



Is the right to be forgotten for breast cancers survivors an improvement?

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The objective is to assess the impact on portfolio, inclusivity and fairness for insured population through simulated data.

What is the Right To Be Forgotten (RTBF)?

- Implemented in France since 2016 people with a history of cancer do not have to have to declare their cancer 5 years after the remission.
- Spread to EU countries.
- Applies mainly to mortgage insurance. These product are quasi-compulsory.
- Objectives:
 - Avoid double penalty (disease + exclusion).
 - Improve access, inclusion, fairness.

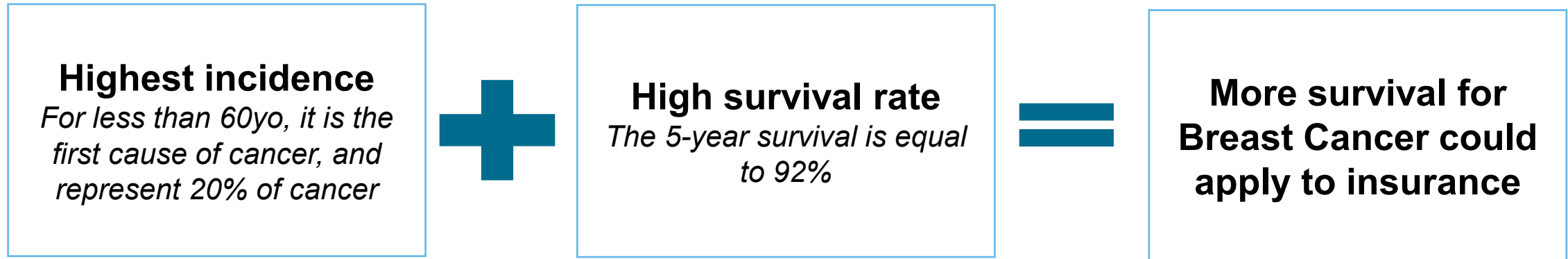
Actuarial consequences largely undocumented, the objective is to assess them through data.

Research questions

- 1. Adverse Selection:** Does RTBF materially increase portfolio risk?
- 2. Inclusivity:** Does removing cancer history increase access to insurance?
- 3. Fairness:** Does removing cancer history improve fairness?

This study will answer these questions through the example of Breast Cancer

Why Breast Cancer?



Database used to answer the problematic

Criterion	Ideal database	SEER database	THIN database
Geographic relevance	Country concerned by RTBF	United States	United Kingdom
Cancer severity data	Available	Available	Not available
Relapse information	Available	Not available (relapse model used)	Available
Population representativeness	Population seeking insurance	Individuals with a history of cancer	Patients consulting a general practitioner
Prevalence adjustment	Not required	Required (via Cancer Research UK)	Required (via Cancer Research UK)
Elements covered	All	Prevention effects, adverse selection	Adverse selection, Inclusivity, Fairness

Assumptions and underwriting rules



Product mortality coverage 10 years.



The premium is the probability of death.



The loading decline threshold is equal to 300%, it means that all individuals that have a risk 4 times higher for the individual without risk at the same age is decline.

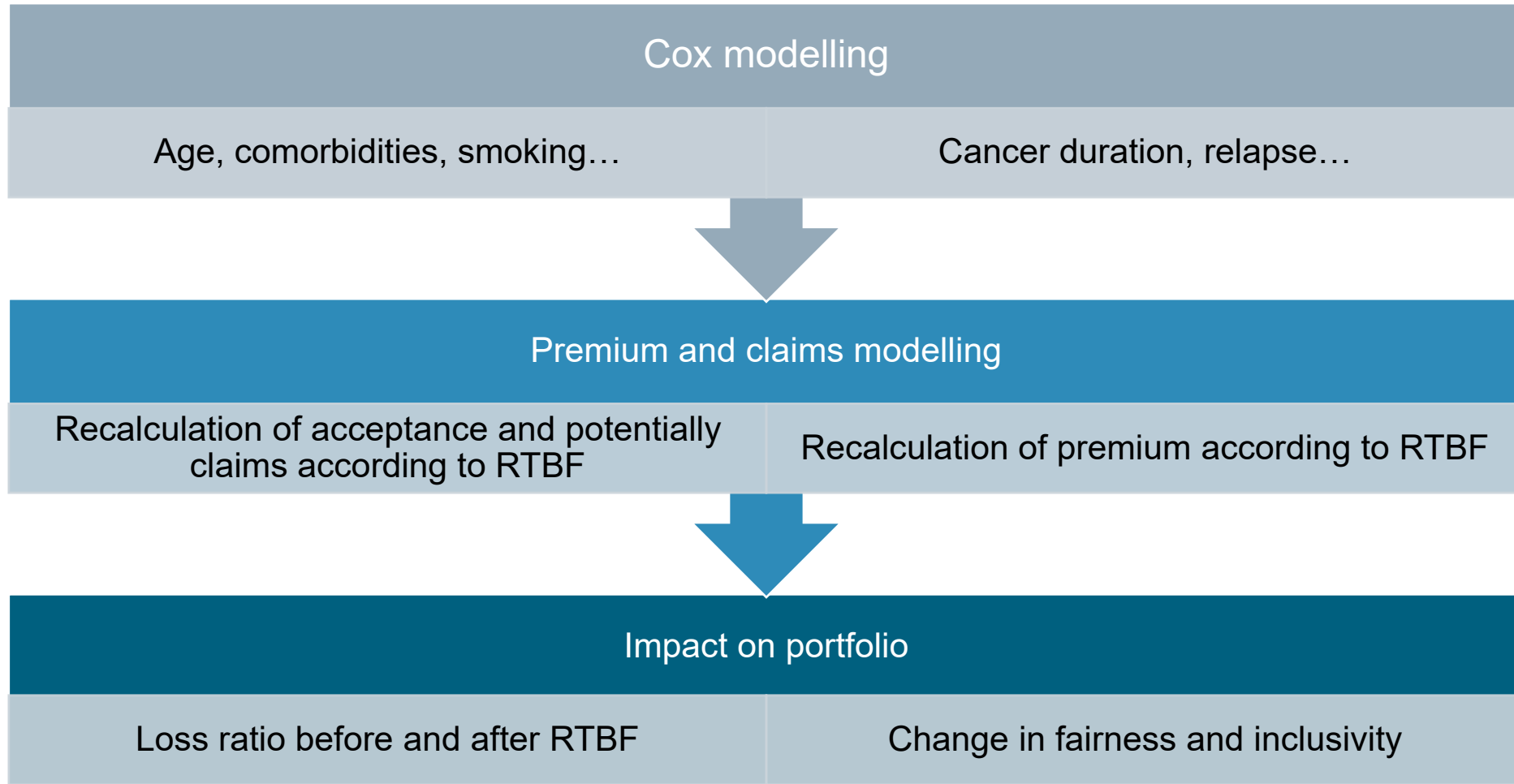


To be insured, the applicant must have no relapse.

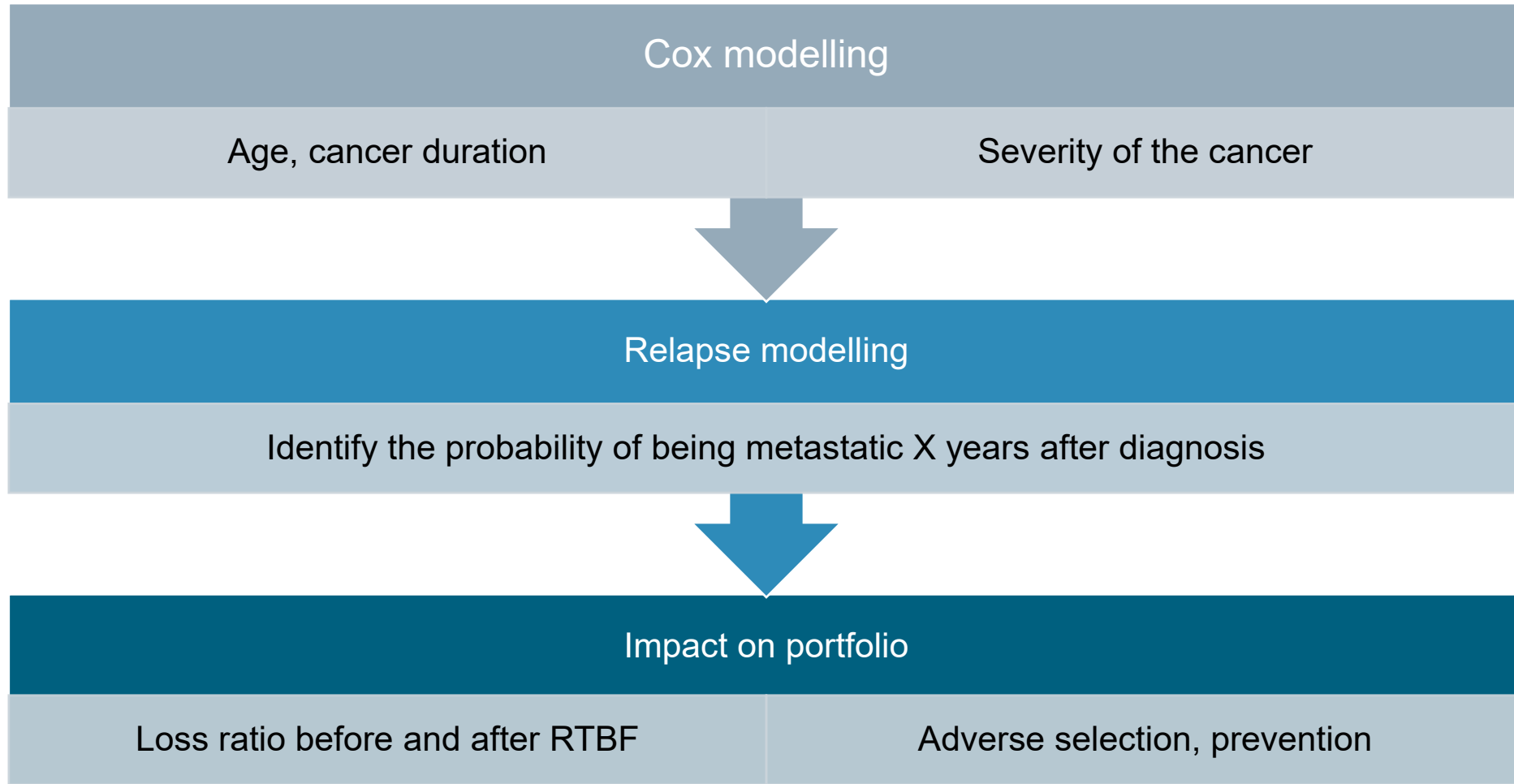


Other assumptions on lapse (5%) and risk-free rate (2%) are applied. Expenses, fees or cost of capital are not applied.

Method 1 - Thin



Method 2 - SEER



Drivers of mortality Thin

Variable	Value	Coefficient	Hazard Ratio	P-Value
Cancer Status (ref= No Cancer)	1 year diagnosis	1.31	3.72	< 0.01
	2 years since BC diagnosis	1.20	3.32	< 0.01
	3 years since BC diagnosis	0.69	2.00	< 0.01
	4 years since BC diagnosis	1.03	2.79	< 0.01
	5 years since BC diagnosis	0.87	2.38	< 0.01
	6 years since BC diagnosis	1.28	3.61	< 0.01
	7 years since BC diagnosis	0.51	1.67	0.06
	8 years since BC diagnosis	0.51	1.67	0.05
	9 years since BC diagnosis	0.39	1.48	0.20
	10 years since BC diagnosis	0.75	2.12	0.02
	11 years since BC diagnosis	-0.19	0.83	0.71
	12 years since BC diagnosis	-0.80	0.45	0.26
	13 years since BC diagnosis	-0.32	0.73	0.65
	14 years since BC diagnosis	0.68	1.98	0.10
	15 years since BC diagnosis	0.22	1.25	0.39
	More than 15 years since BC diagnosis	-0.49	0.61	0.49
	Other Cancer	1.28	3.59	< 0.01
Relapse	1.64	5.14	< 0.01	

Decreasing HR with duration since diagnosis, with more significant results the first year since diagnosis.

Breast cancer seems less lethal than other cancer (HR=3.59)

A relapse of breast cancer is more lethal (HR=5.14)

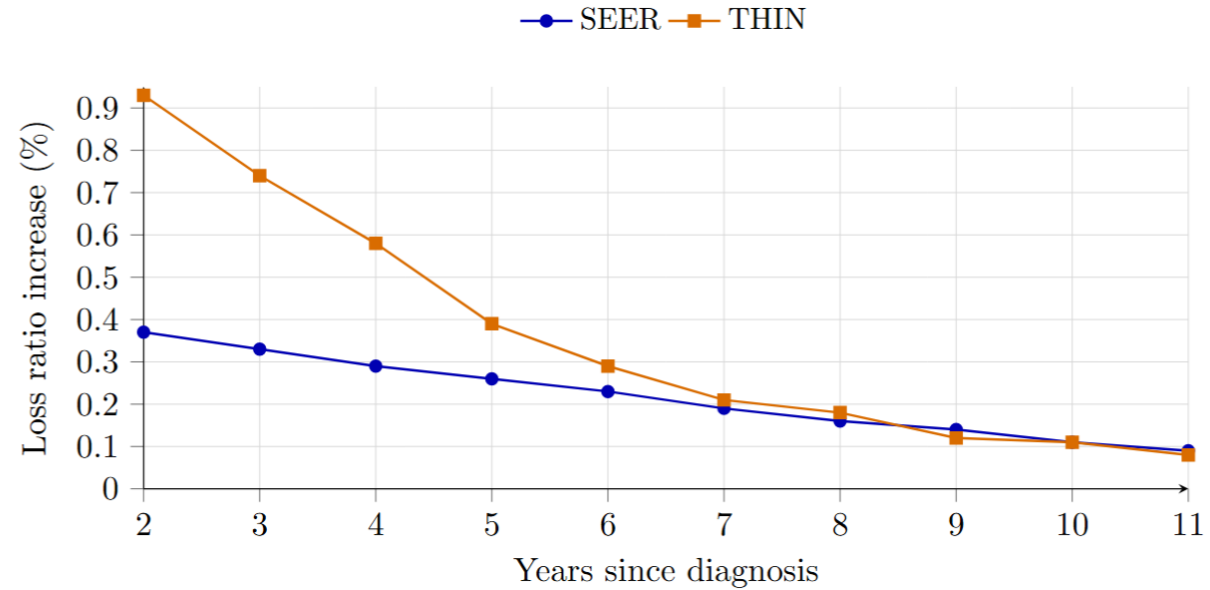
Drivers of mortality SEER

Variable	Value	Coefficient	Coef Min (95%)	Coef Max (95%)	Hazard Ratio	p-value
Age (Ref: 20–25 years)	25–29 years	-0.13	-0.33	0.08	0.88	0.23
	30–34 years	-0.17	-0.36	0.03	0.85	0.09
	35–39 years	-0.20	-0.39	-0.01	0.82	0.04
	40–44 years	-0.30	-0.49	-0.10	0.74	< 0.005
	45–49 years	-0.37	-0.56	-0.18	0.69	< 0.005
	50–54 years	-0.30	-0.49	-0.11	0.74	< 0.005
	55–59 years	-0.20	-0.39	-0.01	0.82	0.04
	60–64 years	-0.16	-0.35	0.03	0.85	0.09
Tumor (Ref: T1)	65–69 years	-0.06	-0.25	0.13	0.94	0.56
	T2	0.65	0.63	0.67	1.91	< 0.005
	T3	1.04	1.01	1.07	2.83	< 0.005
Nodes (Ref: N0)	T4	1.61	1.58	1.64	4.99	< 0.005
	N1	0.72	0.70	0.74	2.06	< 0.005
	N2	1.10	1.08	1.13	3.01	< 0.005
Grade (Ref: Grade I)	N3	1.49	1.46	1.52	4.44	< 0.005
	Grade II	0.52	0.48	0.55	1.67	< 0.005
Hormonal receptors (Ref: Positive)	Grade III	0.86	0.83	0.89	2.36	< 0.005
	Borderline_Unknown	0.39	0.36	0.43	1.48	< 0.005
	Negative	0.37	0.35	0.39	1.45	< 0.005

The TNM classification show an increase of HR according to the severity. For example, T4 has a HR of 4.99 against T1 → It confirms medical intuition.

Negative hormonal receptors are more lethal than positive.

Loss Ratio Impact on RTBF

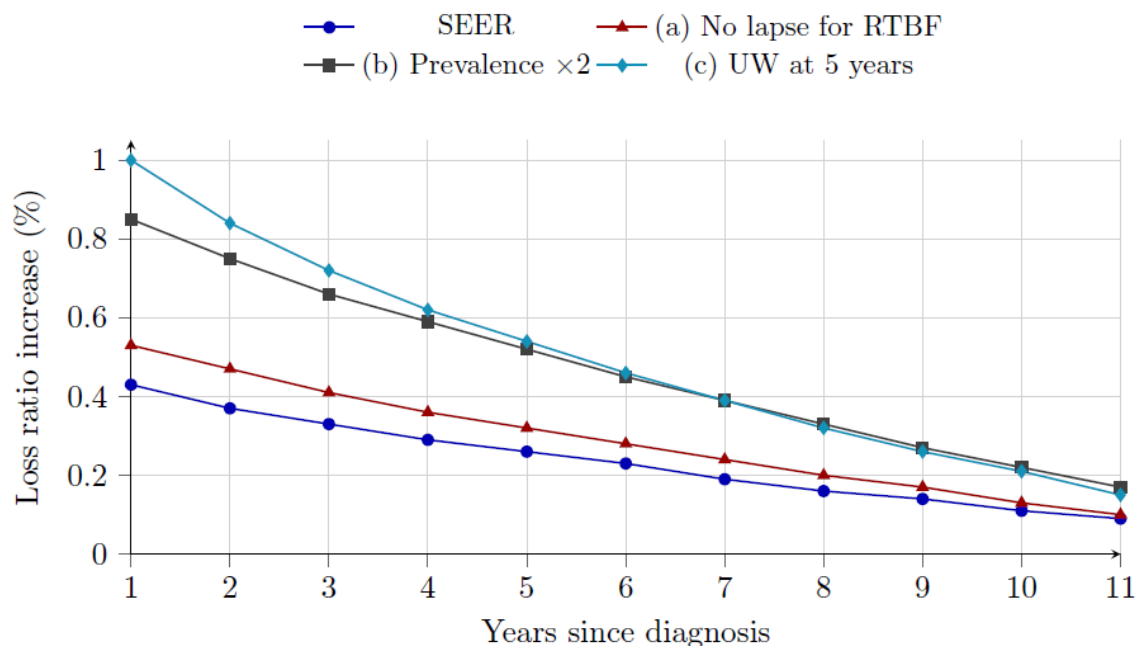


The two curves, so the two methods converge.

By focusing on five year since the diagnosis, increase of Loss Ratio is evaluated at 0.29% for THIN and 0.23% for SEER.

We must be cautious, that this curve concern only Breast cancer , which correspond to around 20% of diagnosed cancer.

Adverse selection



3 scenarios of adverse selection are studied

- **No lapse for RTBF** assumes that there is no lapse for people concerned with the RTBF.
- **Prevalence x 2** assumes that BC prevalence in the portfolio is two time higher than in the general population.
- **UW at 5 years** is related to the fact that people apply for insurance just after they are eligible for the RTBF.

But adverse selection for this product should be limited as it is quasi compulsory and loan-driven. Amount covered and time of application are driven by the house price and availability.

Methods to evaluate inclusivity and fairness

Weak Demographic Parity:

- Acceptance: If the premium is not 300% higher for the individual without risk at the same age. So an individual concerned by the RTBF must have the same probability of being accepted as someone without
- Fairness: The premium calculated must be the same if you are concerned by the RTBF or not.

Equalized Odds (in Appendix):

- Acceptance: Knowing the individual actually died, an individual concerned by the RTBF must have the same probability of being accepted as someone without.
- Fairness: Knowing the individual actually died, the premium calculated must be the same if you are concerned by the RTBF or not.

Calibration (In Appendix):

People concerned by the RTBF, must have similar probability of dying according to their underwriting decision.

Inclusivity through acceptance rate

Age	Acceptance Concerned RTBF (Before RTBF)	Acceptance Concerned RTBF (After RTBF)	Acceptance Not Concerned RTBF	p-value
From 45 to 49	85.6%	97.5%	93.6%	0.76
From 50 to 54	83.5%	94.0%	91.0%	0.09
From 55 to 59	83.0%	95.4%	88.5%	0.00
From 60 to 64	75.4%	91.4%	84.9%	0.00

Whatever the age, the acceptance rate increase after application of RTBF.

For ages 45 to 49, the acceptance increase from 85,6% before application of RTBF to 97.5% after. And it become close to the acceptance of people without history of breast cancer.

However, the acceptance rate is even better than for people without history of BC, probably due to the fact a disease has been removed.

Fairness through amount of premium

Age	Premium Concerned RTBF (Before RTBF)	Premium Concerned RTBF (After RTBF)	Premium Not Concerned RTBF
From 45 to 49	4.91 PM	2.81 PM	2.90 PM
From 50 to 54	6.96 PM	4.02 PM	4.45 PM
From 55 to 59	10.58 PM	6.22 PM	6.79 PM
From 60 to 64	14.08 PM	8.49 PM	9.61 PM

Table 8: Fairness – Weak Demography Parity per Age from 45 to 65

Whatever the age, the premium is close to the premium of people without history of cancer.

A premium of 2.81PM means that for 1,000€ of insured amount the premium is equal to 2.81€.

For all ages, the RTBF reduces the amount of the premium and average premium is equal to average premium of the global population.

Conclusion

Takeaways

RTBF:

- Does not increase materially the loss ratio.
- Improves inclusivity and fairness.

But:

- It tends to over accept people with history of breast cancer.
- It works for mortgage insurance which is quasi compulsory.

Limits

- UK population.
- Only breast cancer.
- Focus on mortality coverage.

Next steps

- Other cancer.
- Assess Critical Illness or other benefits.



Thank You

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