Kapittel 6

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The pension crisis: its causes, possible remedies, and the role of the regulator

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1. Foreword

Kredittilsynet, The Financial Supervisory Authority of Norway, is celebrating its 20th anniversary amid a pension crisis of unprecedented scale both in financial and in geographical terms. Being now based in London, let me quote from articles in the Financial Times describing a (UK) pension industry in some disarray: “Stock market falls hit with-profit policies. 30% reduction of payout on policies.” “Huge clear-out in the life insurance industry.” “Only one European insurer maintains the coveted AAA rating from S&P.” “Large life insurers talk to the City regulator about waiver from statutory solvency rules.” “Pension promises are becoming increasingly unaffordable as people’s life expectancy gets ever longer.” I could have added countless quotations from news media and professional press reporting on pension deficits in occupational schemes and life offices. Insurers, regulators, and the actuarial profession alike have been blamed of being “out of touch with risk”. Three commissions appointed by the government have analysed various aspects of the pension debacle and – in more mundane terms – substantiated the criticisms. The Penrose (2004) report on the near-collapse of life assurer Equitable Life places the blame at the door of the management of the company and the regulator. The Morris (2005) review points to the irresponsiveness of the actuarial profession to advances in its scientific foundation. The Turner (2004) report identifies two major causes of the ongoing pension crisis as being an unforeseen improvement of longevity and the downturn of the financial markets.

In this festschrift entry I shall be describing the risk presented to pension schemes by uncertain economic and demographic developments, discussing possible ways of managing this risk, and presenting to Kredittilsynet my humble advice as to how the regulator could meet these challenges.

2. Diversifiable and non-diversifiable risk

A basic idea underlying life and pension insurance is that the purely random variations between the life lengths of individuals will average out in a sufficiently large insurance portfolio. Technically speaking, the risk associated with the individual life lengths is "diversified through pooling". However, the contracts are long term, and the effective period of a typical pension policy may see substantial changes in mortality, interest rates, and administration costs. Such "environmental" factors affect all policies and, therefore, cannot be diversified by increasing the size of the portfolio: we are all onboard the same boat on our voyage through the troubled waters of the demographic-economic history, and the waves cannot be calmed by increasing the number of passengers. In order to give further substance to the discussions, I need to introduce some basic actuarial concepts.

3. Banking

Consider a person who opens a savings account with a trustee in order to secure himself economically in his retirement. Deposits will be made annually until retirement in m years, and thereafter withdrawals will be made annually until time T. Introduce

c_t , the amount deposited at time $t = 1,2,...,m,$
b_t , the amount withdrawn made at time $t = m+1,...,T,$
S_t , the price of one unit of the trustee's asset portfolio at time $t = 0,1,2,\ldots$

The deposit of c_t at time t purchases u_t units of the asset given by $c_t = u_t S_t$,
or $u_t = c_t / S_t$. Thus, at any time $t = 1,2,...,m$, the balance of the account is the total units purchased times the current value of the asset,

$$V_t = S_t (u_1 + \ldots + u_t) = S_t \ (c_1 / S_1 + \ldots + c_t / S_t) .$$

Likewise, at any time $t = m+1,...,T$, the withdrawal of b_t is financed by selling u_t units of assets given by $b_t = u_t S_t$, and the balance of the account is

$$V_t = S_t (c_1/S_1 + \ldots + c_m /S_m - b_{m+1}/S_{m+1} - \ldots - b_t /S_t) .$$

At the term of the contract all savings have been withdrawn and the account is settled at value $V_T = 0$, which means that

$$c_1/S_1 + \ldots + c_m/S_m = b_{m+1}/S_{m+1} + \ldots + b_T/S_T . \qquad (1)$$

The role of the capital gains on the investment is clearly displayed by this relationship. In year t the asset earns interest at rate

$$r_t = (S_t - S_{t-1}) / S_{t-1} = S_t / S_{t-1} - 1 .$$

We can also write $S_t = S_{t-1} (1 + r_t)$. If there would be no interest, as if the money were tucked away under the mattress, then all S_t would be equal, and (1) would reduce to the trivial $c_1 + \ldots + c_m = b_{m+1} + \ldots + b_T$; one can withdraw exactly what one invested. If interest is positive, one can withdraw more. Loosely speaking, the higher the interest rates (the "steeper" the sequence S_t), the larger the total amount of withdrawals for a given investment. If the asset portfolio consists of bonds, then the interest rates are positive. If the asset portfolio consists of stocks, then the interest rates may be positive or negative, the attraction of this asset class being that high interest (above that of typical bonds) is deemed more likely than low or negative interest.

In practice the future asset prices are unknown, of course, and the customer faces the problem of designing the deposits and the withdrawals in a manner that will give sustainable income over the entire retirement period. Moreover, since T should ideally be his remaining life length, he faces the quite impossible task of predicting this date. Therefore, he should rather do business with a life insurance company that can offer him a pension policy, which is a special form of savings contract that takes survival prospects explicitly into account. I proceed to describe how this is done.

4. Mortality

A life office typically serves tens, maybe hundreds, of thousands of customers, sufficiently many to ensure that survival rates are stable as mentioned in Paragraph 1. On the basis of statistical investigations the actuary constructs a so-called *decrement series*, which takes as it starting point a large number ℓ_0 of new-born and, for each age x = 1,2,… specifies the number of survivors, ℓ_x . Table 1 shows an excerpt of the table used by Danish insurers since 1982 to describe the mortality of insured males. The second column in the table lists some entries in the decrement series. It shows e.g. that about 65% of all new-born will celebrate their 70th anniversary. The number of survivors ℓ_x decreases with the age x. The difference $d_x = \ell_x - \ell_{x+1}$ is the number of deaths at age x. These numbers are shown in the third column of the table. The number of deaths peaks somewhere around age 80, but this does not mean that 80 is the "most dangerous age"; The actuary measures the mortality at any age x by the *one-year mortality rate* $q_x = d_x / \ell_x$, which is the proportion of those who survive to age x that will die within one year. This rate, shown in the fourth column of the table, increases with the age.

Table 1. The Danish G82 mortality table

x	ℓ_x	d_x	q_x
0	100 000	58	0.000579
25	98 083	119	0.001206
50	91 119	617	0.006774
60	82 339	1 275	0.015484
70	65 024	2 345	0.036069
80	37 167	3 111	0.083711
90	9 783	1 845	0.188617
100	401	158	0.394000

5. Pensions

The pension contract offered by typical life offices differs from the savings contract described in Paragraph 3 in several respects. The terminology is different in that the deposits c_j are called *contributions* or premiums, and the withdrawals b_j are called *benefits.* More importantly, the terms and conditions exhibit the following characteristic features:

(i) The payments are contingent on survival so that no payments are made after the death of the policyholder.
(ii) The term T and the payments c_t and b_t are set out in the contract. Typically, a pension policy is whole life.
(iii) Accountancy is made, not on an individual basis, but for the portfolio as a whole, using the financial model in Paragraph 3 in combination with the actuarial model in Paragraph 4.

More precisely, for a policyholder aged x at the inception of the policy, $x + T$ is the highest attainable age ($\ell_{x+T+1} = 0$). The actuarial calculation is based on the idealized assumption that a large number ℓ_x of policyholders of the same age purchase identical policies at time 0 and thereafter survive/die in exact accordance with the decrement series. Thus, with ℓ_{x+t} survivors at any time $t = 1,2,\ldots,T$, the total contributions at time t (= $1,\ldots,m$) are $c_t\,\ell_{x+t}$, and the total benefits at time t (= m+$1,\ldots,T$) are $b_t\,\ell_{x+t}$. Similar to the balance equation (1), one obtains

$$c_1\,\ell_{x+1}/S_1 + \ldots + c_m\,\ell_{x+m}/S_m = b_{m+1}\,\ell_{x+m+1}/S_{m+1} + \ldots + b_T\,\ell_{x+T}/S_T \quad . \qquad (2)$$

The relationship (2) represents the basic paradigm of life insurance, called *the principle of equivalence.* It is laid down in the insurance legislation and enforced through supervision. The rationale of the equivalence principle is that the gains and the losses on individual contracts should average out to zero in a large portfolio, making insurance a “fair game” from the point of view of the insured. The relationship (2) is also significant from a solvency point of view: If the expression on the left is no less than the expression on the right, then the contributions cover the benefits, leaving the company solvent. Equivalence is the benchmark case where the company makes neither profit nor loss.

By comparison with (1), and recalling the discussion following that relationship, it is seen that mortality virtually serves to increase the interest earned on the investments. Indeed, the decrement function ℓ_{x+t} is decreasing with t so that, ceteris paribus, the withdrawals that can be made under the budget constraint (2) outperform those that can be made under the budget constraint (1). This effect, known as *mortality bequest*, is due to Item (i) above, which means that the survivors in the scheme will inherit the savings of those who die. Obviously, the steeper the decrement function, the stronger the impact of the mortality bequest.

6. Numerical illustrations

To gain some insight into the roles of interest and mortality and to assess the risk associated with them, let us proceed to some numerical examples.

Focusing first on interest, let us revisit the budget relationship (1) and assume for the moment that the future asset prices S_t are known upon inception of the contract at time 0. Then it is possible to design the contract with a fixed term T and level deposits $c_t = c$ and level withdrawals $b_t = b$. The annual deposit needed per annual amount withdrawn is

$$c/b = (1/S_{m+1} + \ldots + 1/S_T) / (1/S_1 + \ldots + 1/S_m) . \qquad (3)$$

For the sake of simplicity, suppose the asset is a money account that accrues interest at a fixed rate r per year, so that $S_t = S_{t-1}(1 + r) = S_0(1 + r)^t$. Take $m = 35$ and $T = 70$ (equal amounts saved over 35 years and thereafter equal amounts withdrawn over 35 years).
We have already mentioned the benchmark case with no interest, which gives $c/b = (T - m)/m = 1$, of course. Simple calculations yield $c/b = 0.2538$ if $r = 0.04$ (4% interest per year), and $c/b = 0.0677$ if $r = 0.08$ (8% interest per year).

Next we focus on mortality. For the sake of comparison with the savings contract above, we retain its basic features and consider a pensions contract with level contributions and benefits. Analogous to (3), we find that the ratio of annual contribution to annual benefit is

$$c/b = (\ell_{x+1}/S_1 + \ldots + \ell_{x+m}/S_m) / (\ell_{x+m+1}/S_{m+1} + \ldots + \ell_{x+T}/S_T) . \qquad (4)$$

Taking $m = 35$, $T = 70$, $x = 30$, and using the decrement function in Table 1 (mean life length 73) in conjunction with 4% interest per year, we find that $c/b = 0.1149$. This should be compared with 0.2538 for the savings contract, the difference being due to mortality bequest. With mortality rates equal to the half of those in Table 1 (mean life length 81), one finds $c/b = 0.1592$.

7. Interest risk and mortality risk

The numerical results in the previous paragraph demonstrate that the performance of a pension business is highly sensitive to changes in the economic and demographic environment and that even moderate downturns of interest or improvements of longevity can produce devastating losses. The past decade has seen adverse economic and demographic developments of dramatic proportions, way beyond what the pension industry and the regulators had anticipated. After a bullish run in the late 90s, the capital markets faltered in the wake of a combination of untoward events, notably the burst of the "dot-com bubble", a series of corporate scandals, and the September 11 atrocities. Stock indices plummeted by 50% in a matter of just three years, which amounts to about 17% negative interest per year for this asset class. The combined effects of changes in life-style, improved health services, and advances in the medical science have brought about a great improvement of longevity prospects across industrialized countries. In a matter of only ten years, mortality rates for British males in the older ages were halved. (Saying that improved longevity is an adverse event sounds like bad taste, but I am in good company; any good pension insurance company talks this way.) Now, the capital markets are recovering again, with stocks up some 50% since their record low in 2003. And, as for longevity, it might well happen that the pension industry could be bailed out by some of the scourges of mankind – pandemics, catastrophes, wars, and poverty. The point is, however, that we don't know what will happen. All we know is that under the planning horizon of a typical pension business, which extends over decades, the possible scenarios are countless, and some of them are extreme. Therefore, pension products and pension schemes must be designed in a manner that ensures solvency under some conceived worst-case scenario and at the same time is feasible under any possible scenario. What caused the pension crisis was that the pension industry, notably companies operating in a competitive market, assumed liabilities that could not be met under unfavourable conditions. An episode in 1985 comes to my recollection. The Norwegian Council of Insurance Supervision, the predecessor of Kredittilsynet, was considering an application for licensing of a technical basis with annual interest rates starting at 8% and thereafter descending to 4.5% over some ten years. The chairman, Gudmund Harlem, a prominent and experienced politician, exclaimed: “Those people must be ignorant of contemporary economical history. Today’s interest rates at 10% and above are unsustainable in the long perspective. Only three decades ago they were 2%, and that could happen again.” It has happened already. I shall now proceed to discuss how risk in pensions can be managed through the design of the policies.

8. Risk management

Recall the equivalence requirement (2), which could be also called the solvency condition. The problem is that, at time 0 when the policy is issued, the future indices S_t and ℓ_{x+t} are unknown and many highly different courses of events are possible. Therefore, in order to attain balance under any possible scenario, the payments c_t and b_t must somehow be allowed to depend on the indices. The design of the payments should aim to ultimately fulfil the solvency requirement, due regard being had to the purpose of the product, the interests of the customers, and the social welfare aspect of this line of insurance. How to achieve this is a prevailing conundrum in actuarial science. We shall describe some possible resolutions.

9. With profit insurance

This scheme, also called *participating policy,* is the traditional approach. The contract specifies contributions c_t^* , $t = 1,\dots,m$, and benefits b_t^* , $t = m+1,\dots,T$, at face value (£, $, €, NOK,…). These contractual payments are binding to both parties throughout the term of the contract, and the insurer cannot counter adverse developments of interest or mortality by raising premiums or reducing benefits. Therefore, the contractual premiums are set on the safe side, sufficiently high to cover the contractual benefits under (ideally) any scenario. The way this is usually done is to enforce equivalence with the unknown indices S_t and ℓ_{x+t} appearing in (2) replaced by so-called “technical” indices S_t^* and ℓ_{x+t}^* that are prudently chosen and ideally should represent a worst case scenario. Subsequently, as time passes and the true indices surface, the insurer will see systematic surpluses emerging from the prudent technical assumptions. These surpluses belong to the insured and are to be repaid in the form of *dividends* or *bonuses*. Denoting the dividend payment in year t by d_t , the contributions and benefits seen by the policyholder are

$$c_t = c_t^* - d_t \ , \ t = 1,\dots,m, \text{ and } b_t = b_t^* + d_t \ , \ t = m+1,\dots,T.$$

Dividends should be allotted in such a manner that, at the end of the day, the equivalence principle (2) is satisfied under the experienced interest and mortality conditions. While this ultimate balance is a statutory requirement, the timing of the bonus payments is to the insurer's discretion. Restraint must be exercised in order not to jeopardize solvency, and bonuses should therefore be paid later rather than sooner, but still in a manner that conforms with the purpose of the product. For the pension policy it would make sense to postpone bonus payments until the time of retirement, and let them come as added benefits in – to the extent possible – even annual amounts. There exist more sophisticated schemes for redistribution of surpluses, a popular one being to use the surpluses as premiums for purchase of additional benefits as stipulated in the contract. An actuarial account of these methods is given in Norberg (2001).

The with profit concept has been blamed for the pension crisis. Unjustly of course: if you get a ticket for speeding, you don't put the blame on your Mercedes. The with profit vehicle was good enough, but it wasn't conducted with sufficient prudence. The truth of the matter is that, in attempts to attract customers, insurers wanted their products to appear cheap. Level-headed actuarial judgement had to give way for salesman thinking; premiums were set too low, and bonuses were promised prematurely.

10. Index-linked insurance

This concept, also known as *unit-linked insurance* or *variable life insurance*, is relatively new. It was introduced only in the 70s, but quickly occupied a considerable share of the market. As the name suggests, the index-linked policy stipulates premiums and benefits that are linked to the indices S_t and ℓ_{x+t} . In its clear-cut form it specifies that

$$c_t = \underline{c}_t \, S_t / \ell_{x+t}, \quad t = 1,2,...,m, \text{ and} \qquad (5)$$
$$b_t = \underline{b}_t \, S_t / \ell_{x+t}, \quad t = m+1,...,T, \qquad (6)$$

where the $\underline{c}_t$ and the $\underline{b}_t$ are certain "baseline" payments chosen at time 0. Upon inserting the expressions in (5) into the balance constraint (2), the latter reduces to

$$\underline{c}_1 + \ldots + \underline{c}_m = \underline{b}_{m+1} + \ldots + \underline{b}_T .$$

And – mumbo jumbo – the problematic indices have disappeared from the equivalence equation, which can now be satisfied by suitable specification of the baseline payments at the outset. The crux of the matter is that the entire interest risk and mortality risk is placed on the shoulders of the insured, who will have to live – and die – with the money that the markets and the living conditions will allow. The company will remain solvent no matter what happens.

Index-linked products in the clear-cut form described here do not exist in practice. In fact, linking to the decrement function has not yet been seen anywhere but in the present article. Linking to the asset index is usually made for the benefits only. Moreover, existing index-linked products are invariably equipped with some guarantee that the benefits will not fall short of a certain level. Thus, one would replace S_t in (6) with $\max(S_t, g)$, the maximum of

S_t and a prescribed guaranteed "floor" g. Such modifications to the perfect linking re-introduce risk on the part of the company, and it therefore appears that the solvency problem remains partly unsolved. However, if S_t is the price of a liquid asset, then the amount $\max(S_t, g)$ is nothing else than a so-called financial derivative that can be traded in financial markets. Thus it appears that, in order to restore solvency, all the insurer needs to do is to buy this derivative at its current market value and charge the customer with the expense as an additional premium. This device – and its limitations – will be discussed more extensively in Paragraph 11.

Perfect linking of the benefits to the asset price seems reasonable to the extent that the latter mimics the price index for consumers' goods – this is precisely what is done or intended for state pensions. If, however, the asset is a (composite of) stock, then one may be concerned that the benefits might fall short of what is needed to sustain the customer's purchasing power, and there would be a need for a guarantee. Actually, the thinking that originally led to the advent of index-linking was not about equivalence and solvency, but rather about allowing the customers to prosper from investing in exciting stocks instead of the usual dull bonds. The same sort of thinking that lead to the liberalised investment regulations for insurers in the 80s, the heyday of the notorious "deregulation". Stock markets were faring well in those days, and the lesson of 1929 and the following depression had long been forgotten or repressed by most people (not Harlem, though). Mark Twain, always confounded by financial and business affairs, summarized a rather different experience from 1881: "October: This is one of the peculiarly dangerous months to speculate in stocks in. The other are July, January, September, April, November, May, March, June, December, August, and February." The same could have been said one hundred twenty years later. And now stocks – and the confidence in them – are up again. The total historical experience is that stocks are volatile, hence the guarantee. A modern actuarial/financial analysis of such guarantees is found in Moeller (1998).

11. In the market we trust (?)

The past few decades have witnessed an amazing expansion and change in the workings of the financial markets, the most eye-catching development being financial innovation that has resulted in a plethora of so-called *derivative securities* or just *derivatives*. As the name indicates, a derivative security is a financial contract that is derived from some more basic economic index and that is itself a tradable security. Derivatives are now available on an extensive range of indices – equity prices, interest rates, currency exchange rates, commodity prices, energy prices, and many more. Today the derivatives market is the largest capital market in the world. Common forms of derivatives are *options, forwards,* and *futures,* which are various forms of guarantees on future asset prices, and *swaps,* which serve to exchange profits and losses between owners of distinct assets. Their common purpose is to facilitate trade and to eliminate risk. We should rather say *spread* risk because risk cannot be exorcised by magic formulas written on pieces of paper. Indeed, financial instruments designed to reduce risk also open opportunities of excessive risk-taking, spectacular examples being the 1995 bankruptcy of Barings Bank, which lost $1.4bn in speculation on future contracts, and the 1998 near-collapse of Long Term Capital Management, which mistakenly gambled on a convergence of interest rates. These and a number of other corporate failures have earned the derivatives a mixed reputation. Used cleverly, however, derivatives are powerful tools for risk management in virtually any line of business.

In parallel with the rapid transformation of financial practices there have been great advances in the financial mathematics, which now presents coherent theories for pricing of derivatives. The basic principle goes as follows: If the market is sufficiently rich in liquid assets, then a given future financial claim can be perfectly *hedged* (duplicated) by an investment portfolio that is *self-financing*, which means that the portfolio is initiated with an single investment and thereafter dynamically rebalanced with no further infusion or withdrawal of capital – every purchase of assets is financed by sales of some other assets. The amount needed to initiate this strategy, is the market price of the claim: if e.g. the claim should be priced higher than the initial investment; then one could sell the claim and purchase the portfolio that will settle it, and pocket the difference at no risk. Such a costless and risk-free gain, called *arbitrage*, is not possible in a well-functioning market. The richer the market is in tradable assets, the greater its hedging capacities. Thus, the introduction of new assets is a way of creating hedging opportunities for risks that otherwise would remain with the businesses that carried them in the first place. Such financial innovation, known as *securitization* and using derivatives as its basic instruments, serves to transfer an ever increasing variety of economic risk to the marketplace.

Going back to the guaranteed sum assured $\max(S_t, g)$ encountered in the previous paragraph, this is a standard derivative that is widely traded in today's market, at least for basic assets like stocks and for short maturities t. Since index-linked products are mainly term insurances with relatively short contract periods, the market of today provides some partial hedging opportunities for life offices offering such products. In pensions, where the typical contracts have much longer durations, there are very limited possibilities of hedging such financial claims. As for the longevity risk associated with the indices ℓ_{x+t}, the supply of suitable market instruments is almost nil.

Generally speaking, securitization has been slow to catch on in insurance. In the 90s the Chicago Board of trade started to issue catastrophe derivatives enabling the insurance companies to hedge risk related to natural hazards like floods, hurricanes, and earthquakes. Such derivatives are now commonplace. More recently, Swiss Re launched a $250m four year bond with interest and principal related to a broad mortality index, the purpose being to enable life offices to hedge against catastrophic mortality developments, and the European Investment Bank launched a £540m twenty-five year mortality bond opening opportunities for pension funds and life offices to offset longevity risk. (Actually, similar schemes were seen already in the 17th and 18th centuries in the rudimentary form of Tontine bonds issued by some European governments.) The EIB securitization was not very successful, presumably because the market agents were not sufficiently familiar with this form of risk and, therefore, were not willing to buy the bonds at sustainable prices.

However, from these tender beginnings we can expect that the market for mortality derivatives will expand to large scale and great variety, ultimately making ordinary investors sharing in the longevity risk that up to now has been carried entirely by the pension schemes and their members. The enterprise will present the financial engineers to challenges arising from the special features of pension contracts. We have already alluded to the exceedingly long maturities needed for mortality derivatives (normally, derivatives have maturities of just a few years). Also it is widely held that, in order to be transparent to market agents and also not susceptible to manipulation, such derivatives need to be based on broad market indices like population statistics, which may fail to catch the risk profile of special individual pension schemes. The design of mortality derivatives with capacity of spanning different tranches of mortality risk is therefore an issue. For instance, a corporate mortality bond based on a more narrow index like the mortality experience of the issuer's scheme, would require full disclosure of relevant portfolio data. This is likely to be feasible only for compulsory, non-competitive schemes. Yet another limitation, arising from the regulatory framework, is that the customer and the pension scheme will always remain parties to the pension contract. Thus, securitization cannot take forms that allow a pension scheme to take the pension liabilities off its balance sheet. The only feasible way seems to be that some third party like an exchange or a bank issues derivatives in which the pension scheme can seek hedging opportunities. This being so, the pension schemes will have to base their market management of mortality risk on the principles and methods of modern financial economics. Now, in every theoretical analysis there is a superimposed risk due to the possible inadequacy of the very model. Such model risk is particularly critical when assumptions are made about the workings of the society – a highly complex and ever changing system – in a very long time perspective. In the present case a special difficulty is due to the scale of the market operations that can be anticipated: the pension industry is the largest accumulator of capital in the economy, and its trades will be in such huge volumes that they necessarily will impact the prices of the assets. This is true already on the level of the individual (major) life office and, a fortiori, on the level of the industry as a whole, with all companies making similar moves. This "globalization of the herd instinct" is currently at work in the UK, where the pension funds could switch up to £150bn out of equity into bonds, pushing up the prices of the latter. There exists no single agreed model representation of such complex phenomena. (As the saying goes: "If you need an expert's opinion on some economics issue, ask an economist. If you need a second expert opinion, ask the same economist.") At this point I would like to emphasize that the actuarial methods described in Paragraphs 9 and 10 do not involve any model assumptions about the mechanisms governing mortality and asset prices.

For overviews of securitization of mortality risk, see Cairns et al. (2004) and Cummins (2004). A financial mathematics approach is taken by Dahl (2004).

12. Epilogue and advice

The merger between insurance and finance is manifest in the ongoing dismantling of the borders between the industries, in the emergence of countless products in the interface of insurance and finance, and also on the theoretical side in the strong impact of modern financial economics on insurance mathematics. Finance has become an integral part of insurance, and it brings with it products, schemes, and management tools of high sophistication and complexity. In these circumstances the regulator must be equipped with adequate expertise in the combined area of actuarial science and finance, what Buehlmann (1987) in a famous article in the ASTIN Bulletin called "actuaries of the third kind". Research is needed as much in the supervisory office as it is in the bodies that are subject to its regulation. In consequence, the regulator should actively promote an actuarial education that is on a par with the state of the art, combining modern insurance mathematics, financial mathematics, and computational technology, and – as argued by Sverdrup (1954) – with emphasis on basic principles. Abandoning the established actuarial precautions and relying entirely on the financial markets to come to our rescue, is not a responsible strategy. The way forward lies somewhere in the middle, and to find it – combining old and new roadmaps and combining foresight with sound conservatism – is a challenge to the regulator. I would also like to remind that in pensions there are numerous pending issues that cannot be resolved by finance magic, but will require further development of actuarial models and methods per se: fluctuations and trends in longevity, population dynamics and state pensions, heterogeneity and risk classification, selection phenomena, lapses and surrenders and transfers between schemes, non-systematic mortality risk in small portfolios, optimal design of contributions and benefits, fast computation, and many more. The timeless "leitmotif" is that insurance is – always was and will always be – a high-tech industry, whose operations should be based on the best of practical judgement and available scientific methods.

Admonitions aside, I would like to congratulate Kredittilsynet on great achievements in the past and express my best wishes for the future.

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