Aging & Healthcare I: The Red Herring Hypothesis

Population Economics – Lecture 7

Riccardo Di Francesco

University of Southern Denmark

23 September 2026

This block: Lectures 5–8

The fiscal side of population aging

L5 The generational economy & National Transfer Accounts

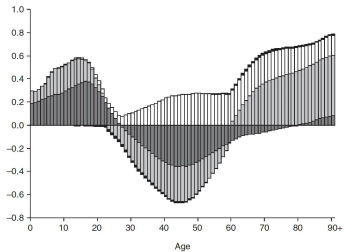
L6 Pensions & labor supply

L7 Aging & healthcare I: the red herring hypothesis

L8 Aging & healthcare II: steepening & forecasting

Where L5 and L6 left us

- L5 found the **lifecycle deficit**.
- When consumption exceeds labor income, the gap has to be financed.
- Past 60 that gap is closed mainly by **public transfers**.
- L6 studied the largest transfer in **cash**: the **public pension**, which we decomposed into four policy levers.



Today we open another box

Healthcare is the other large claim on old age, and it has **no fixed rule** like a pension formula. So its cost has to be read off age profiles of actual spending.

Learning outcomes

By the end of this lecture you should be able to:

- Describe age profiles of healthcare expenditure.
- State the red herring hypothesis and explain how it is tested.
- Distinguish the care types driven by age from those driven by time-to-death.

Readings

Part I — what we spend, and on whom

Kallestrup-Lamb, M., Marin, A. O. K., Menon, S., & Søgaard, J. (2024). Aging populations and expenditures on health. *The Journal of the Economics of Ageing*, 29, 100518.

A survey for this lecture *and* the next.

Part II — proximity to death

Zweifel, P., Felder, S., & Meiers, M. (1999). Ageing of population and health care expenditure: a red herring? *Health Economics*, 8(6), 485–496.

Introduces the red herring hypothesis: proximity to death, not age, drives healthcare expenditure.

Seshamani, M., & Gray, A. M. (2004). A longitudinal study of the effects of age and time to death on hospital costs. *Journal of Health Economics*, 23(2), 217–235.

Thirty years of hospital records: age matters, but modestly and only close to death.

Key questions (≈ 3 minutes)

- Does population aging cause population health and/or healthcare expenditures?
- Which interventions can affect population health and healthcare expenditure?

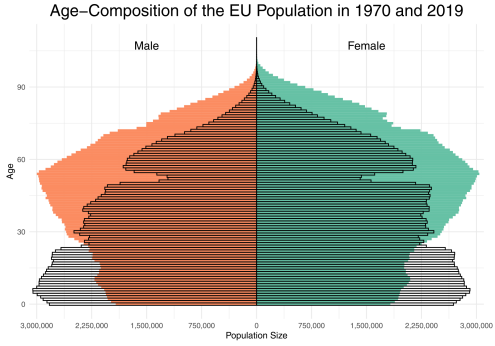
PART I

What does aging do to healthcare spending?

The population is getting older, and spending rises with age.

Kallestrup-Lamb et al. (2024)

Kallestrup-Lamb et al. (2024): the population is aging

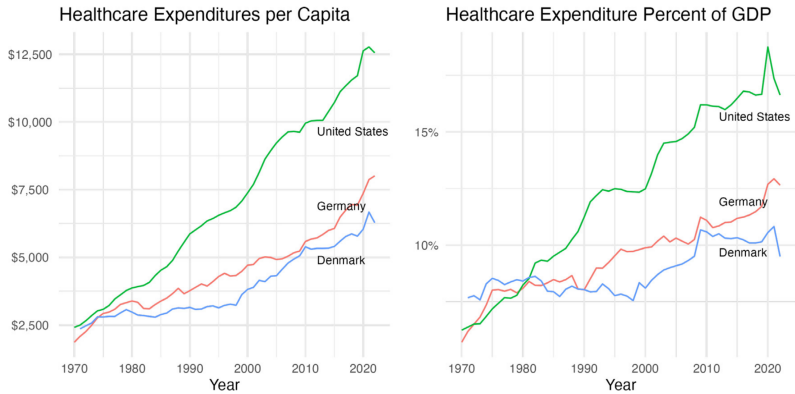


The pyramid of 1970 has become a spinning top in 2019.

Question ($\approx$ 2 minutes)

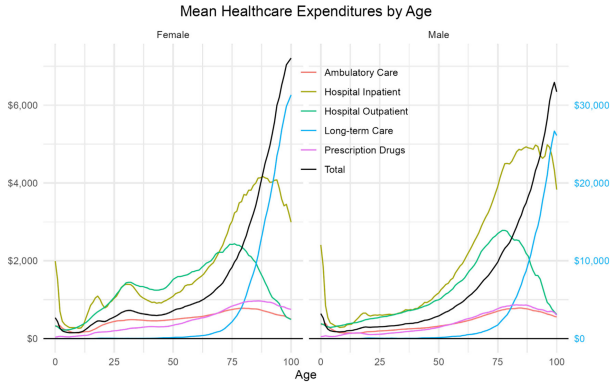
What has changed, and what could explain it?

Kallestrup-Lamb et al. (2024) (cont'd): and spending keeps rising



All three populations are aging, yet as a share of GDP their health spending grows at **very different paces**.

Kallestrup-Lamb et al. (2024) (cont'd): spending by age, Denmark



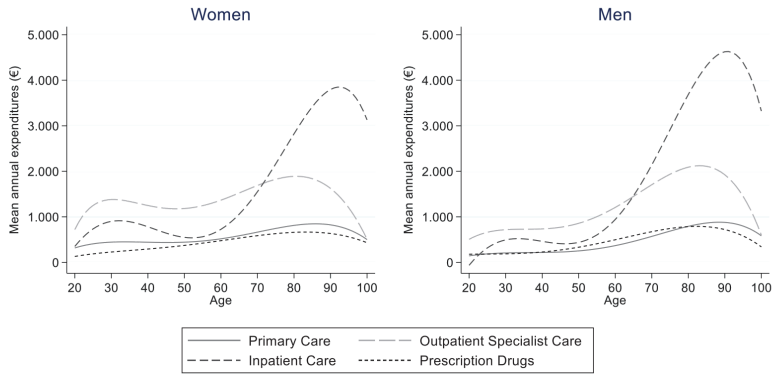
Mean expenditure per person, 2012, by age and sex, in 2012 US dollars. All care covered by the Danish universal scheme.

Long-term care and Total are on the right axis; everything else on the left.

Question ($\approx$ 3 minutes)

What do you see?

Fledsberg et al. (2023): the same shape in Sweden



Sweden. Mean annual publicly financed expenditure in euros, by age, care category and sex.

Fahle et al. (2016): and in what Americans pay themselves

TABLE 6

Mean expenditure, by category and age

	Aged 55–64	*Aged 65–74*	*Aged 75–84*	*Aged 85 and over*	*All*
Hospital, inpatient	319	241	314	437	306
Nursing home	32	159	946	3,538	543
Doctor	325	242	250	339	289
Outpatient surgery	104	54	56	38	76
Dental	329	361	344	304	339
Prescription drugs	649	789	908	941	761
Home health services	18	19	86	323	56
Special services and facilities	30	21	48	82	35
Helper	21	49	187	816	129
Non-medical	354	426	478	649	515
Hospice	40	244	145	165	159
Insurance costs	2,574	2,748	2,779	2,603	2,663
Other	75	83	169	284	114
Total	4,430	4,757	6,071	9,755	5,289
Total excluding nursing home	4,425	4,607	5,135	6,239	4,765

Mean annual **out-of-pocket** spending by age group, 2014 US dollars. Health and Retirement Study.

A different country, system and payer — **what households pay beyond their insurance** — and it still rises with age.

Freezing the profile

We already know how to turn a profile into an aggregate. From L5:

$$H_t = \sum_a \underbrace{h(a, t_0)}_{\substack{\text{healthcare expenditure} \\ \text{held fixed}}} \times \underbrace{N(a, t)}_{\substack{\text{population, projected} \\ \text{the pyramid, moved forward}}} .$$

Question ($\approx$ 3 minutes)

Freeze $h(a, t_0)$ and let the population keep aging.

- Does national healthcare expenditure rise?
- What does freezing h assume about *why* older people spend more?

Why do older people spend more?

The data seem to suggest that **age drives spending**. But they only show that older people spend more, not *why*. Two very different stories fit them:

It is about *age*

Care needs rise with age itself: an 85-year-old costs more than an **otherwise identical** 65-year-old.

An older population is more expensive, whatever the reason it aged.

It is about *dying*

Care is concentrated in the last months of life. The old look expensive because more of them are close to death.

Why the population aged matters: longer lives postpone the cost. $h(a)$ shifts when people live longer.

Question ($\approx$ 3 minutes)

Which do you think it is — and what would you need to measure to tell them apart?

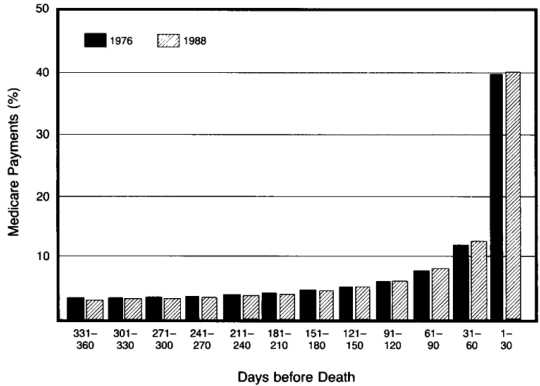
PART II

Proximity to death

Maybe age itself does not drive spending, but only stands in for something else.

Zweifel, Felder & Meiers (1999) · Kallestrup-Lamb et al. (2024)

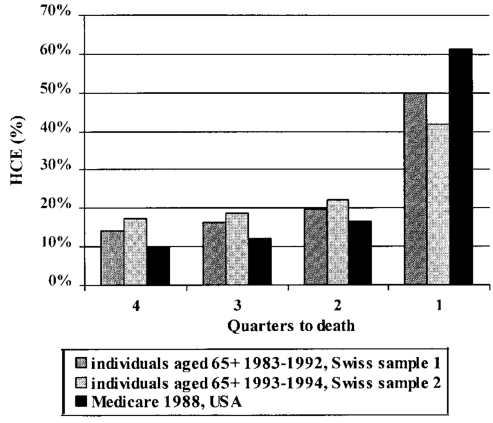
Lubitz and Riley (1993): spending is concentrated at the very end of life



Medicare payments in the last year of life, by days before death, 1976 and 1988.

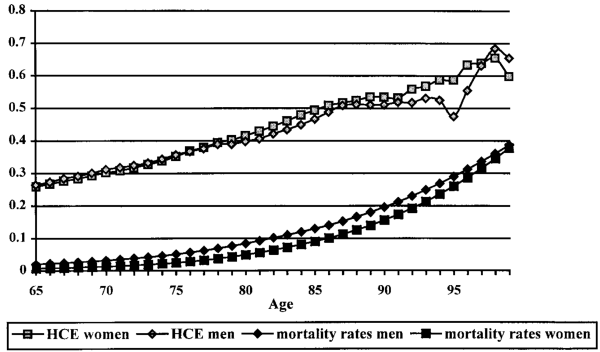
The final 30 days take **about 40 percent** of the year's spending — and the shape is unchanged across twelve years.

Zweifel et al. (1999): the same concentration in Switzerland



A different country/insurance system, and the last quarter still takes the largest share.

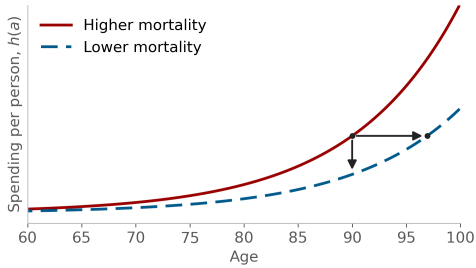
Zweifel et al. (1999) (cont'd): the two curves in one picture



Switzerland, 1992. Average expenditure per member aged 65+ of a large sick fund (open markers) against the age-specific mortality rate of the resident population (filled markers).

- Spending and mortality climb together over the same ages.
- At 70, few people are in their last two years. **At 90, many are.**

The red herring hypothesis



Zweifel, Felder and Meiers (1999)

Once time-to-death is accounted for, age has **little or no effect** on healthcare expenditure.

$\Rightarrow$ If that is right, the cross-sectional age profile is a *composition* effect.

Why the name: "Exclusive emphasis on population ageing as a cause of growth in per capita HCE runs the risk of creating a red herring by distracting from the choices that ought to be made." (Zweifel et al., 1999)

Zweifel et al. (1999) (cont'd): how the hypothesis is tested

Put both candidates in the same regression and let them compete:

$$\ln HCE = \beta_0 + \underbrace{\beta_1 A + \beta_2 A^2 + \beta_3 (A \cdot SEXF)}_{\text{age}} + \underbrace{\sum_{q=1}^{7} \gamma_q Q_q}_{\text{quarters to death}} + \cdots + \varepsilon.$$

A calendar age
$SEXF$ $= 1$ if female
Q_q $= 1$ in the q-th quarter *before death* (8th: benchmark)

Question ($\approx$ 2 minutes)

Suppose the red herring hypothesis is exactly true. What should we see in the regression?

Zweifel et al. (1999) (cont'd): the data

	Sample 1	**Sample 2**
Sick fund	KKB, mainly rural	Helvetia, mainly urban
Deaths observed	1983–1992	1993–1994
Individuals	681 (570 aged 65+)	360 (348 aged 65+)
Each person	8 quarterly expenditure records — the last two years of life	

- The novelty in 1999 was **longitudinal** data: you cannot measure time-to-death in a cross-section.

Zweifel et al. (1999) (cont'd): the result

Variable	Sample 1[b]				Sample 2[b]			
	All individuals		Individuals aged 65+		All individuals		Individuals aged 65+	
Constant	3.064**	(0.479)	5.314*	(2.708)	10.606**	(1.223)	12.087*	(6.773)
A	0.062**	(0.013)	−0.043	(0.068)	−0.111**	(0.031)	−0.115	(0.147)
A^2	−0.0004**	(0.0001)	0.0002	(0.0004)	0.0007**	(0.0002)	0.0006	(0.0008)
SEXF	0.720*	(0.283)	1.632*	(0.740)	0.567	(0.538)	0.206	(0.869)
$A \cdot$ SEXF	−0.007	(0.004)	−0.017	(0.009)	−0.005	(0.006)	−0.001	(0.010)
INS	0.239**	(0.061)	0.761**	(0.212)	0.283**	(0.075)	0.293**	(0.099)
λ	—		2.424**	(0.856)	—		−2.986*	(1.856)
$Q1$	1.407**	(0.090)	1.888**	(0.195)	1.167**	(0.138)	0.619*	(0.358)
$Q2$	0.596**	(0.091)	0.818**	(0.139)	0.513**	(0.133)	0.234	(0.237)
$Q3$	0.398**	(0.091)	0.539**	(0.135)	0.310*	(0.130)	0.267	(0.167)
$Q4$	0.229*	(0.092)	0.246*	(0.109)	0.225	(0.123)	0.172	(0.158)
$Q5$	0.253**	(0.092)	0.280**	(0.109)	0.202	(0.117)	0.154	(0.149)
$Q6$	0.230*	(0.091)	0.218*	(0.108)	0.190	(0.111)	0.152	(0.142)
$Q7$	0.070	(0.092)	0.089	(0.108)	0.025	(0.108)	0.011	(0.138)

- **Age** (A, A^2): not significant in either 65+ column.
- **Quarters to death**: coefficients rise the closer to death. In sample 2, only Q_1 is significant.

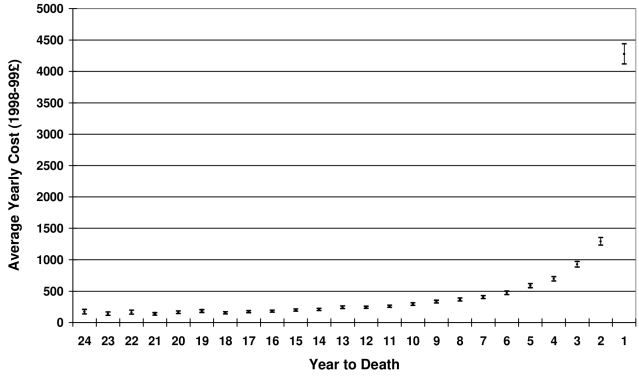
Zweifel et al. (1999) (cont'd): what the result does, and does not, establish

At 65+, **time-to-death** carries the effect and **age** adds nothing detectable.

But the result has **three limits**:

1. **Small samples.** 570 and 348 people.
2. **One country.** Switzerland only.
3. **All care lumped together.** Mostly hospital, never split by type of care.

Seshamani and Gray (2004): costs rise for years before death

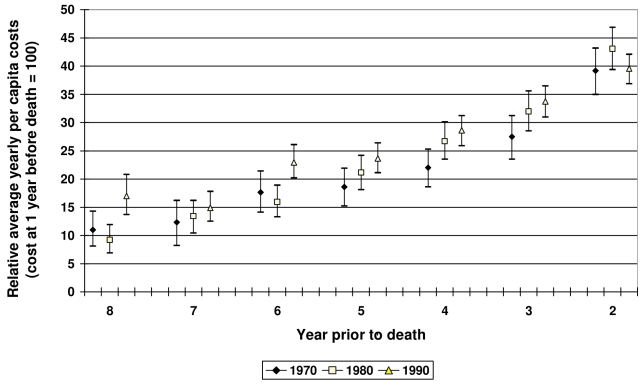


Predicted average yearly hospital cost by years to death, 1998–99 pounds, with 95% confidence intervals.

- **Oxfordshire, England**: everyone aged 65+ at the end of 1970, followed to 1999.
- **90,929 people**, yearly costs up to 24 years before death.
- **Hospital care only**.

A **bigger sample**, in a **new country**, focused on **one type of care**.

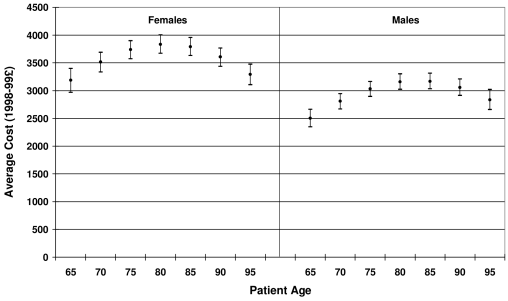
Seshamani and Gray (2004) (cont'd): the same pattern across cohorts



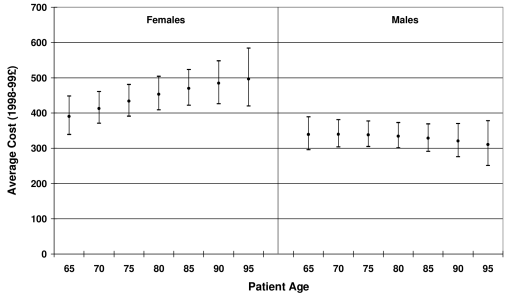
- Three cohorts, a decade apart each: the rise towards death is **not significantly different**.

Seshamani and Gray (2004) (cont'd): age matters only near death

Last year of life



Ten years before death



Predicted average yearly hospital cost by age, 1998–99 pounds, with 95% confidence intervals.

Note the different vertical scales.

- **Last year of life** (left): rises to about 80–85, then falls. The differences are significant.
- **Ten years before death** (right): no significant differences by age.

Question ($\approx$ 3 minutes)

Hospital spending in the last year of life is lower at 95 than at 80. Why might that be?

There are so many types of healthcare

We measured **healthcare** — and healthcare is not one thing. A hip replacement, a box of pills and a nursing-home bed are different goods, bought for different reasons.

So the hypothesis need not have one answer. It can hold for some components and fail for others.

Type of care	Red herring	What drives spending
Hospital (in- and outpatient)	+	time-to-death, robustly
Prescription drugs	?	mixed
Ambulatory care	?	mixed
Long-term care	−	**age, not time-to-death**

Kallestrup-Lamb et al. (2024) collect the paper-by-paper verdicts in their Table 1.

Takeaway

The red herring hypothesis is not a statement about healthcare. It holds for the care people use when they are dying, and fails for the care people use because they are old.

Summary

Part I — what does aging do to healthcare spending

1. Spending rises steeply with age, and the population is shifting into exactly those ages.
2. Freeze the profile, project the population, and aging looks like a fiscal emergency.

Part II — proximity to death

3. **The profile is partly a composition effect.** The old cost more in part because more of them are dying.
4. **The test is one equation.** At 65+, age does not survive and time-to-death is large in a regression.
5. **The result has limits.** Small samples, one country, all care lumped together.
6. **Better data refine it.** Time-to-death dominates and is stable across cohorts; age matters modestly, and only close to death.
7. **It is care-specific.** Hospital care is about dying; long-term care is about age.

Back to the key questions

1. **Does population aging cause population health and/or healthcare expenditures?**
   - *Health:* lower mortality means people are healthier. Beyond that, these papers measure healthcare, not health.
   - *Expenditures:* less than the age profile suggests. The old cost more partly because more of them are **close to death**. This holds for hospital care; for **long-term care**, age itself drives spending.

2. **Which interventions can affect population health and healthcare expenditure?**
   - These papers do not evaluate interventions.
   - More generally, we do not know a person's **time-to-death** until they die. So it is hard to design an intervention under the red herring hypothesis.