

Postcode-Level Longevity Risk Heterogeneity in the UK: Implications for Pension Buyouts and Annuity Pricing

Luba Orlovsky

Principal Researcher, Earnix Ltd., London, UK
lubao@earnix.com | IOCR 2026

INTRODUCTION & AIM

MARKET CONTEXT

£38 - 49 billion sustained annual volumes in the UK Bulk Purchase Annuity (BPA) market, with **£350-550 billion** of buy-ins projected over the next decade.

Regulatory Pressure

PRA 2026 priorities highlight the scale, and FCA Consumer Duty sharpen pricing -fairness and transparency requirements.

THE BLIND SPOT

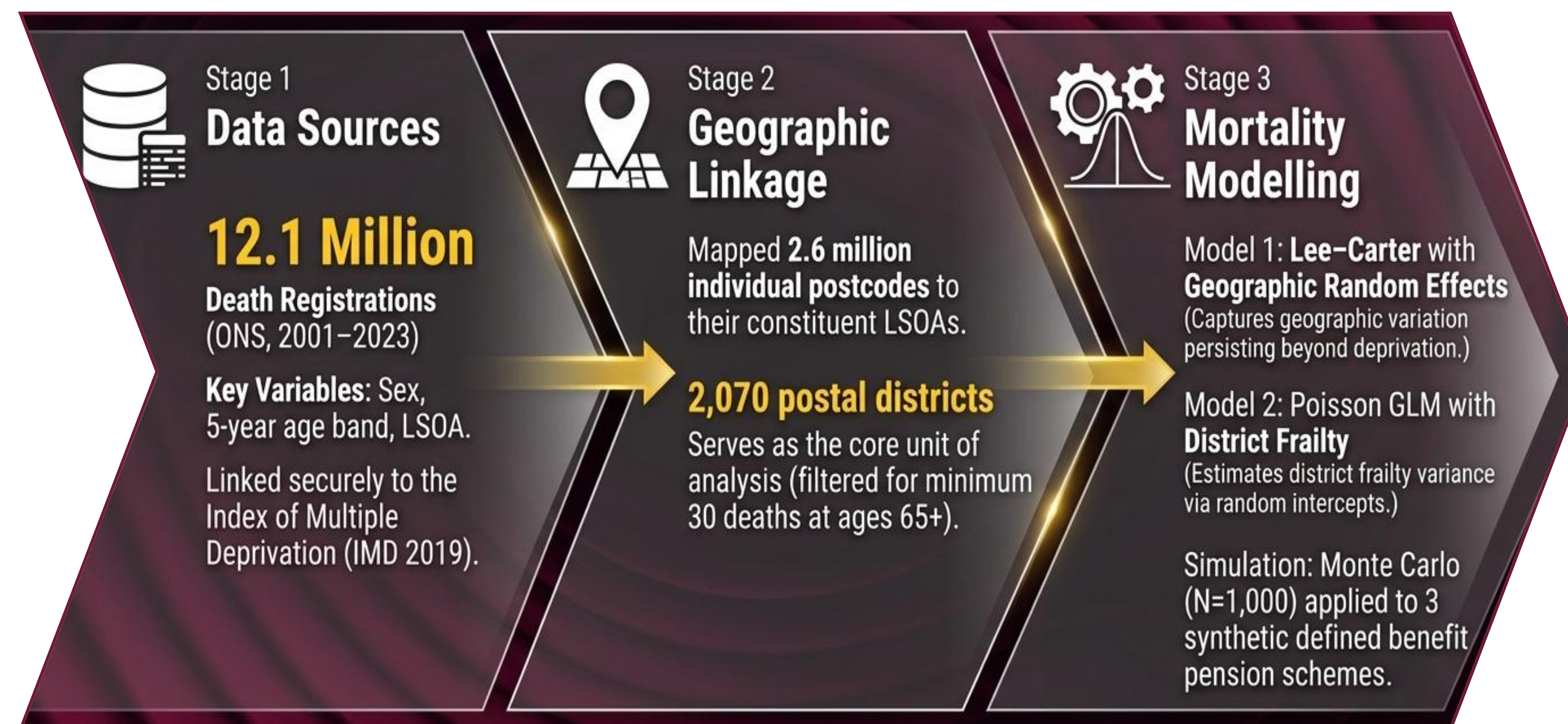
Current practice (S3PA / SAPS tables) aggregates mortality at the **postcode-sector** level, which can mask material within-sector heterogeneity, especially for geographically concentrated pension schemes.

Postcode sector **~7,000** residents vs **Postal district ~2,500** residents ✓

RESEARCH AIM

To evaluate whether postal-district granularity (~2,500 residents) improves longevity risk assessment using exclusively publicly available ONS data.

METHOD



RESULTS & DISCUSSION

Life-expectancy variation, model outputs and annuity-pricing impact across 2,070 postal districts

The Deprivation Gradient

3.7-Year Gap

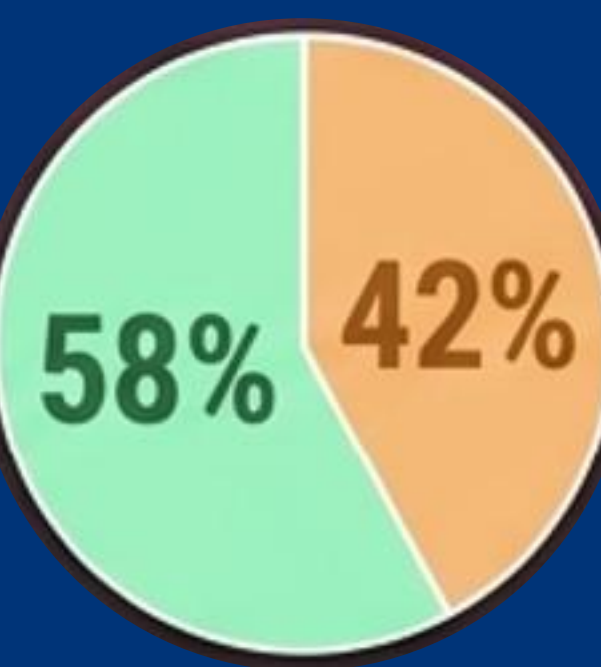
Life expectancy at age 65 (LE65) drops from 22.98 (Least Deprived) to 19.28 (Most deprived)

+57% Mortality

Hazard ratio for the most deprived quintile ($p < 0.001$).

The Unobserved Reality

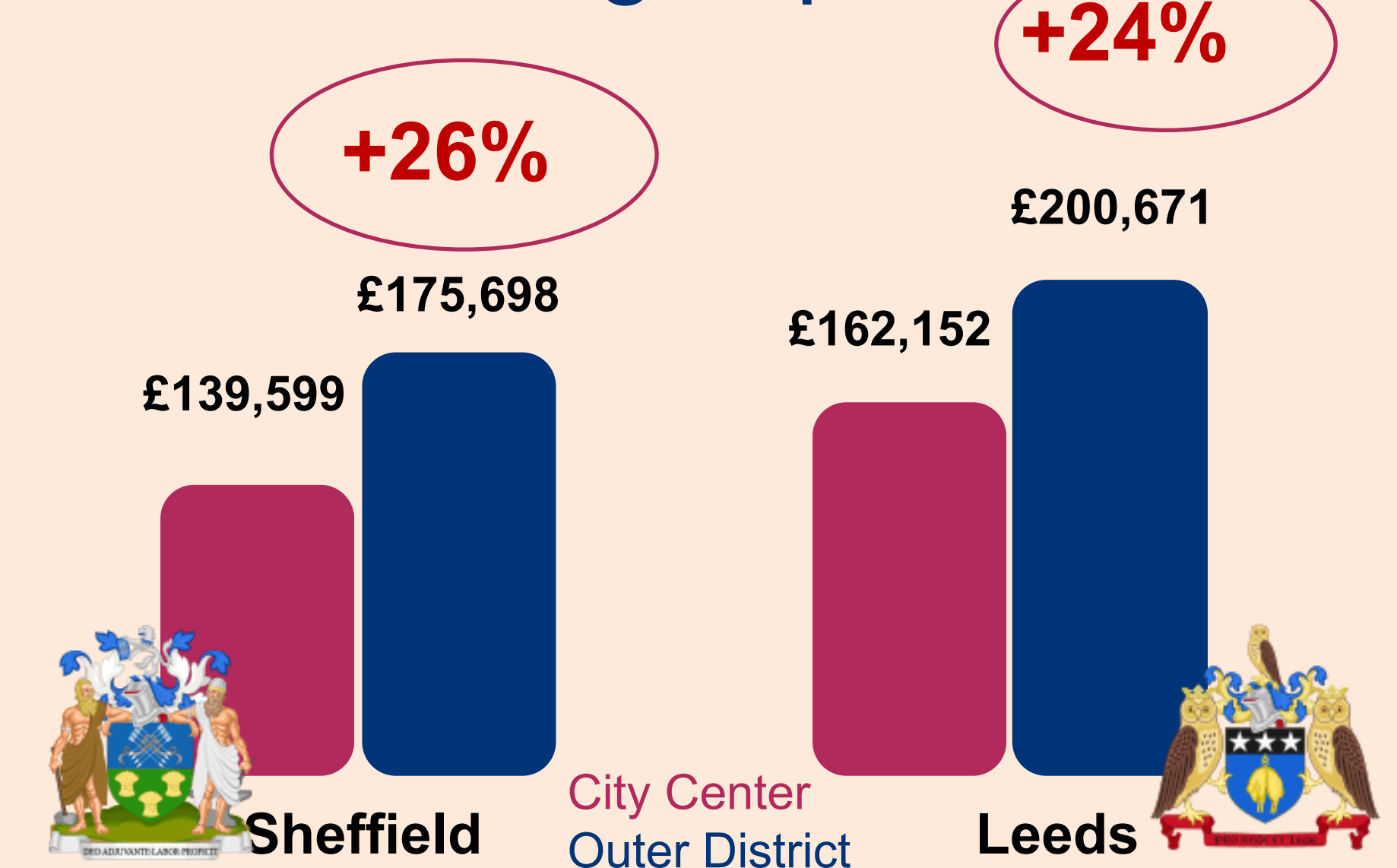
IMD explains only 58% of district mortality variation



The remaining 42% are not explained by deprivation and driven by unobserved local factors. (Residual $\sigma = 0.13$)

This residual creates a massive 4.5x multiplicative mortality range across districts after controlling for deprivation

The Pricing Impact



Annuity value gap within the same city can reach up to ~25% (£ 36,000 per member)

£10,000 p.a. pension, male 65, 4% discount, 2.5% escalation

For a 1,000-member scheme, this creates a **£36 Million invisible liability** under current sector-level pricing

CONCLUSIONS

Granularity Changes Valuations

Context: 99.9% of smoothed LE65 variance lies between sectors.

The Shift: However, district-level modeling uncovers massive residual heterogeneity in age-specific mortality rates. This specific curve is what dictates accurate annuity pricing.

Mitigation of Under-reserving

Geographically concentrated schemes (e.g., the Industrial North/Midlands) face significant hidden tail risks.

Precision district pricing captures **±0.24%** reserve variations (translating to millions of pounds) that are completely missed by standard S3PA baselines.

Regulatory & Commercial Alignment

Provides a transparent, open-data framework that actively supports FCA Consumer Duty (proving fair value) and PRA Solvency UK requirements.

Empowers pension trustees with independent, highly accurate tools for membership longevity profiling.

FUTURE WORK / REFERENCES / ACKNOWLEDGMENT

Next steps

Step 1: Demographic Precision

Incorporate sex-specific population estimates to sharpen the male-female mortality differential accuracy.

Step 2: Ultimate Granularity

Expand the current open-data framework down to individual-level postcode unit data.

Step 3: Advanced Methodologies

Integrate Machine Learning approaches to handle sophisticated, multi-variable mortality predictions.

Limitations: total-person (not sex-specific) denominators may attenuate the male-female differential; COVID-19 (2020-21) may distort recent years; aggregate, not individual-level, data; IMD is a relative measure.

DATA: 12.1M ONS death registrations (2001-2023) · 2,315 postal districts, England & Wales · English IMD 2019 · all publicly available.

Acknowledgments ONS (death registrations & small-area populations); MHCLG (English IMD 2019); Earnix Ltd. Conflicts: author employed by Earnix Ltd.; research conducted independently.

Key refs: Lee & Carter (1992) · Renshaw & Haberman (2006) · CMI S3PA/SAPS (2018) · LCP UK PRT Report 2025 · FCA Consumer Duty (2024) · PRA 2026 Priorities.