Investigating the benefits of mutuality: Mutual versus proprietary annuity provision

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Richard Lewin

is a graduate of Fitzwilliam College, Cambridge where he prepared his doctoral thesis in finance at the Judge Institute of Management Studies. He is currently working as an Investment Strategist at Wiggins Group PLC.

Stephen Satchell

is a fellow of Trinity College and a lecturer in Economics at Cambridge University. He is interested in Finance and Econometrics, and has written at least 75 papers in this area. He is an academic advisor to many leading asset management companies, and a frequent speaker at City conferences.

Abstract The paper is concerned with annuities research and retirement income provision. This is an important area of research in the UK, as annuity instruments lie at the heart of any post-retirement income scheme. The paper examines the structural differences across the provider market for pension annuities — financial instruments typically exchanged for accrued pension wealth to provide an income stream for life. The financial services industry is probably unique in having a substantial mutual sector coexisting with, and competing against, joint stock companies. Specifically in this paper, we undertake an empirical examination of the differences observable across UK annuity rates, between the mainstream mutual and Plc providers over the period 1994–2001. This time frame has encompassed a wholesale transformation of the UK life assurance market, as the majority of mutual assurance providers have elected to change corporate form through the process of demutualisation. This trend towards wholesale proprietary structures has concurred with a general consolidation across the financial services industry. The paper examines these changes from an annuitant's perspective and shows that mutuality appears to have served policyholders well, as demonstrated by improved annuity rate offerings across a spectrum of standardised annuity products.

Keywords: *agency theory; demutualisation; life insurance; mutuality; pension annuities*

Introduction

Our research concerns annuity offerings made by mutual and proprietary life assurance companies. We investigate the pricing dispersion in the annuity market, to see if mutuality *per se*, is a factor in annuity rate pricing. Annuities are standardised financial instruments based on demographic information and

actuarial calculation and, as commoditised products, are applicable to a comparative study of the life assurance industry. The questions posed by our empirical research concentrate on determining whether mutual life insurance institutions have provided superior returns, relative to their proprietary peers, as based upon the competitive pricing of a range of

Stephen Satchell

Faculty of Economics and Politics, Austin Robinson Building, Sidgwick Avenue, Cambridge, CB3 9DD.

Tel: 01223-335213;
Fax: 01223-35475; e-mail:
Steve.Satchell@econ.
cam.ac.uk

standardised annuity products. Without the cost loading implied by profit ordinarily attributable to shareholders at investor-owned companies, we could reasonably expect some discernible improvement in annuity rates offered by friendly societies. Indeed, in competitive market equilibrium, the ability to capture more business should be evident from passing on such cost savings to policyholders, which has already been promulgated as an intrinsic benefit of mutuality.¹ If the remaining mutual societies are indeed more competitive, then this ought to be verifiable by an empirical examination. Moreover, if policyholders were better off with mutual providers, there would be a strong *a priori* reason for the retention of this special corporate status; conversely, wholesale conversion might otherwise be supported.

In the UK, Australia, South Africa, Switzerland and America, dozens of large mutual banks and insurers have recently become shareholder-owned institutions.² Our empirical investigation covering 1994–2001 encompasses the period over which this demutualisation phenomenon took hold. The financial services sector is almost unique, perhaps with the exception of US property-liability insurers,³ in having a significant presence across these two competing organisational forms. Several articles have already appeared in regards to agency theory and the ownership structures observed across the life insurance industry.

Agency theory, as used by Fama and Jensen^{4,5} to examine ownership structures, suggests inherent advantages from the method of efficiency with which each corporate form controls for incentive conflicts within the relationships between owners, managers and policyholders. The differing abilities to manage owner-policyholder and owner-manager conflicts have

implications for the comparative advantage of the two organisational structures in insurance-related activities. Pottier and Sommer⁶ use agency theory to investigate the determinants of the insurance industry, as characterised by distinct patterns, with life insurers generally organised either as proprietary or mutual operating companies. Mayers and Smith⁷ contended the greater the managerial discretion in an insurance context, the more likely it is that an insurer will be a proprietary, as opposed to a mutual, entity. This paper focuses on the provision of annuities, which are long-term contracts that tend to increase the potential of owner-policyholder conflicts, thereby suggesting a prevalence of mutual providers, as described by Hansmann.⁸ In respect to annuity provision, reliable actuarial mortality tables would suggest an inherent advantage in the mutual structure. However, life insurance also involves significant interest rate risk according to Babble and Santomero,⁹ increasing the importance of asset and liability management, thereby favouring proprietary structures. Thus the recent collapse in interest rates may have been a contributory factor behind the demutualisation trend. Lamm-Tennant and Starks¹⁰ find evidence in support of this hypothesis with stock insurers associated with riskier activities, suggesting the trend towards demutualisation is a reflection of increased risk in annuity provision. The controversial High Court case involving guaranteed annuity rates at Equitable Life (EL), as described in a further paper, is a clear example of how this argument has been supported by more recent industry events. At the beginning of the 21st century we are at a unique vantage point to determine if the ‘tide of conversion’, according to Gascoigne,¹¹ is indeed beneficial to longer-term policyholders

and pension annuitants.

There is clearly a pressing need for the remaining mutual insurers to reassure their membership by asserting the true social and economic benefits of mutuality, underpinning the relevance of our study to the wider financial community. As more UK building societies and insurance companies are set to demutualise, this work questions whether this is in the best interest of customers. From the management perspective, a stock market listing is seen as a way of raising additional finance for the underlying business. For the long-term policyholders, however, as opposed to the recent speculative carpetbagger community, mutuality still seems to make a great deal of sense. Market returns data provide clear evidence that savers, borrowers and investors tend, on average, to get a better deal with companies that do not have to worry about keeping shareholders satisfied. Among the mortgage lenders, for example, building societies rather than traditional banks almost invariably charge the lowest standard variable rates. The annual survey of mortgage costs by Moneyfacts in 2000 found that 16 out of the 20 cheapest lenders were mutual building societies. Only two non-mutuals made it into the top ten, Standard Life Bank (a subsidiary of Standard Life (SL)) and Direct Line (HSBC). Among the life insurers, a similar picture emerged over the past decade, as the highest investment returns to policyholders also came from the mutual sector. This is supported by *Money Management* magazine, the industry 'bible', which showed that, as of 2000, nine of the top ten with-profits performers were also mutuals, or recent former mutuals. This paper looks to see what evidence there is in the annuity market to corroborate or refute these earlier findings.

Mutuality and the case of life insurance provision

In the case of life assurance policyholders, mutuality should mean higher average investment returns. In general, mutual companies should be able to make more long-term decisions, since they are not bound to report quarterly earnings figures to shareholders, allowing them to focus on providing competitive rates. As a customer-oriented organisation, this is a big consistency advantage in terms of administration. Moreover, the mutual concept has certain fundamental attractions since it combines social cohesion, through self-help organisation, to demonstrate the value of voluntary collaborative action within a market economy. Although this appears sound from a historical perspective, many mutuals have still struggled to differentiate themselves recently as competition intensified. Many life assurance companies have been forced to demutualise, in part because they paid out too much to policyholders in the struggle to compete. This deprived mutual societies of their capital strength just as competition in the underlying insurance business intensified. Past performance became all the more important as the industry became more highly regulated. Mutual assurers were subsequently caught in a vicious circle of having to keep bonus rates high, thereby raising expectations that bonus rates would continue to remain so. This is one explanation as to why mutual societies tended to deliver the best investment returns to policyholders during the 1990s, suggesting that they were paying out more than they could reasonably afford. The obvious exception to this is SL, which remains one of the UK's biggest and strongest life assurance companies with over £50bn in its long-term fund and over £75bn under management at SL Investments.

However, the controversial decision defeating the pro-conversion lobby (53.5 per cent voting against the motion) may well have been a pyrrhic victory in the longer-term demise of mutuality in the UK. Pressures may have rescinded slightly, but the need to reassure members of the benefits of mutuality by better returns has taken centre stage, with the remaining mutuals led by SL having to put up, or shut up, on returns to their members.

Whether this action is too little, too late, will only be confirmed by the next wave of pro-conversion challenges to mutual status. Pension annuitants, however, should be more interested in the financial strength of a company rather than its ownership status, since smaller companies do not have the liquidity to cover mistakes should things go wrong, as amply illustrated by the EL saga.

According to Heller,¹² one surprising fact of the accelerated demutualisation trend among life insurers is that, for a life company *per se*, there may be a more compelling reason than for a building society to remain a mutual. This is because life mutuals compete by offering long-term policies that have a direct savings element, in which shares of company profits are credited to policies of participating members. There is a greater incentive (from a product perspective on the life side) to retain the mutual characteristics, with demutualisation only really beneficial to facilitate merger and acquisition activity. Looking past the largest companies, there are two essential ways for medium-sized companies to compete effectively. For those that offer commodity products, good service and low expense, efficiencies are paramount; alternatively insurers must compete through customer specialisation (eg, National Farmers' Union) so they are less compelled by

their membership to convert, due to an absence of alternative niche providers. Life companies find it easier to achieve economies of scale if they demutualise as they have many different types of business for example, an investment firm can be the jewel in the crown of a life business. A decade ago, life companies were worried about the prospect of insufficient surpluses, but the advent of the bull market increased reserves as the value of underlying equity portfolios rose. The prospect of increasing management wealth through stock options was probably insufficient to prompt managers of mutual providers to put their companies at risk of a take-over any earlier. Indeed there had been only one significant transaction whereby a mutual actually acquired a Plc, the acquisition of London & Manchester by Friends Provident in 1998, themselves now on the path to demutualisation.

One valid reason for mutual assurers to demutualise is to give policyholder-owners back some of the value built up in a company, but management teams are usually more concerned about their positions and so the status quo usually looks preferable to insiders. Demutualisation could be necessary for those who, rather than fearing the possibility of take-over, see a lucrative opportunity in the prospect of being acquired — perhaps by a bank that might pay a significant premium to enter the insurance business. The reasons underlying recent generous bancassurance deals are partly based on accounting anomalies, which is explored in more detail in Appendix 1.

Life insurance mutuals have tended to demutualise on the pretext of gaining improved access to capital markets, to support existing business operations and to expand financial service offerings. Carson *et al.*¹³ provide evidence among US mutual life insurance companies that

demutualisation was not dominated by a motive to access capital markets, but rather by the prospect of wealth transfer to prospective shareholders. To continue to thrive and prosper it is contended that mutual insurance companies must have the same ability to access the various capital markets as stock competitors, as the continued financial viability of the assurer is clearly in the best interest of policyholders. However, Carson *et al.*¹⁴ also rejected the access to capital hypothesis, as the free cash flow of institutions was positively associated with the likelihood of demutualisation, US conversion candidates being among those mutuals with the highest ratio of surplus to assets in the sector. Some mutual insurers do have legitimate needs for capital beyond the traditional growth of surplus from ongoing investment and life operations. While most companies have the capital for internal organic growth, they do not have access to equity capital as acquisition currency, in pursuing inorganic growth opportunities through industry consolidation. The liberation of insurance companies from the shackles of a mutual structure can finance a new competitive strategy by allowing the provision of new products, the formation of strategic distribution alliances and facilitating the acquisition of competitors.

Annuitisation of pension funds

The mandatory annuitisation of accumulated pension funds, as reviewed by McDonald,¹⁵ originated under the Finance Act 1921. The Finance Act 1956, first codified mandatory annuitisation prior to age 75 for individual pension accounts for the self-employed, known as Section 226 Retirement Annuities. This is broadly speaking the present situation, although in 1988 the introduction of Personal Pensions caused further complications,

due to the inclusion of National Insurance Contribution (NIC) rebates into opt-out schemes. Any NIC rebates obtained in opting out of the state pension scheme have to be fully annuitised between the age of 60 and 75. The pretext for this mandatory requirement was that the basic state pension is effectively an unfunded annuity, so there is already a major trade-off in terms of 'risk in provision' to be made on electing to opt-out — hence provisions were stipulated to prevent the dissipation of sufficient savings to allow pensioners to fall back on the state for support. At the individual level, the timing of annuitisation between the age 60 and 75 is a utility-based decision, a direct trade-off between taking the annuity premium, resulting from statistical redistribution and capital depletion with certainty, versus continuing to earn the investment premium with uncertainty. The timing of the annuitisation decision and the welfare implications of a mandatory upper age limit have already been widely reviewed, see Kapur and Orszag.¹⁶ Adverse selection problems, such as socio-economic, gender equality, genetic testing and redistribution, create individual information asymmetries among plan recipients. Government gilts back annuities, with supply and demand conditions in the open market, as well as fund size, making an impact on the level of available offerings. Obvious questions of moral hazard arise in relation to whether the Government has a vested interest in the annuitisation of pension holdings, simply to maintain domestic borrowing facilities. As irreversible instruments, annuities generally provide a higher return than comparable bonds, as there is no lapse risk to the issuer or right to deconstruct the product and receive capital repayment.

There is thus a statistical redistribution

of wealth across residual scheme participants as increasing morbidity benefits surviving annuitants. One important commercial consideration is that annuities are considered natural hedges against life insurance liabilities; see Randall and Satchell,¹⁷ thereby boosting the number of providers. This function is derived from the lump sum payment on insurance policy termination, ie, the surrender value, which may be offset by the capital introduced by a corresponding annuity position. Additionally, the life insurance premiums payable over the insurable term are an additional partial hedge to the ongoing annuity stream commitments. These dual effects have led to the development of a highly competitive and commoditised industry for annuity provision, with commensurately low profit margins, see Murthi, Orszag and Orszag.¹⁸ Open market choice from the absence of lock-in provisions means that annuity providers do not have to be the policy-originating firm. The legal impediment to lock-in provisions, for an essentially commoditised product, means that insurance companies can have potential shortfalls in offsetting corresponding annuitants against their net pension liabilities — as some former policyholders will inevitably elect to switch to alternative providers. It is easier to get people to take on highly marketed specialised and commission-related life insurance/pension products, versus the myriad of highly commoditised annuity offerings. SL, considered a bastion of mutuality despite having shareholders until 1925, has released several tranches of an innovative 25-year capped-rate loan at 6.49 per cent. The average mortgage rate over the past 20 years has been more than 10 per cent, and previous interest rate volatility caused mortgage lenders to be extremely cautious of offering long-term fixed or

capped rate loans. SL has resolved this particular problem, as being both a mortgage lender and a life assurance company it could offset loans on the mortgage book with money raised from the sale of annuities across the life side.

Demographic issues

In the annuities market, the essential consideration is in relation to endogenous causes of mortality, as annuitants are already at or near retirement age. Insurance companies cannot use the trends in the general population to estimate potential liabilities, due to adverse selection risk and other asymmetric information characteristics in the market for annuity provision. The vast strides in medicine over the last century, coupled with the introduction of pensions and nationwide access to healthcare, have been reflected in an explosion of survival rates across all ages. This is particularly acute across the oldest ages, as medical intervention has become a more potent tool for prolonging life. For individuals, the decision of whether to defer or purchase an annuity depends on socio-economic considerations that will influence the size of the ultimate annuity purchased. Individuals possess asymmetric information regarding the state of their own health, through an intimate knowledge of their lifestyles and imputed life span, as derived with reference to hereditary conditions and the experience of proximate generations. Those with higher expected mortality are unlikely to become willing early annuity holders as the net benefit is perceived to be less; conversely those likely to outlive their means of support are just those most likely to buy additional cover, and as early as possible, see Kapur and Orszag.¹⁹

Generally, poorer annuitants tend to buy less insurance and are at a higher

mortality risk, heavily truncating the mortality schedules facing the entire insurance industry. The corollary is that wealthier clients, most able to pay for preventative healthcare, are likely to buy larger amounts of insurance cover, in extreme cases leading to another potential moral hazard. Hence the actual life tables used by insurance companies in determining premiums reflect these observed distortions at a sample level. This is the classic adverse selection problem in insurance, with annuity providers loading their offerings to reflect these inherent considerations. There is significant variation in life expectancy for individuals opting to convert financial resources into annuities, versus the observed mortality trends in the general population. Public sector compulsion of annuitisation would decrease this component of the adverse selection problem, although the recent literature suggests that the money's worth of an annuity may be eroded further; see Murthi *et al.*²⁰ for UK data and Brown *et al.*²¹ for US data. Annuities impose a high capital adequacy requirement on providers, to meet solvency margins and reserve requirements with appropriate duration government securities. This is reinforced at the actuarial level, as current pensioner incomes need to be backed by gilt-edged securities, the basis for which is average retirees' life expectancy after annuitisation. Annuity rates therefore reflect underlying long-term government borrowing rates around the 15-year gilt benchmark. These rates are then adjusted to reflect life expectancy of the peer group, to allow for cross subsidisation among holders plus any insurance company profit loading. However, a large component of the imbedded annuity value to the provider comes in the form of associated cross-selling opportunities.

There are numerous types of annuities,

which provide different expected pay-offs linked to individual or joint mortality. Brown and Poterba²² summarise the range of joint-life annuity products that are currently available. Standard insurance industry practice assumes independence of lives when valuing annuities where the promise is based on more than one life. One important question is whether mortality is in fact dependent or independent, as characteristically long-term partners tend to show some dependence in mortality, perhaps due to mutual support and cross-checking of nutrition and general welfare. Carriere *et al.*²³ use dependent mortality models with a bivariate survivorship function called a copula to value this type of annuity. Their results show strong positive dependence between joint lives, with real economic significance to practitioners. Annuity values are reduced by approximately 5 per cent when dependent mortality models are used, compared to the standard models that assume independence.

Empirical analysis

Our data set is derived from Moneyfacts,²⁴ in their monthly magazine publication *Life, Pensions and Unit Trusts*, which covers the period November 1996 through March 2001. This provided us with an 80-month period of prevailing market rates across 20–30 mainstream annuity providers, split between mutual and proprietary institutions, over a range of annuity products. The earlier portion of the series was verified against another comprehensive publication *Money Management Rate Update*,²⁵ which covered the period up to April 1996. Our annuity data is comprised of a range of provider-specific information, divided between Compulsory Purchased Annuities (CPAs) and Immediate, or Purchased Life Annuities (PLAs), across

the ages 60, 65, 70 and 75, for male and female lives, and 65/60, 70/65, 75/70 for our joint-life tables. The monthly rates are the effective coupon (or starting rate in the case of escalating annuity products) of the expected monthly payments (in advance for CPAs and in arrears for PLAs), as received after the purchase of an annuity in month m . The subset of products includes level annuities (with or without guarantees) and escalating annuities (at 5 per cent compound per annum). Guaranteed annuities ensure that the estate (on death of a single life policyholder), or surviving spouse (in the case of a joint-life policy), continues to receive payments on death (of the first life for joint annuities), up to the agreed guarantee limit, typically five to ten years in length from inception of the policy. Moreover in respect of joint-life policies, these have either no reduction, or a one-third reduction on the first death (or death of male life) dependent on the specific parameters of the individual policy. For comparative purposes, however, we selected categories based on available data as well as being representative of the range of offerings available to hypothetical annuitants over the period.

Actual annuity rates are normally adjusted to reflect specific age(s) and underlying actuarial predictions for prospective cohort mortality.²⁶ There are several caveats to consider when constructing a consistent annuity dataset, since some mutual providers additionally require annuitants to meet a plethora of specific criteria to be accepted onto an annuity scheme. This is quite apart from the special circumstance annuities available to diabetics, smokers, those suffering from hypertension or weight problems, and a host of other critical illnesses, which may additionally qualify them for impaired life annuity products. There are also a number of niche

providers in the annuity market; for members of the medical profession — the Royal Nurses Pension Fund (RNPF) — and for members of the construction industry — the Building and Construction Engineering (B&CE) Assurance; both of which historically cater for these specific groups. We have ignored these providers from our calculations in order to provide a fairer picture of the actual distribution of annuity rates available to hypothetical annuitants. Our data reveal that PLAs are generally lower yielding instruments than comparable CPAs, in part due to significant adverse selection problems, since clients tend to purchase these products out of non-pension wealth after converting any existing pension funds via the CPA route. Crucially the market for CPAs is extremely competitive, due to the open market option for fair transfer value to a different annuity provider. Despite this potential switching procedure on annuitisation, considerable inertia tends to reduce wholesale transfers across the industry — even though the Annuity Bureau, among others, specialises in providing day-to-day pricing for the benefit of the plethora of independent financial advisors.

The results, illustrated in Figures 1 to 6, show that the CPA market is characterised by a lower variation across providers, with associated mutuality margins fluctuating around 1 per cent and 2 per cent, ahead of Plc offerings across the spectrum of annuity products in this category. The PLA data, however, uncover a wider dispersion among proprietary providers, with a clearer ‘mutuality benefit’ as observed fluctuating between 2 per cent and 9 per cent. Here it must be acknowledged that the CPA market accounts for over 90 per cent of total premium volume in the annuity market, due to extensive accrued pension wealth largely derived from company

Figure 1: Average PLA versus CPA mutuality margin %

Figure 2: Average CPA versus PLA mutual advantage (£)

schemes, see Boardman, Findlater and Wadsworth.²⁷ Mutual providers have had a tougher time in differentiating themselves in this market, as transparency has lead to keen rate competition to retain previously captive company accounts. Legislation preventing lock-in at annuitisation allows corporate clients

to see exactly how much pension transfer value is available and who offers the best annuity rates. In the immediate annuity market, however, the mutuals have consistently improved the rates attainable, relative to the Plc class, although even here there has been some pronounced changes over the period of our study.

Figure 3: Number of PLA providers: August 1994–March 2001

Figure 4: CPA provider series: August 1994–March 2001

At the beginning of the time series the first few years were dominated by the mutual providers, with a declining mutuality advantage over the proprietary operators, starting in excess of 5 per cent across all the major product classes. However by 1997, the dynamic changes brought about by competition and driven

by demutualisation caused the number of mutual providers to fall, as revealed in Figures 3 and 4, and the separation in annuity rates across the groups narrowed. This is evidence of commercial pressure from the Plc group in raising rates and eroding the traditional mutuality margin, possibly even forcing some of the weaker

Figure 5: Standard deviation of mutual versus PLC CPA providers

Figure 6: Standard deviation of mutual versus PLC PLA providers

mutuals to opt for conversion. If so, then these mutuals probably already offered less competitive rates, NPI being a case in point, exacerbating the immediate difference between the best and worst providers in the mutual group, just prior to their eventual proprietary transition. More interestingly however, as the tide

of demutualisation ebbed, with the last major conversions of Scottish Widows, Canada Life and Sun Life of Canada²⁸ completed in 1999, the mutuality margin reasserted itself. This could herald a mutual renaissance, as the remaining mutuals strive harder to justify their continued existence by offering more

generous annuity rates. If this were the case though, this might risk leading them to raise rates to uneconomic levels. SL, as the largest mutual life assurance provider and with the greatest long-term fund, is committed to mutuality *per se*, having set their rates at industry leading levels over the last few years, to stem the pressure on them to opt for conversion. However the trend in the mutuality margin might also reflect the fact that the more recent converters, as newly formed Plcs, subsequently had higher shareholder-imposed costs, reducing corresponding annuity rates accordingly.

Irrespective of our readers' conclusion on this issue, the last years of our study clearly demonstrate that the average mutuality margin has widened considerably, across all product categories, corresponding with a reduction in the number of conversions. In Figures 5 and 6 we observe generally lower dispersion across CPA versus PLA providers, noticeably among the Plc group, possibly from the desire to retain captive funds from existing corporate clients. Our illustrative results in Figures 1–6 clearly show that at the hiatus of conversion taking place in the 1998–1999 period, the difference in rates was marginal, suggesting intense competition or possibly apathetic inertia over this period. This erosion in the historic mutuality margin may have clouded the case for preserving mutuality at a crucial point in time. Since then, the mutual lobby, faced with decimation in its membership and potential long-term extinction, has had to become far more proactive in getting the message of the benefits of mutuality across.

In generating our result tables we have made use of adjusted *t*-tests as described in Appendix 2, to compare the means of each class of provider group across each product class, as taken from our underlying series. The results, set out in

Tables 1 to 6, (Appendix 3) each describe a set of 10,000 standard annuity instruments, for both the CPA and PLA annuity markets, for each of three age categories. These age-related categories are not identical for the CPA and PLA annuities however, despite substantial overlap, as PLA products tend to be purchased upon retirement with CPAs more often taken out at earlier ages in line with early retirement options as part of company schemes. The first three tables describe the results for the CPA data with Tables 4–6 containing our results for the PLA data series. We now proceed to discuss Table 1 in detail, whereupon we will comment on the remaining results in the context of an overall summation. Table 1 details the *t*-test results for our standard annuity products for the CPA market at age 60. These include results for male, female and joint-life last survivor (JLLS) groups (reducing by one third ($-1/3$), and no reduction (NR) annuities respectively), across three categories of Level Annuity Without Guarantee (LWG), Level Annuity Guaranteed for 5 years (LG5) and Escalating Annuity at 5 per cent compound per annum. As is usual in the pricing of joint-life annuities, our data assume the female partner is 5 years junior in age to her male partner. From our results, it is clear that the adjusted *t*-tests provide strong evidence that mutual providers have significantly outperformed their proprietary counterparts across a range of annuity products in all categories.

The data within the tables are set out as follows: the first row presents the mean monthly payment for each type of provider across our time series, followed by the corresponding variance observed across the range of proprietary and mutual providers. The third row indicates the average mutuality margin over the period, in absolute terms, and as

a percentage of the underlying annuity series. The fourth row in each table then details the correlation coefficient between the series, alongside the number of monthly periods in question.²⁹ The fifth row shows the normal and adjusted *t*-statistics, followed in the sixth row by the critical *t*-values (at a 5 per cent confidence interval), and the associated probability values. Within each section, the single lives are presented side-by-side, male and female, with the joint lives presented beneath, with the non-reducing annuities, shown to the right of those products with one-third reduction on loss of the first life. The occasional insignificant results found in the second of the two joint life series may be attributable to a lack of available data.

Conclusions

The purpose of this paper was to investigate differences in annuity rates between mutual and proprietary providers. The paper has focused on the relative characteristics of two corporate groupings, the mutual form that is customer-owned, and the proprietary form that is investor-owned. These are the prevalent organisational forms, balancing the interests of competing stakeholder groups, and co-existing in a competitive market for life assurance and related annuity provision. It is evident from the research that the last seven years have been characterised by the gradual replacement of one group by the other, through the process of demutualisation. Over the study period, the number of mutual providers changed from being in the clear majority (approximately two-thirds across all the product groupings) to end up in a significant minority (representing just one-third). Notwithstanding this trend within the mutual provider community,

the total number of annuity providers has contracted by approximately a third as well, due to recent consolidation through mergers or takeovers, and in the specific case of EL, a winding up of the life business. Importantly, there have been no significant additions to the ranks of mutually owned societies over the period examined. This study involved the collection of an annuity data series for the period August 1994 to March 2001, and outlined a brief discussion of the problems encountered. Having collected the data across an 80-month time frame, a testing of the means across each group of providers was carried out.

The results provide support to the case for mutuality, and suggest that wholesale demutualisation may result in significant welfare loss to pension annuitants by way of a reduced level of annuity rates. These results do not depend upon artificial assumptions of normality since their statistical significance is extremely high in most cases, such that the result has profound social welfare implications. Moreover the research suggests that mutuals have remained competitive, possibly recently enhancing their collective credibility by a more transparent and competitive pricing policy, to reflect the benefits of mutuality more explicitly to their membership. However, it further highlights that this form of organisation was ill-equipped to respond to the rapidity of conversion of a plethora of mutual societies, which was clearly both unanticipated and unprecedented. The significant steps to defend the mutual ethos by Standard Life are therefore welcome, if not somewhat belated. Moreover the continued pressure on margins across the industry, as more and more commoditised products are launched, suggests good reasons behind the widespread consolidation observed across the industry. There was clearly real economic urgency behind the wave of

conversions that have already occurred. The level of sophistication of financial retirement products accelerated, with increased index-linked offerings and draw down or phased retirement schemes, further undermining the apparent supremacy of the mutual organisational form. The remaining mutual sector must therefore be extremely vigilant to maintain the continued valuable presence in the financial services industry, while ensuring that its continuity as a community asset is not jeopardised by uneconomic pricing, poor corporate governance or a lack of precautionary reserves. Social welfare may be improved by the presence of a vibrant mutual sector, as historically low-income families get a better deal from mutuals, with the continued presence of a strong mutual sector helping to keep proprietary profits in check. The social cost implied by the wholesale loss of the established mutual assurance sector appears concomitantly high. Overall, our study demonstrates that mutual insurance providers have delivered better returns to pensioners by way of annuity offerings, as supported by the mutuality advantage evident in the PLA market, and albeit less strongly supported in the more competitive CPA market. These results are indicative of a cost advantage to mutual insurance providers, although wider dispersion in available annuity offerings recently may also be indicative of artificial short-term boosts to bolster the chances of retaining their mutual status in the longer term.

Appendix 1: Adjusted *t*-test for correlated data series

It is well known that testing means across two populations using a *t*-test assumes that the two groups are independent. However, in completing our statistical analysis we observe a very high correlation among the mutual and

proprietary annuity provider series, affording a correlation statistic between 0.80 and 0.99 in Tables 1–6. This suggests two critical factors need to be accounted for in our work. First, we need to investigate why the annuities series are correlated to such a high degree. Annuities are financial instruments that must be backed by the insurance provider by taking offsetting positions in the sovereign debt market. The underlying instruments used by financial institutions to offset these collective obligations are government securities, and therefore our annuity series will be directly affected by changes in default-free debt yields. Because of the high correlation due to these common interest rate effects, it becomes necessary to adjust our *t*-tests to account for this fact. Therefore we use a procedure to adjust our ‘naïve’ *t*-test to account for this high correlation, as the *t*-statistic will otherwise understate the true value due to the correlated nature of the two data series.

Accordingly, we assume that:

$$\begin{pmatrix} x_{1t} \\ x_{2t} \end{pmatrix} \stackrel{iid}{\sim} \left[\begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix} \right]$$

The above means that x_{1t} has mean μ_1 , variance σ_1^2 , where ρ is the correlation between the two series. Here x_{1t} , for example, is the annuity yield for a standardised annuity product across the mutual sector. Then, to test the hypothesis (H_0): $\mu_1 = \mu_2$ where μ_1 and μ_2 are the means of the mutual and proprietary provider series respectively, we make use of the Wald Test:

$$\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2 + \sigma_2^2 - 2\rho\sigma_1\sigma_2}{n}\right)$$

Therefore under H_0 :

$$\frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2 + S_2^2 - 2\hat{\rho}S_1S_2}{n}}} \sim N(0,1)$$

Where S_1^2 and S_2^2 are sample estimators of σ_1^2 and σ_2^2 , and $\hat{\rho}$ is the estimated correlation coefficient.

We present a proof below, since such a test statistic is not available in the statistics literature.

Proof:

$$\begin{aligned}\text{var}(\bar{X}_1 - \bar{X}_2) &= \text{var}(\bar{X}_1) + \text{var}(\bar{X}_2) \\ &\quad - 2\text{cov}(\bar{X}_1, \bar{X}_2) \\ &= \frac{\sigma_1^2}{n} + \frac{\sigma_2^2}{n} - \frac{2}{n^2} \text{cov}(\sum X_{1i}, \sum X_{2i}) \\ &= \frac{\sigma_1^2 + \sigma_2^2 - 2\rho\sigma_1\sigma_2}{n}\end{aligned}$$

The result follows using the usual test statistic formula

$$\frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\text{var}(\bar{X}_1 - \bar{X}_2)}}$$

Appendix 2: Bancassurance deals – an accounting footnote

Aside to the proposed ‘synergies’ and ‘cross-selling’ opportunities underpinning financial services consolidation, there are fundamental accounting reasons for the sudden interest in bank and insurance company mergers in the UK. When one bank buys another it normally pays more than the book value for the target, and must account for this premium by subtracting the difference, or goodwill, from its shareholder equity. This lowers the ratio of equity to a bank’s ‘risk-weighted’ asset holdings. This ratio, known as tier-one capital, is fundamental in the evaluation of banks, as creditors, shareholders and regulators all require it

in gauging a bank’s riskiness. Preservation of the crucial tier-one capital ratio can therefore force a bank to finance a takeover with a mixture of cash and shares, in order to expand the equity base to compensate for the outstanding goodwill charge. However, the ruse of ‘bancassurance’ accounting allows some of the aforementioned goodwill to be assimilated on the basis of underlying long-term contracts. In theory, of course, goodwill represents the discounted value of all future profits, whether from banking or insurance, over and above the net asset value of the target company. However in much of Europe insurers, unlike banks, may include part of their goodwill as detailed within net assets as ‘embedded value’. The reason for this is that with-profits life insurance or pension annuities are long-term contracts. Not only do profits accrue mainly in the latter years, but actuaries are able to estimate these reasonably well. Hence there is a technical allowance to embed some goodwill, and concomitantly reduce the offsetting charge, which might otherwise dramatically undermine the tier-one capital ratio. This has proved a sharp motivation behind the prevalence of more recent bancassurance deals taking place in the banking sector, typified by the purchase of Scottish Widows by Lloyds TSB for £7.3bn at the end of 1999. Such transactions are in direct response to the flexibility available in the accounting rules, a consequence of which will be further bancassurance type deals, rather than straightforward consolidation among the pure banking insurance businesses.

Appendix 3

Table 1: CPA *t*-tests for 60-year olds, mutual versus proprietary annuity providers

CPA: Level annuity without guarantee

CPA male LWG 60	Average mutuals	Average plcs	CPA female LWG 60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£888.0	£873.6	Mean: Mutuals/Plcs	£802.5	£790.7
Variance: Mutuals/Plcs	11141.2	11534.9	Variance: Mutuals/Plcs	10074.9	9236.4
Mutuality margin: £/%	£14.39	1.71%	Mutuality margin: £/%	£11.72	1.45%
Correlation/no. months	0.9937	80	Correlation/no. months	0.9942	80
<i>t</i> -statistic/adjusted <i>t</i>	0.854	10.663	<i>t</i> -statistic/adjusted <i>t</i>	0.755	9.181
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.82E-17	Critical <i>t</i> -value/ <i>p</i> -value	1.990	4.32E-14
CPA JLLS-NR LWG M60/F55	Average mutuals	Average plcs	CPA JLLS-1/3 LWG M60/F55	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£708.0	£698.6	Mean: Mutuals/Plcs	£673.4	£670.4
Variance: Mutuals/Plcs	9665.8	8519.7	Variance: Mutuals/Plcs	2154.7	2982.2
Mutuality margin: £/%	£9.36	1.29%	Mutuality margin: £/%	£2.99	0.55%
Correlation/no. months	0.9852	80	Correlation/no. months	0.9835	44
<i>t</i> -statistic/adjusted <i>t</i>	0.621	4.789	<i>t</i> -statistic/adjusted <i>t</i>	0.277	1.618
Critical <i>t</i> -value/ <i>p</i> -value	1.990	7.71E-06	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.13E-01

CPA: Level annuity guaranteed for 5 years

CPA male LG5 60	Average mutuals	Average plcs	CPA female LG5 60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£878.6	£863.2	Mean: Mutuals/Plcs	£797.9	£786.3
Variance: Mutuals/Plcs	10544.7	10907.3	Variance: Mutuals/Plcs	9886.3	9018.9
Mutuality margin: £/%	£15.38	1.85%	Mutuality margin: £/%	£11.60	1.44%
Correlation/no. months	0.9938	80	Correlation/no. months	0.9935	80
<i>t</i> -statistic/adjusted <i>t</i>	0.940	11.816	<i>t</i> -statistic/adjusted <i>t</i>	0.755	8.681
Critical <i>t</i> -value/ <i>p</i> -value	1.990	3.85E-19	Critical <i>t</i> -value/ <i>p</i> -value	1.990	4.09E-13
CPA JLLS-NR LG5 M60/F55	Average mutuals	Average plcs	CPA JLLS-1/3 LG5 M60/F55	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£704.1	£697.8	Mean: Mutuals/Plcs	£670.5	£668.3
Variance: Mutuals/Plcs	9387.4	8660.3	Variance: Mutuals/Plcs	2105.3	2967.3
Mutuality margin: £/%	£6.30	0.88%	Mutuality margin: £/%	£2.27	0.45%
Correlation/no. months	0.9874	80	Correlation/no. months	0.9796	44
<i>t</i> -statistic/adjusted <i>t</i>	0.419	3.623	<i>t</i> -statistic/adjusted <i>t</i>	0.211	1.134
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.13E-04	Critical <i>t</i> -value/ <i>p</i> -value	2.017	2.63E-01

CPA: Escalating at 5% compound per annum

CPA male escalating 60	Average mutuals	Average plcs	CPA female escalating 60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£548.6	£530.8	Mean: Mutuals/Plcs	£463.4	£449.3
Variance: Mutuals/Plcs	7426.7	9630.7	Variance: Mutuals/Plcs	6148.4	7456.8
Mutuality margin: £/%	£17.75	3.95%	Mutuality margin: £/%	£14.14	3.70%
Correlation/no. months	0.9900	80	Correlation/no. months	0.9898	80
<i>t</i> -statistic/adjusted <i>t</i>	1.216	8.996	<i>t</i> -statistic/adjusted <i>t</i>	1.084	8.915
Critical <i>t</i> -value/ <i>p</i> -value	1.990	9.89E-14	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.42E-13
CPA JLLS-NR escalating M60/F55	Average mutuals	Average plcs	CPA JLLS-1/3 escalating M60/F55	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£371.2	£359.2	Mean: Mutuals/Plcs	£348.2	£334.4
Variance: Mutuals/Plcs	5252.3	6139.3	Variance: Mutuals/Plcs	1181.9	2116.0
Mutuality margin: £/%	£11.92	4.03%	Mutuality margin: £/%	£13.75	4.66%
Correlation/no. months	0.9857	80	Correlation/no. months	0.9652	44
<i>t</i> -statistic/adjusted <i>t</i>	0.999	7.590	<i>t</i> -statistic/adjusted <i>t</i>	1.588	5.825
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.45E-11	Critical <i>t</i> -value/ <i>p</i> -value	2.017	6.56E-07

Table 2: CPA *t*-tests for 65-year olds, mutual versus proprietary annuity providers**CPA: Level annuity without guarantee**

CPA male LWG 65	Average mutuals	Average plcs	CPA female LWG 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£1002.9	987.2	Mean: Mutuals/Plcs	£884.2	873.8
Variance: Mutuals/Plcs	11535.1	12753.9	Variance: Mutuals/Plcs	10147.2	9777.2
Mutuality margin: £/%	£15.70	1.69%	Mutuality margin: £/%	£10.42	1.20%
Correlation/no. months	0.9945	80	Correlation/no. months	0.9933	80
<i>t</i> -statistic/adjusted <i>t</i>	0.901	10.926	<i>t</i> -statistic/adjusted <i>t</i>	0.660	7.982
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.84E-17	Critical <i>t</i> -value/ <i>p</i> -value	1.990	9.44E-12
CPA JLLS-NR LWG M65/F60	Average mutuals	Average plcs	CPA JLLS-1/3 LWG M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£754.1	745.7	Mean: Mutuals/Plcs	£736.9	733.0
Variance: Mutuals/Plcs	9590.7	8356.3	Variance: Mutuals/Plcs	2205.7	2779.0
Mutuality margin: £/%	£8.39	1.06%	Mutuality margin: £/%	£3.87	0.59%
Correlation/no. months	0.9910	80	Correlation/no. months	0.9889	44
<i>t</i> -statistic/adjusted <i>t</i>	0.560	5.265	<i>t</i> -statistic/adjusted <i>t</i>	0.363	2.732
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.18E-06	Critical <i>t</i> -value/ <i>p</i> -value	2.017	9.09E-03

CPA: Level annuity guaranteed for 5 years

CPA male LG5 65	Average mutuals	Average plcs	CPA female LG5 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£982.7	966.5	Mean: Mutuals/Plcs	£876.0	865.1
Variance: Mutuals/Plcs	10541.9	11529.8	Variance: Mutuals/Plcs	9886.1	9265.1
Mutuality margin: £/%	£16.20	1.76%	Mutuality margin: £/%	£10.89	1.25%
Correlation/no. months	0.9941	80	Correlation/no. months	0.9934	80
<i>t</i> -statistic/adjusted <i>t</i>	0.975	11.775	<i>t</i> -statistic/adjusted <i>t</i>	0.704	8.338
Critical <i>t</i> -value/ <i>p</i> -value	1.990	4.59E-19	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.91E-12
CPA JLLS-NR LG5 M65/F60	Average mutuals	Average plcs	CPA JLLS-1/3 LG5 M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	749.3	£741.8	Mean: Mutuals/Plcs	731.4	£729.1
Variance: Mutuals/Plcs	9192.5	8361.5	Variance: Mutuals/Plcs	2126.9	2735.6
Mutuality margin: £/%	£7.47	0.97%	Mutuality margin: £/%	£2.22	0.37%
Correlation/no. months	0.9900	80	Correlation/no. months	0.9862	44
<i>t</i> -statistic/adjusted <i>t</i>	0.504	4.779	<i>t</i> -statistic/adjusted <i>t</i>	0.211	1.441
Critical <i>t</i> -value/ <i>p</i> -value	1.990	7.99E-06	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.57E-01

CPA: Escalating at 5% compound per annum

CPA male escalating 65	Average mutuals	Average plcs	CPA female escalating 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	664.1	644.7	Mean: Mutuals/Plcs	549.6	£536.3
Variance: Mutuals/Plcs	8351.3	10923.3	Variance: Mutuals/Plcs	6848.0	8276.4
Mutuality margin: £/%	£19.38	3.47%	Mutuality margin: £/%	£13.23	2.87%
Correlation/no. months	0.9906	80	Correlation/no. months	0.9873	80
<i>t</i> -statistic/adjusted <i>t</i>	1.249	9.241	<i>t</i> -statistic/adjusted <i>t</i>	0.962	7.357
Critical <i>t</i> -value/ <i>p</i> -value	1.990	3.30E-14	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.54E-10
CPA JLLS-NR escalating M65/F60	Average mutuals	Average plcs	CPA JLLS-1/3 escalating M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	425.9	416.0	Mean: Mutuals/Plcs	413.8	400.0
Variance: Mutuals/Plcs	5609.8	6720.7	Variance: Mutuals/Plcs	1289.0	2123.7
Mutuality margin: £/%	£9.82	2.89%	Mutuality margin: £/%	£13.78	3.78%
Correlation/no. months	0.9907	80	Correlation/no. months	0.9742	44
<i>t</i> -statistic/adjusted <i>t</i>	0.791	6.863	<i>t</i> -statistic/adjusted <i>t</i>	1.565	6.653
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.36E-09	Critical <i>t</i> -value/ <i>p</i> -value	2.017	4.10E-08

Table 3: CPA *t*-tests for 70-year olds, mutual versus proprietary annuity providers**CPA: Level annuity without guarantee**

CPA male LWG 70	Average mutuals	Average plcs	CPA female LWG 70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1165.8	1145.3	Mean: Mutuals/Plcs	1004.4	993.7
Variance: Mutuals/Plcs	12134.7	14620.4	Variance: Mutuals/Plcs	10364.2	10760.0
Mutuality margin: £/%	£20.50	1.92%	Mutuality margin: £/%	£10.68	1.12%
Correlation/no. months	0.9950	80	Correlation/no. months	0.9928	80
<i>t</i> -statistic/adjusted <i>t</i>	1.121	11.610	<i>t</i> -statistic/adjusted <i>t</i>	0.657	7.660
Critical <i>t</i> -value/ <i>p</i> -value	1.990	9.36E-19	Critical <i>t</i> -value/ <i>p</i> -value	1.990	4.00E-11
CPA JLLS-NR LWG M70/F65	Average mutuals	Average plcs	CPA JLLS-1/3 LWG M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	820.0	812.1	Mean: Mutuals/Plcs	824.4	818.2
Variance: Mutuals/Plcs	9392.3	8477.8	Variance: Mutuals/Plcs	2245.7	2709.0
Mutuality margin: £/%	£7.96	0.94%	Mutuality margin: £/%	£6.22	0.80%
Correlation/no. months	0.9918	80	Correlation/no. months	0.9914	44
<i>t</i> -statistic/adjusted <i>t</i>	0.532	5.448	<i>t</i> -statistic/adjusted <i>t</i>	0.586	5.151
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.61E-07	Critical <i>t</i> -value/ <i>p</i> -value	2.017	6.17E-06

CPA: Level annuity guaranteed for 5 years

CPA male LG5 70	Average mutuals	Average plcs	CPA female LG5 70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1121.0	1102.0	Mean: Mutuals/Plcs	986.0	974.9
Variance: Mutuals/Plcs	10322.3	12253.6	Variance: Mutuals/Plcs	9620.1	9883.6
Mutuality margin: £/%	£18.98	1.83%	Mutuality margin: £/%	£11.12	1.18%
Correlation/no. months	0.9944	80	Correlation/no. months	0.9921	80
<i>t</i> -statistic/adjusted <i>t</i>	1.130	11.731	<i>t</i> -statistic/adjusted <i>t</i>	0.712	7.950
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.55E-19	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.09E-11
CPA JLLS-NR LG5 M70/F65	Average mutuals	Average plcs	CPA JLLS-1/3 LG5 M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	813.1	807.1	Mean: Mutuals/Plcs	814.0	808.0
Variance: Mutuals/Plcs	9048.8	8178.2	Variance: Mutuals/Plcs	2098.7	2869.8
Mutuality margin: £/%	£5.93	0.70%	Mutuality margin: £/%	£6.02	0.82%
Correlation/no. months	0.9877	80	Correlation/no. months	0.9652	44
<i>t</i> -statistic/adjusted <i>t</i>	0.404	3.466	<i>t</i> -statistic/adjusted <i>t</i>	0.567	2.627
Critical <i>t</i> -value/ <i>p</i> -value	1.990	8.56E-04	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.19E-02

CPA: Escalating at 5% compound per annum

CPA male escalating 70	Average mutuals	Average plcs	CPA female escalating 70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	825.0	802.4	Mean: Mutuals/Plcs	669.7	659.1
Variance: Mutuals/Plcs	9450.3	12828.7	Variance: Mutuals/Plcs	7472.8	9575.3
Mutuality margin: £/%	£22.61	3.19%	Mutuality margin: £/%	£10.66	1.97%
Correlation/no. months	0.9908	80	Correlation/no. months	0.9827	80
<i>t</i> -statistic/adjusted <i>t</i>	1.355	9.430	<i>t</i> -statistic/adjusted <i>t</i>	0.730	4.635
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.41E-14	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.39E-05
CPA JLLS-NR escalating M70/F65	Average mutuals	Average plcs	CPA JLLS-1/3 escalating M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	498.7	487.9	Mean: Mutuals/Plcs	501.9	487.5
Variance: Mutuals/Plcs	5919.9	7037.5	Variance: Mutuals/Plcs	1407.1	2230.5
Mutuality margin: £/%	£10.74	2.57%	Mutuality margin: £/%	£14.36	3.16%
Correlation/no. months	0.9910	80	Correlation/no. months	0.9764	44
<i>t</i> -statistic/adjusted <i>t</i>	0.844	7.487	<i>t</i> -statistic/adjusted <i>t</i>	1.580	7.139
Critical <i>t</i> -value/ <i>p</i> -value	1.990	8.65E-11	Critical <i>t</i> -value/ <i>p</i> -value	2.017	8.09E-09

Table 4: PLA *t*-tests for 65-year olds, mutual versus proprietary annuity providers**PLA: Level annuity without guarantee**

PLA male LWG 65	Average mutuals	Average plcs	PLA female LWG 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£974.4	£940.3	Mean: Mutuals/Plcs	£854.7	£826.1
Variance: Mutuals/Plcs	13275.0	12521.2	Variance: Mutuals/Plcs	11682.4	11577.8
Mutuality margin: £/%	£34.16	3.67%	Mutuality margin: £/%	£28.66	3.54%
Correlation/no. months	0.9877	80	Correlation/no. months	0.9923	80
<i>t</i> -statistic/adjusted <i>t</i>	1.902	16.841	<i>t</i> -statistic/adjusted <i>t</i>	1.681	19.194
Critical <i>t</i> -value/ <i>p</i> -value	1.990	7.28E-28	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.76E-31
PLA JLLS-NR LWG M65/F60	Average mutuals	Average plcs	PLA JLLS-1/3 LWG M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£721.2	£700.7	Mean: Mutuals/Plcs	£711.8	£679.6
Variance: Mutuals/Plcs	11228.0	10200.1	Variance: Mutuals/Plcs	2736.7	3402.0
Mutuality margin: £/%	£20.54	2.91%	Mutuality margin: £/%	£32.13	4.91%
Correlation/no. months	0.9920	80	Correlation/no. months	0.8752	44
<i>t</i> -statistic/adjusted <i>t</i>	1.255	3.128	<i>t</i> -statistic/adjusted <i>t</i>	2.720	7.547
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.50E-21	Critical <i>t</i> -value/ <i>p</i> -value	2.017	2.09E-09

PLA: Level annuity guaranteed for 5 years

PLA male LG5 65	Average mutuals	Average plcs	PLA female LG5 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£952.6	£919.1	Mean: Mutuals/Plcs	£847.0	£817.1
Variance: Mutuals/Plcs	12471.7	11593.6	Variance: Mutuals/Plcs	10984.9	10296.5
Mutuality margin: £/%	£33.47	3.67%	Mutuality margin: £/%	£29.98	3.69%
Correlation/no. months	0.9875	80	Correlation/no. months	0.9899	80
<i>t</i> -statistic/adjusted <i>t</i>	1.930	16.799	<i>t</i> -statistic/adjusted <i>t</i>	1.838	17.846
Critical <i>t</i> -value/ <i>p</i> -value	1.990	8.49E-28	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.92E-29
PLA JLLS-NR LG5 M65/F60	Average mutuals	Average plcs	PLA JLLS-1/3 LG5 M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£718.8	£699.2	Mean: Mutuals/Plcs	£706.9	£672.7
Variance: Mutuals/Plcs	11344.5	9437.1	Variance: Mutuals/Plcs	2627.4	3741.1
Mutuality margin: £/%	£19.64	2.70%	Mutuality margin: £/%	£34.14	5.37%
Correlation/no. months	0.9897	80	Correlation/no. months	0.8177	44
<i>t</i> -statistic/adjusted <i>t</i>	1.219	10.125	<i>t</i> -statistic/adjusted <i>t</i>	2.838	6.427
Critical <i>t</i> -value/ <i>p</i> -value	1.990	6.31E-16	Critical <i>t</i> -value/ <i>p</i> -value	2.017	8.74E-08

PLA: Escalating at 5% compound per annum

PLA male escalating 65	Average mutuals	Average plcs	PLA female escalating 65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£636.7	£607.0	Mean: Mutuals/Plcs	£525.9	£497.7
Variance: Mutuals/Plcs	6997.6	10137.0	Variance: Mutuals/Plcs	5451.0	7864.9
Mutuality margin: £/%	£29.67	5.58%	Mutuality margin: £/%	£28.23	6.47%
Correlation/no. months	0.9840	80	Correlation/no. months	0.9870	80
<i>t</i> -statistic/adjusted <i>t</i>	2.027	11.226	<i>t</i> -statistic/adjusted <i>t</i>	2.188	12.769
Critical <i>t</i> -value/ <i>p</i> -value	1.990	4.94E-18	Critical <i>t</i> -value/ <i>p</i> -value	1.990	6.72E-21
PLA JLLS-NR escalating M65/F60	Average mutuals	Average plcs	PLA JLLS-1/3 escalating M65/F60	Average mutuals	Average plcs
Mean: Mutuals/Plcs	£401.2	382.8	Mean: Mutuals/Plcs	£399.5	£368.7
Variance: Mutuals/Plcs	5154.5	5950.0	Variance: Mutuals/Plcs	1307.5	2305.4
Mutuality margin: £/%	£18.41	5.46%	Mutuality margin: £/%	£30.80	9.10%
Correlation/no. months	0.9756	80	Correlation/no. months	0.8353	44
<i>t</i> -statistic/adjusted <i>t</i>	1.563	9.530	<i>t</i> -statistic/adjusted <i>t</i>	3.399	7.654
Critical <i>t</i> -value/ <i>p</i> -value	1.990	8.99E-15	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.47E-09

Table 5: PLA *t*-tests for 70-year olds, mutual versus proprietary annuity providers**PLA: Level annuity without guarantee**

PLA male LWG 70	Average mutuals	Average plcs	PLA female LWG 70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1126.9	1088.0	Mean: Mutuals/Plcs	976.0	938.8
Variance: Mutuals/Plcs	13276.0	13618.4	Variance: Mutuals/Plcs	10807.3	11542.1
Mutuality margin: £/%	£38.89	3.65%	Mutuality margin: £/%	£37.15	4.06%
Correlation/no. months	0.9889	80	Correlation/no. months	0.9921	80
<i>t</i> -statistic/adjusted <i>t</i>	2.121	20.058	<i>t</i> -statistic/adjusted <i>t</i>	2.223	21.145
Critical <i>t</i> -value/ <i>p</i> -value	1.990	9.76E-33	Critical <i>t</i> -value/ <i>p</i> -value	1.990	3.25E-38
PLA JLLS-NR LWG M70/F65	Average mutuals	Average plcs	PLA JLLS-1/3 LWG M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	790.6	763.9	Mean: Mutuals/Plcs	803.8	766.6
Variance: Mutuals/Plcs	10899.3	9463.6	Variance: Mutuals/Plcs	2446.0	3293.4
Mutuality margin: £/%	£26.67	3.44%	Mutuality margin: £/%	£37.26	5.02%
Correlation/no. months	0.9929	80	Correlation/no. months	0.8720	44
<i>t</i> -statistic/adjusted <i>t</i>	1.671	17.115	<i>t</i> -statistic/adjusted <i>t</i>	3.262	8.794
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.66E-28	Critical <i>t</i> -value/ <i>p</i> -value	2.017	3.67E-11

PLA: Level annuity guaranteed for 5 years

PLA male LG5 70 years	Average mutuals	Average plcs	PLA female LG5 70 years	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1084.8	1046.2	Mean: Mutuals/Plcs	957.8	922.6
Variance: Mutuals/Plcs	11976.0	11938.9	Variance: Mutuals/Plcs	10146.2	10108.5
Mutuality margin: £/%	£38.54	3.74%	Mutuality margin: £/%	£35.24	3.87%
Correlation/no. months	0.9873	80	Correlation/no. months	0.9906	80
<i>t</i> -statistic/adjusted <i>t</i>	2.229	19.775	<i>t</i> -statistic/adjusted <i>t</i>	2.214	22.787
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.50E-32	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.78E-36
PLA JLLS-NR LG5 M70/F65	Average mutuals	Average plcs	PLA JLLS-1/3 LG5 M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	790.2	761.1	Mean: Mutuals/Plcs	794.6	754.9
Variance: Mutuals/Plcs	10817.1	8647.8	Variance: Mutuals/Plcs	2194.0	3566.8
Mutuality margin: £/%	£29.10	3.72%	Mutuality margin: £/%	£39.76	5.51%
Correlation/no. months	0.9929	80	Correlation/no. months	0.8209	44
<i>t</i> -statistic/adjusted <i>t</i>	1.865	16.195	<i>t</i> -statistic/adjusted <i>t</i>	3.475	7.716
Critical <i>t</i> -value/ <i>p</i> -value	1.990	8.05E-27	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.20E-09

PLA: Escalating at 5% compound per annum

PLA male escalating 70	Average mutuals	Average plcs	PLA female escalating 70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	789.4	751.7	Mean: Mutuals/Plcs	646.4	611.9
Variance: Mutuals/Plcs	7293.7	11773.3	Variance: Mutuals/Plcs	5566.6	8653.5
Mutuality margin: £/%	£37.66	5.62%	Mutuality margin: £/%	£34.54	6.28%
Correlation/no. months	0.9822	80	Correlation/no. months	0.9876	80
<i>t</i> -statistic/adjusted <i>t</i>	2.439	11.457	<i>t</i> -statistic/adjusted <i>t</i>	2.590	13.654
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.81E-18	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.72E-22
PLA JLLS-NR escalating M70/F65	Average mutuals	Average plcs	PLA JLLS-1/3 escalating M70/F65	Average mutuals	Average plcs
Mean: Mutuals/Plcs	479.8	453.0	Mean: Mutuals/Plcs	492.6	455.6
Variance: Mutuals/Plcs	5367.0	6256.4	Variance: Mutuals/Plcs	1201.3	2371.3
Mutuality margin: £/%	£26.80	6.42%	Mutuality margin: £/%	£36.95	8.63%
Correlation/no. months	0.9817	80	Correlation/no. months	0.8466	44
<i>t</i> -statistic/adjusted <i>t</i>	2.223	15.262	<i>t</i> -statistic/adjusted <i>t</i>	4.100	9.167
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.85E-25	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.13E-11

Table 6: PLA *t*-tests for 75-year olds, mutual versus proprietary annuity providers**PLA: Level annuity without guarantee**

PLA male LWG 75	Average mutuals	Average plcs	PLA female LWG 75	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1339.3	1290.4	Mean: Mutuals/Plcs	1149.7	1101.2
Variance: Mutuals/Plcs	13179.3	14992.9	Variance: Mutuals/Plcs	9873.5	12398.4
Mutuality margin: £/%	£48.90	3.89%	Mutuality margin: £/%	£48.51	4.57%
Correlation/no. months	0.9872	80	Correlation/no. months	0.9916	80
<i>t</i> -statistic/adjusted <i>t</i>	2.606	21.406	<i>t</i> -statistic/adjusted <i>t</i>	2.908	23.870
Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.26E-34	Critical <i>t</i> -value/ <i>p</i> -value	1.990	7.20E-38
PLA JLLS-NR LWG M75/F70	Average mutuals	Average plcs	PLA JLLS-1/3 LWG M75/F70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	888.9	859.3	Mean: Mutuals/Plcs	933.8	889.2
Variance: Mutuals/Plcs	10004.1	9370.6	Variance: Mutuals/Plcs	2070.7	3120.3
Mutuality margin: £/%	£29.64	3.46%	Mutuality margin: £/%	£44.62	5.15%
Correlation/no. months	0.9919	80	Correlation/no. months	0.8683	44
<i>t</i> -statistic/adjusted <i>t</i>	1.905	20.446	<i>t</i> -statistic/adjusted <i>t</i>	4.108	10.618
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.74E-33	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.35E-13

PLA: Level annuity guaranteed for 5 years

PLA male LG5 75	Average mutuals	Average plcs	PLA female LG5 75	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1252.2	1207.7	Mean: Mutuals/Plcs	1107.5	1064.7
Variance: Mutuals/Plcs	11091.2	12024.1	Variance: Mutuals/Plcs	8958.6	10236.1
Mutuality margin: £/%	£44.45	3.76%	Mutuality margin: £/%	£42.77	4.12%
Correlation/no. months	0.9865	80	Correlation/no. months	0.9894	80
<i>t</i> -statistic/adjusted <i>t</i>	2.615	21.888	<i>t</i> -statistic/adjusted <i>t</i>	2.761	24.453
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.79E-35	Critical <i>t</i> -value/ <i>p</i> -value	1.990	1.34E-38
PLA JLLS-NR LG5 M75/F70	Average mutuals	Average plcs	PLA JLLS-1/3 LG5 M75/F70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	886.1	854.3	Mean: Mutuals/Plcs	915.5	867.0
Variance: Mutuals/Plcs	9802.4	8587.6	Variance: Mutuals/Plcs	1813.2	3316.6
Mutuality margin: £/%	£31.78	3.70%	Mutuality margin: £/%	£48.47	5.78%
Correlation/no. months	0.9907	80	Correlation/no. months	0.8324	44
<i>t</i> -statistic/adjusted <i>t</i>	2.096	19.545	<i>t</i> -statistic/adjusted <i>t</i>	4.489	9.935
Critical <i>t</i> -value/ <i>p</i> -value	1.990	5.38E-32	Critical <i>t</i> -value/ <i>p</i> -value	2.017	1.05E-12

PLA: Escalating at 5% compound per annum

PLA male escalating 75	Average mutuals	Average plcs	PLA female escalating 75	Average mutuals	Average plcs
Mean: Mutuals/Plcs	1001.5	951.9	Mean: Mutuals/Plcs	822.0	770.7
Variance: Mutuals/Plcs	7228.0	14149.5	Variance: Mutuals/Plcs	4970.4	10012.5
Mutuality margin: £/%	£49.54	5.78%	Mutuality margin: £/%	£51.31	7.30%
Correlation/no. months	0.9751	80	Correlation/no. months	0.9842	80
<i>t</i> -statistic/adjusted <i>t</i>	3.031	10.893	<i>t</i> -statistic/adjusted <i>t</i>	3.749	13.858
Critical <i>t</i> -value/ <i>p</i> -value	1.990	2.12E-17	Critical <i>t</i> -value/ <i>p</i> -value	1.990	7.50E-23
PLA JLLS-NR escalating M75/F70	Average mutuals	Average plcs	PLA JLLS-1/3 escalating M75/F70	Average mutuals	Average plcs
Mean: Mutuals/Plcs	581.0	551.4	Mean: Mutuals/Plcs	621.8	575.8
Variance: Mutuals/Plcs	4738.2	6644.4	Variance: Mutuals/Plcs	1057.7	2393.1
Mutuality margin: £/%	£29.62	5.89%	Mutuality margin: £/%	£45.97	8.33%
Correlation/no. months	0.9827	80	Correlation/no. months	0.8521	44
<i>t</i> -statistic/adjusted <i>t</i>	2.483	14.057	<i>t</i> -statistic/adjusted <i>t</i>	5.191	11.212
Critical <i>t</i> -value/ <i>p</i> -value	1.990	3.36E-23	Critical <i>t</i> -value/ <i>p</i> -value	2.017	2.40E-14

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- 25 *Money Management Rate Update*, 1994–1996, Financial Times Publications, London.
- 26 Insurers start with the same demographic information from the Government Actuary. These mortality indicators are then refined on advice from the Institute of Actuaries and the insurer's own payout experience, adverse selection, and necessary cost and profit (in the case of Plc's) loadings. The cost of a government bond portfolio as a hedge to offset aggregate obligations, including any index-linked element, is also considered.
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28 Mutual Assurance Company of Canada became Clarica Life Insurance, the first of the four major Canadian mutual life insurers to list in 1999, along with Manufacturers Life, Sun Life of Canada and Canada Life.

29 This number only varies insofar as the joint life series for one-third reduction has only 44 observations, due to an absence of previous information relating to these products prior to August 1997.