Länderübergreifende Mortalitäts-modellierung für Lebensversicherungen bei der Allianz

DAV Jahrestagung
Fachgruppe Actuarial Data Science

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Who we are

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- Data scientist and Executive Assistant to Head of Group Data Analytics at Allianz SE
- Master of Science in Statistics, LMU
- Previous research expertise in interdisciplinary statistical consulting

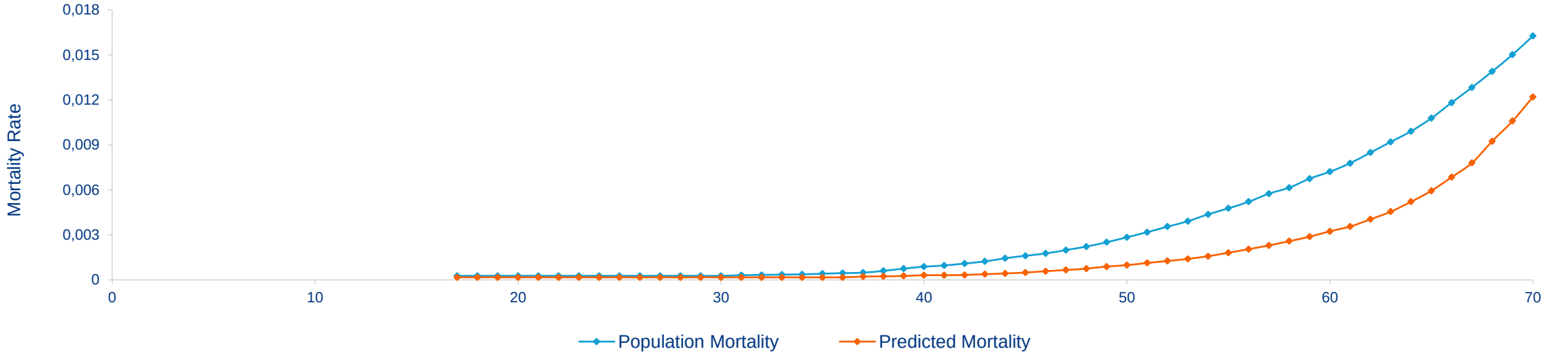
Levent Alkaya

- Senior data scientist in Group Data Analytics at Allianz SE
- Master of Science in Statistics, LMU
- 10+ years of experience in insurance industry

William Jackson

- Senior pricing manager in Global Center of Competence Life at Allianz SE
- Fellow of the Society of Actuaries, USA
- Master of Actuarial Science, Georgia State University
- Nearly 20 years experience in life pricing

Motivation of the Global Data Sharing Project



- Successful pricing of life protection products relies on an accurate picture of the mortality of prospective customers, which differs significantly from the general population
- Insurance companies have historically segmented mortality estimates by age and gender, but even this is challenging if the insured population is small
- Segmenting further by e.g., Occupation Class, Sum assured etc., can give a company a better picture, but requires the right data to do so

What are the challenges we hoped to overcome with the Global Data Sharing project?

Unlike P&C and healthinsurance, mortality products are slow to accumulate data

Traffic accidents in Germany 2022: 2.40 million*
Deaths in Germany in 2022: 1.06 million*

As a result, even the wealthiest (in terms of data) entities have limitations on what they can learn from their own data

Lebenserwartung

Vs.

Aspettativa di vita

Differences in life expectancy between countries mean that data cannot simply be transferred or pooled across borders

* Data from the German Federal Statistics Office (https://www.destatis.de/)

Allianz has experience on mortality scattered around the world …

Image source: puzzlehobby.com

… and only if all pieces are brought together, we get a clear picture

Image source: puzzlehobby.com

Data from 8 different countries have been collected

- Nearly 10mn life years of exposure and nearly 10k claims have been collected
- Covers risk factors beyond the basics of age and gender (e.g., occupation, sum assured)
- Data frame contains blocks of missing data:

	Feature 1	Feature 2	…						Feature p
Country 1								missing	
Country 2							missing	missing	missing
Country 3					missing	missing			
Country 4									missing
Country 5						missing		missing	missing
Country 6							missing	missing	missing
Country 7						missing		missing	
Country 8								missing	missing

Smartphones can take high quality pictures nowadays …

Image source: Shutterstock

… but taking the best pictures in every situation
requires different specialized lenses

for objects
in the distance

for
landscapes

for
closeups

for specific
wide-angle
photos

Image source: amazon

We can transfer this concept to the modeling of mortality by splitting into a global and multiple local models

Global model

Country 1

Country 2

Country 3

Country …

Local (specialist) models

Image source: amazon

Mathematical description of the two-step modelling approach

$$y_i = f\left(x_i^{global}\right) \cdot h_j\left(x_i^{all}\right) \cdot t_i$$

- y_i: Number of deaths in group *i*
- $f(x)$: Global model
- $h_j(x)$: Local specialization model for country *j*
- t_i: Number of life years that was observed for group *i*

```
self.estimator.fit(
    X=x,
    y=y,
    sample_weight=weight,
    eval_metric=eval_metric,
    init_score=np.log(self.abt.df.loc[self.abt.df.index.isin(x.index), "pred_step1"]),
    verbose=self.abt.conf.get_verbose(),
```

Advantages of two step approach

- Allows distinction between „local“ features (e.g., geographical, UW or product information) and „global“ features (e.g., age, gender, occupation, …)
- Calculation of models which are specialized on the different countries while at the same time including the global experience
- Incorporating new data from a single country does not change the other countries’ results as only the specialist model has to be retrained

Smart Life Pricing approach ensures scalability across the globe

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High or low-quality life data available

- In case of accepted data quality evaluation, the global model will be enriched. Otherwise only local retraining will be conducted
- High quality standards of the core model confirmed and aligned by the countries

Entity has no or limited internal life data

- Smart life pricing approach identifies the most similar country based on life insurance and health(system)-related external data
- Overall population mortality data serve as a bridge to transfer our initial model to the new country with additional help of AI data augmentation

→ We can scale our pricing foundation to a new country regardless of data quality and availability

→ We support different levels of engagement and usage of our results

Building most similar country index

Insurance Statistics from OECD

Performance indicators for life insurance

Life insurance **share of the total insurance market**

Density: Ratio of life insurance premiums to whole population

Penetration: Level of development of life insurance sector in a country

Total gross premiums (life)

Retention rate

Selected dimensions of the Country similarity index

Variance in Entitlements

Health care (The health index)

Retirement pension (Minimum Pensionable Age for Men?)

Infrastructure by country

Medical doctors

Hospital beds

Basic health care access

Healthcare Funding

Risk of catastrophic expenditure for surgical care

Overall population mortality from HMD

Age- and gender specific mortality rates

Our models‘ insights can be used in different ways

Allianz

1

Our models‘ outcomes are a basis to support or challenge each Allianz entity‘s own data or the respective market data. This can be especially important in markets with limited data, or mature markets lacking data on new segments

2

Additionally, they allow an Allianz entity to identify potential new segments beyond age and gender

3

Finally, they can be used without adjusting tariffs by targeting better risks in the sales process, thereby enhancing the overall profitability of the portfolio

Thank you!