Expanding the Longevity Frontier

Unlocking New Markets Through Longevity Analytics

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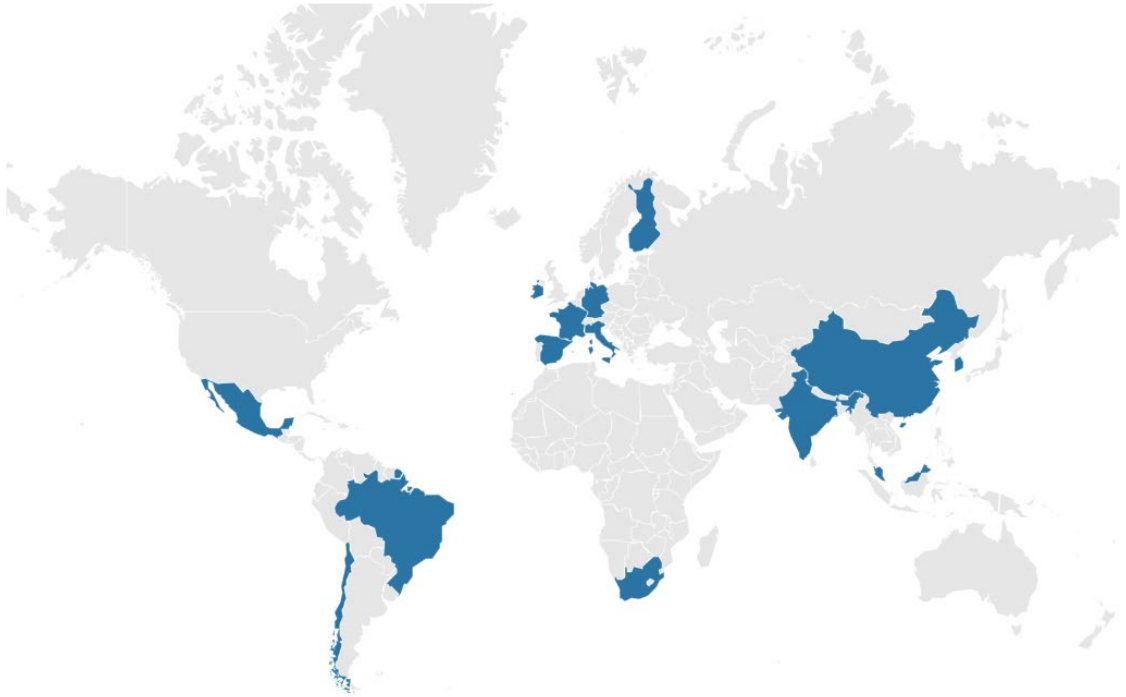
Why new longevity markets matter

The industry's next phase of growth depends on successful expansion into untapped markets.

Country	Total Estimated Retirement Assets (2024) (USD billion)
South Korea	1,098
Germany	556
China	480
Mexico	342
Malaysia	326
Finland	299
India	270
Italy	258
South Africa	257
Brazil	232
Hong Kong	224
Chile	198
France	166
Ireland	149
Spain	142
Total	**4,997**



Source: Thinking Ahead Institute

The data challenges

Can we estimate longevity risk with confidence?

Limited mortality data

- Small datasets with short observation periods
- Inconsistent administration records
- Missing demographic characteristics (lack of granularity)

Population data isn't a substitute

- Pension populations can be highly selected
- Socioeconomic differences can be substantial

The link between historical and future mortality

- COVID changed mortality patterns in ways still being understood
- Emerging markets have less historical credibility to anchor improvement trends

How data science can accelerate market development

A few ideas that haven't been used to their full potential yet:

Transfer Learning

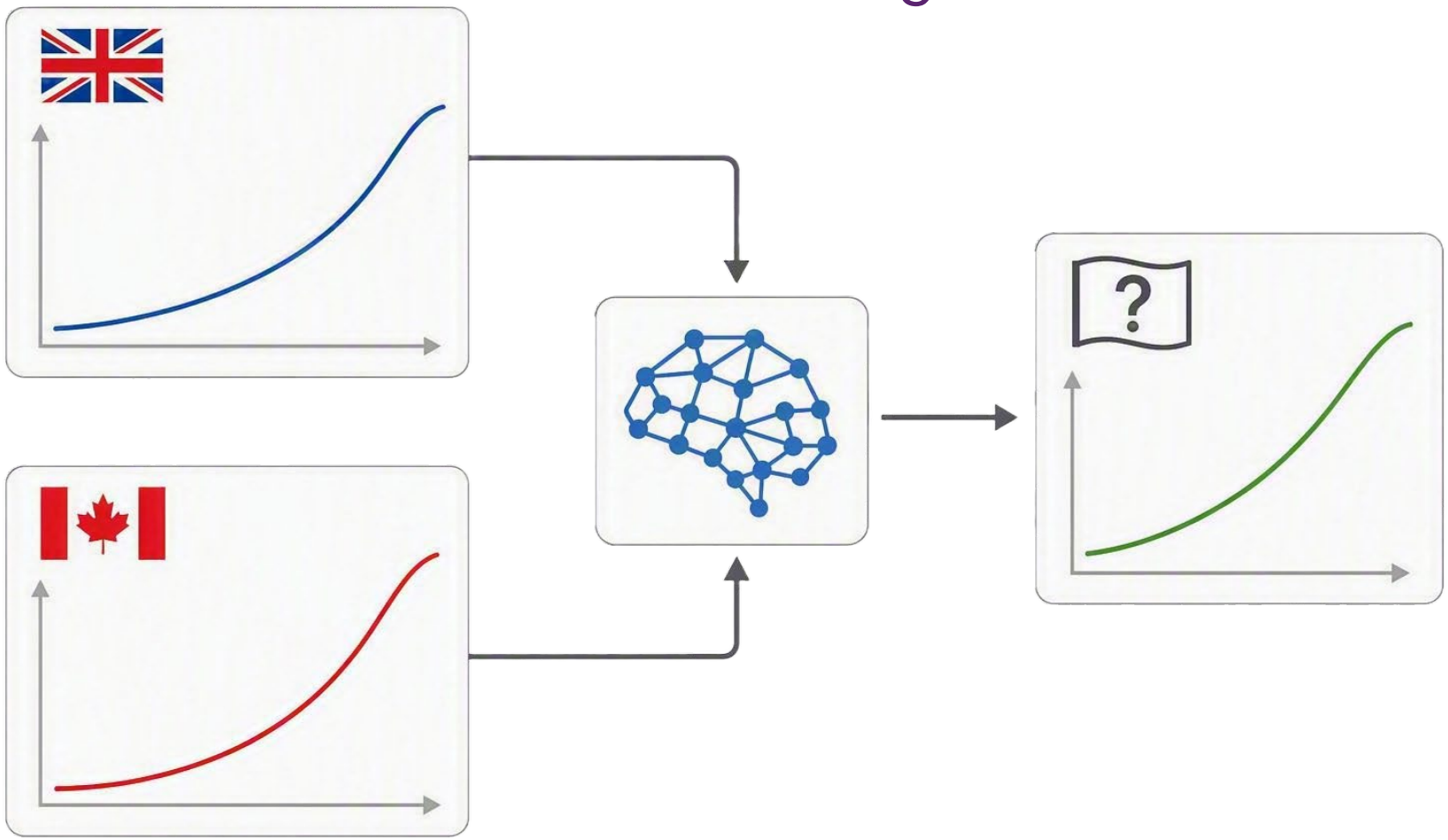
Neural Networks

Generative Adversarial Networks

Transfer learning

Source Task

Target Task



Transfer learning

- Isn't this just what actuaries have been doing for decades?

- Not exactly. Instead of just blending existing mortality curves:

$$q_x^{emerging} = X\% \cdot q_x^{Country\ A} + (1 - X\%) \cdot q_x^{Country\ B}$$

  a transfer model can transfer the relationships between the predictors and mortality

$$q_x^{emerging} = f(attained\ age, retirement\ age, amount, collar, region, etc.)$$

Transfer learning

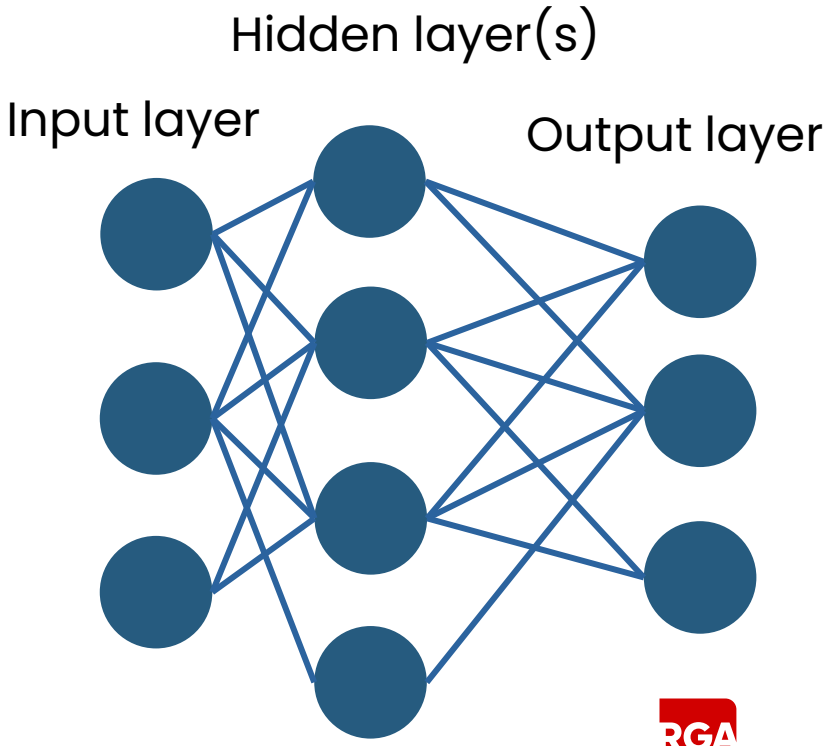
What to be aware of

!!

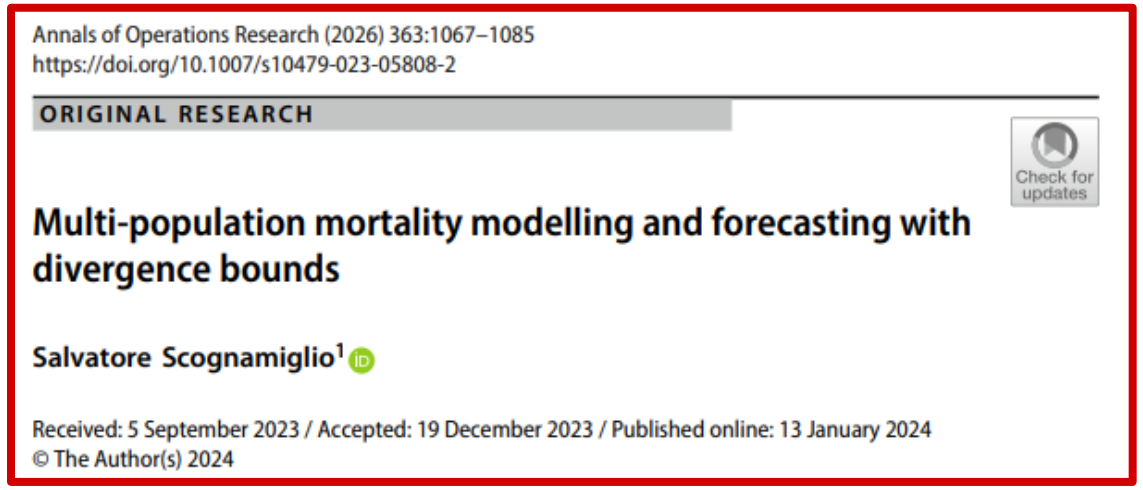
- Not as trustworthy as a model trained on credible target-market data
  - Consider there to be wider confidence intervals around point estimates
- Negative transfer is a risk.
  - It's possible that other countries' data may not improve mortality predictions.
  - Find ways to measure this.
    - Retrospective "new-market" experiments
    - Poisson deviance on death counts
    - Binomial log loss on individual records
    - Translate these metrics into financial impacts as well.

Neural networks

- Machine learning model loosely inspired by the structure of the brain.
- Key structural parts:
  - Nodes: tiny units that receive and process data
  - Layers: groups of nodes stacked together
  - Connections: exist between nodes in subsequent layers; each one has a weight
- Data travels forward through the network.
- The network uses a loss function to assess model performance and recalibrate the weights of each of the connections.



Neural networks



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https://doi.org/10.1007/s10479-023-05808-2

ORIGINAL RESEARCH

Check for updates

Multi-population mortality modelling and forecasting with divergence bounds

Salvatore Scognamiglio[1]

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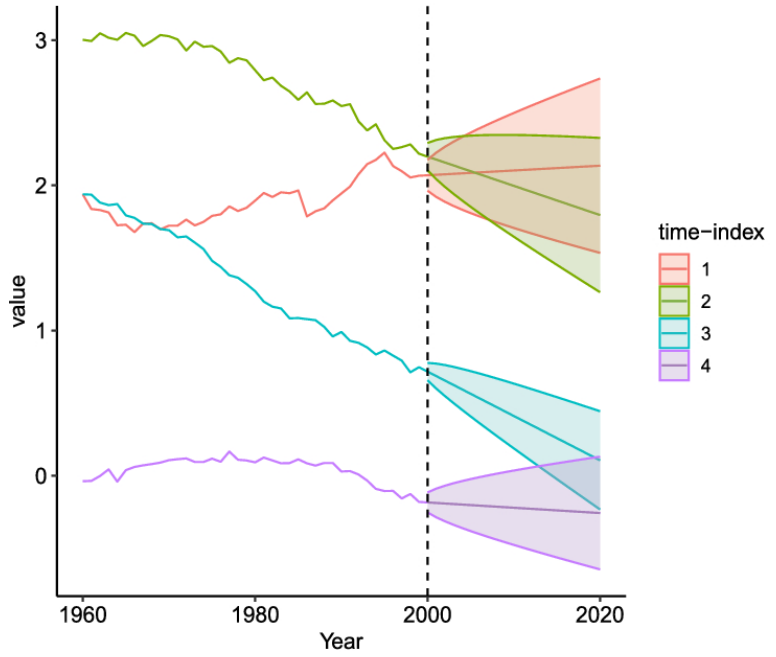
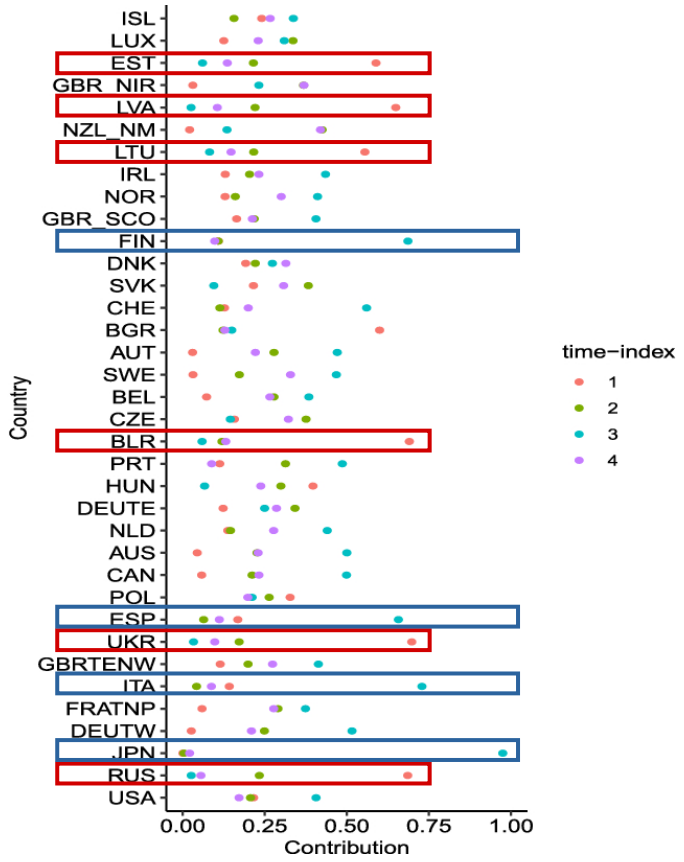
- Trained on HMD data from 1960 to 1999
- Goal: projecting future mortality levels in 72 different countries.

Neural networks

Trained on HMD data, 1960-1999



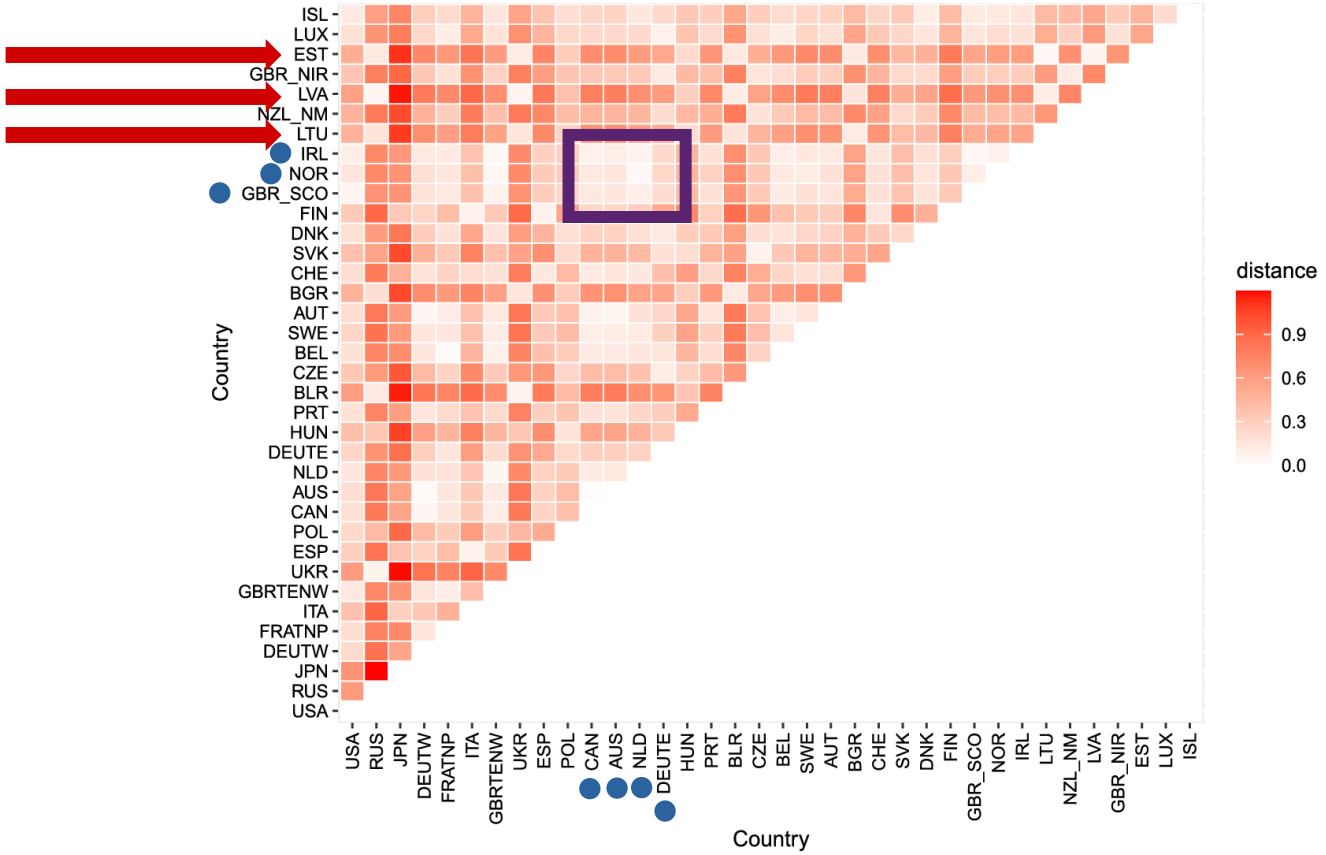


Source: Scognamiglio, 2024

Time-index 3 contributes the steepest decline in mortality, or the most notable improvement in longevity.

Time-index 1 indicates higher mortality with a slight upward trend.

Neural networks



Source: Scognamiglio, 2024

By quantifying the divergence in mortality forecasts, the neural network can identify which countries have similar mortality patterns.

Generative adversarial networks (GANs)

- Pits 2 neural networks against each other to generate completely new, highly realistic data from scratch
  - Neural network 1: the generator
  - Neural network 2: the discriminator
- As the discriminator gets better at determining fakes, the generator becomes better at creating fakes.
- More often for image generation, but could be extended into the longevity space

Generative adversarial networks (GANs)

INPUTS

Mortality tables from nearby or otherwise similar countries

Regional economic and socioeconomic indicators

Any available local pensioner death data

PROCESS

Can specify actuarial constraints

Customize loss function for divergence from known benchmarks

OUTPUTS

A synthetic mortality table that aligns with global mortality trends and details you know about the target market

In conclusion

- Each of these three modeling ideas help combat the sparse-data issue that's present in many emerging markets.
  - They're not just improving pricing—they are enabling entirely new markets.
- Using these techniques requires significant review and oversight.
  - Assumptions may not be as accurate or robust as those built on credible data.
- Data science and AI transforms sparse experience into transaction-enabling assumptions — making markets possible where they weren't before.

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