

Book Review

Leases for Lives – Life Contingent Contracts and the Emergence of Actuarial Science in 18th-Century England, by David R. Bellhouse, Cambridge: Cambridge University Press, 2017 xii, 261 pp; ISBN: 9781107111769

The main message of this interesting book is that actuarial science first began to be practised in the context of property transactions and the valuation of reversions, rather than insurance or pensions.

The author convincingly supports his argument by very detailed research, particularly focussed on the first half of the 18th century, during which there was only very limited scope for members of the public to take out any kind of insurance depending on mortality or survival. In this period some of the main contributions to probability theory and actuarial science were published, but they were not applied in practice to insurance until in 1762 the Equitable Life Assurance Society came into existence and for the first time used age-dependent premium rates for long-term life assurance contracts.

The foundation stone for actuarial science in England was the ground-breaking paper by Edmond Halley, published by the Royal Society in 1693 (Halley, 1693a). This was followed by a supplementary paper later that year (Halley, 1693b). It seems to have been realised within the next 15 years that Halley's life table and annuity values could be used to value leases on lives. It was common practice for the lord of a manor to grant a lease to a tenant, which would continue after his death to his wife and one of his children, thus giving the family enough security to encourage them to make improvements to the property. Instead of an annual rent, the tenant paid a capital sum for the lease, which in 1700 was usually equivalent to 11, 12 or 13 times the annual value of the property (Hatton, 1699). When the first of these three lives died, it was normal for another life to be added to the lease, perhaps a child of one of the original lessees, in return for a capital sum known as a "fine", which was payable to the lord of the manor. A common practice had developed that this fine would not depend on anyone's age but would be 1 year's annual value. This sum had been seen as fair when interest rates were 10% per annum around 1600, and was based on the crude theory that people survived 7 years on average, so that adding a third life to the lease was equivalent to extending the lease from 14 to 21 years. However, by 1700 interest rates had come down to 6% per annum and the true cost of extending from 14 to 21 years would have been two and a half times the annual value, so landlords were getting a raw deal.

Halley's tables now provided an opportunity to introduce an altogether different way of working out what should be paid for a lease on lives, and for adding a new life after one had died, by taking account of the ages of the lives. Land surveyors, and the landlords who employed them, may have seen this as a chance to depart from customary practices in order to get greater fairness between landlords and tenants. It is probably going too far, however, to suggest (as the author does on page 49) that Halley's work on annuities was itself motivated by issues relating to land – it is much more likely that his main interest was in calculating how much should be paid for Government annuities, a subject on which he comments in his papers.

The author reviews the books, containing material on leases for lives, that appeared in the first half of the 18th century, including Ward (1707, 1710) and Hatton (1714). Both Ward and Hatton probably had connections with the surveying profession. An important book by John Richards of

Exon (1730), who must also have been a surveyor because of his detailed knowledge of estate transactions, appeared in 1730. Bellhouse reviews this book fairly briefly – for a more detailed review see Lewin (2003). The book deals not only with leases on lives but also with the valuation of reversions, i.e., expectations which would arise under a will after the death of another beneficiary.

To demonstrate the differences which the new method could make in practice, Richards gives a practical example (not quoted by Bellhouse). He considers an estate of houses worth a net £44 per annum which is leased to two lives aged 67 and 52, and is worth £446 (using a discount rate of 6% per annum). Adding a third life aged 22 raises the value to £596. The increase in value (£150) is almost 3.5 times the annual value, whereas common practice would require a fine of only twice. (This figure of twice the annual value was itself greater than was common in 1700.) Richards makes it clear that in calculating these values he is using the annuity valuation methods of the mathematician Abraham de Moivre (de Moivre, 1725), combined with the values in Halley's tables.

Bellhouse points out that some of the problems on reversions published by de Moivre are similar to cases which actually came before the courts. He also discusses in detail the evidence that mathematicians acted as consultants before 1750 on a variety of real-life questions involving life annuities, reversions and property transactions, but not insurance. In 1739, in a newspaper advertisement for the second edition of *The Doctrine of Chances*, de Moivre states that clients could “consult him by Letter about any Case relating to Leases, for a Number of Years certain, or to Annuities upon Lives”. This wording appears to me to exclude leases on lives, which suggests that de Moivre was not particularly concerned with practical matters relating to such leases, and that he was much more interested in the theory of life annuities and in complex mathematical questions concerning reversions.

Finally the book reviews the development of life assurance after 1760 and concludes, perhaps controversially, that an important factor in the increasing involvement of mathematicians was a more widely appreciated need for solvency standards, following the demise of a number of poorly funded annuity societies.

The book ends its discussion of the subject around 1800, but there is evidence that surveyors continued to use actuarial tables after that date. John Dugmore (1827), a surveyor of Swaffham, Norfolk, wrote a commonplace book around 1827. Among the tables it contains is one for renewing with one life the lease of an estate held on three lives. His book also contains tables of expectations of life and annuity values for one, two and three lives, based on the Northampton table of mortality.

One of the strengths of Bellhouse's book is that, using an electronic computer, he works through the arithmetic of some of the figures quoted by 18th-century writers without adequate explanations, so that he is able to determine where the figures came from and their degree of accuracy. His research is thorough and the book is illustrated by numerous charts and tables. I can recommend it to everyone who is interested in the emergence of actuarial science in the 18th century.

Chris Lewin

Institute and Faculty of Actuaries
Library and Publications
Level 2, Exchange Crescent
7 Conference Square, Edinburgh EH3 8RA, UK
E-mail: journals@actuaries.org.uk

References

- de Moivre, A. (1725). *Annuities upon Lives, or, the Valuation of Annuities upon Any Number of Lives*. London: F. Fayram et al.
- Dugmore, J. (1827). Manuscript commonplace book, written around 1827, held in the Library of the Institute and Faculty of Actuaries.
- Halley, E. (1693a). An estimate of the degrees of the mortality of mankind. *Philosophical Transactions*, 17, 596–610.
- Halley, E. (1693b). Some further considerations on the Breslaw Bills of mortality. *Philosophical Transactions*, 17, 654–656.
- Hatton, E. (1699). *Comes Commercii; or, The Trader's Companion*. London: C. Coningsby et al.
- Hatton, E. (1714). *An Index to Interest*. London: J. Brown and J. Richardson.
- John Richards of Exon (1730). *The Gentleman's Steward and Tenants of Manors Instructed*. London: J. Senex & W. Innys. pp. 67–72 for the quoted practical example of renewing leases on lives.
- Lewin, C.G. (2003). *Pensions and Insurance Before 1800 – A Social History*, pp. 345–354.
- Ward, J. (1707). *The Young Mathematician's Guide*. Edw. Midwinter for John Taylor, 1707.
- Ward, J. (1710). *Clavis Usurae; or, A Key to Interest, Both Simple and Compound*. London: W. Taylor.