered SE at individual level in parentheses.

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

- Negative effects are stronger in market-based

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Effect of Parental Survival on Fertility Outcomes

Heterogeneous Effects by Country Group

	Northern Europe		Southern Europe		Western Europe	
Outcome:	N. grandchildren	P(new grandchild)	N. grandchildren	P(new grandchild)	N. grandchildren	P(new grandchild)
Model:	(1)	(2)	(3)	(4)	(5)	(6)
$P_{i,w}^{tot}$	-0.0815	-0.0238	0.0273	0.0022	-0.1235***	-0.0217
	(0.0594)	(0.0264)	(0.0377)	(0.0185)	(0.0352)	(0.0158)
individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	3.31	0.265	2.13	0.228	2.70	0.238
R^2	0.936	0.429	0.921	0.433	0.938	0.468
Observations	5,611	4,364	6,882	5,344	14,380	11,095

Clustered SE at individual level in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

- Significant negative effect on number of grandchildren in Western Europe; insignificant elsewhere
- No significant effect on probability of new grandchild in any region

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Effect of Parental Survival on Fertility Outcomes

Heterogeneous Effects by Type of Care System

	Family		Government		Market	
Outcome:	N. grandchildren	P(new grandchild)	N. grandchildren	P(new grandchild)	N. grandchildren	P(new grandchild)
$P_{i,w}^{tot}$	0.0492	0.0065	-0.0815	-0.0238	-0.1946***	-0.0611**
	(0.0476)	(0.0212)	(0.0594)	(0.0264)	(0.0665)	(0.0302)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	2.29	0.239	3.31	0.265	2.23	0.216
R^2	0.918	0.417	0.936	0.429	0.929	0.473
Observations	5,153	4,106	5,611	4,364	3,951	3,078

Clustered SE at individual level in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

- Strongest negative effects in market-based systems: fewer grandchildren and lower probability of new grandchild
- Family-based systems show small positive but insignificant effects

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Dynamic Problem of G

- **State variables**, all daughters identical:

$$X(G) = [\eta(G) > 0, k(G) \geq 0, \eta(M) > 0, k(M) \geq 0, \mathbb{I}(GG), k(GG) \geq 0]$$

- **Control variables**:

$$C(G, X(G)) = \left[c \geq 0, I \geq 0, h^D \geq 0, m \geq 0, h^{GG} \geq 0, z^{GG} \geq 0\right]$$

- **Dynamic problem**:

$$V(G, X(G)) = \max_{c, I, h^D, h^{GG}, z^{GG}, m} u(c, I) + \nu_M \cdot k(G) \cdot V(M, X(M)) + \mathbb{I}(GG) \cdot \nu_{GG} \cdot v(G, q) + \beta \mathbb{E}\left[v(G', q')\right]$$

s.t.

$$c(G, X(G)) = w \cdot \eta(G) \cdot \ell(G, X(G)) - p^{GG} \cdot \mathbb{I}(GG) \cdot z^{GG}(G, X(G)) - m(G, X(G)) \cdot k(G)$$

$$I(G, X(G)) = 1 - \left(\ell(G, X(G)) + h^{GG}(G, X(G)) + k(M) \cdot k(G) \cdot h^D(G, X(G))\right)$$

$$q^{GG}(G, X(G)) = f\left(h^{GG}(G, X(G)), z^{GG}(G, X(G))\right) \cdot k(GG).$$

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Dynamic Problem of M

- **Choice-specific state variables**, permanent income shock:

$$X(M) = \left[\eta(M) > 0, k(G) \geq 0, \mathbb{E}\left[h^D(G) \mid X(M)\right], \mathbb{E}\left[m(G) \mid X(M)\right]\right]$$

- **Control variables**:

$$C(M, X(M)) = \left[c \geq 0, I \geq 0, k(M) \geq 0, h^D \geq 0, z \geq 0, \Phi\left(X'(G')\right)\right]$$

- **Dynamic problem**:

$$V(M, X(M)) = \max_{k,c,I,h^D} u(c, I) + k(M, X(M)) \cdot v(M, q) - \chi \cdot \mathbb{I}_{M,k(M)>0} +$$
$$\beta \int V\left(G', \tilde{X}'(G'); \eta'(M'), k'(M')\right) \Phi\left(\tilde{X}'(G'); d\eta'(M'), dk'(M')\right)$$

s.t.

$$c(M, X(M)) = w \cdot \eta(M) \cdot \ell(M, X(M)) - p^D \cdot k(M, X(M)) \cdot z^D(M, X(M)) + m(G, X(G))$$
$$I(M, X(M)) = 1 - \left(\ell(M, X(M)) + k(M, X(M)) \cdot h^D(M, X(M))\right)$$
$$1 - s = h^D(M, X(M)) + h^D(G, X(G)) + z^D(M, X(M))$$
$$q(M, X(M)) = g\left(h^D(M, X(M)), h^D(G, X(G)), z^D(M, X(M)), s\right)$$
$$X'(G') = H(\tilde{X}(M), k'(M', X'(M')), \pi).$$

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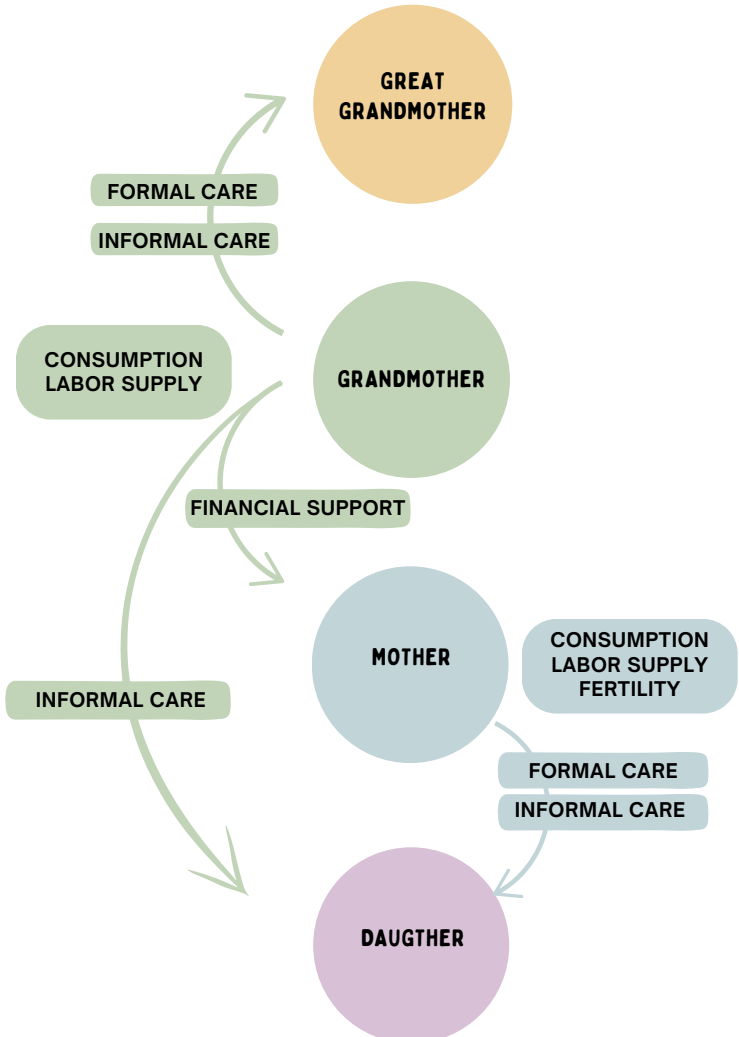
Inter-generational Decisions



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