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Abstract

Mortality trends in Cyprus show a similar decreasing trend over the past thirty years to other developed countries. Using detailed, age specific data from 2003 and 2009, we estimate the impact of the change in Cypriot male and female mortality on a stylized life annuity framework for a Cypriot retiree. Based on these results and the general pension framework in Cyprus, we propose a few measures that can alleviate the burden of decreased mortality on pension obligations.

Keywords: Mortality, Pensions, Reform, Cyprus.

1. Introduction

A change in mortality risk impacts both life insurance and life annuity contracts. An increase in mortality triggers more claims for life insurance contracts since the population dies, on average, at a younger age. At the same time however, an increase in mortality implies a shorter average life expectancy, hence it has a decreasing effect on the outstanding retirement obligations (i.e. life annuities). In Cyprus, the state bears more pension obligations and less life insurance obligations than the insurance and pension industry. Therefore decreases in mortality over time are expected to affect negatively (positively) the financial position of the Cyprus state (insurance industry).

In this paper we estimate changes in mortality risk in Cyprus and project the impact of these changes on retirement benefits. We find that mortality in Cyprus decreases over the past years, a trend consistent with worldwide trends in mortality. To measure the impact of decreases in mortality, first we define a stylized pension benefit framework for a typical retiree in Cyprus and estimate the actuarial present value at that age using the 2003 life table. Then we repeat our calculations using the 2009 life table.

We find an average increase in actuarial present values over the six year period (2003-2009) of 4.95% for males and 3.78% for females, ceteris paribus. In monetary terms, we estimate this longevity cost to be about €10 million for the state employees in Cyprus over our analysis period (2003-2009). Since most pension plans in Cyprus are state (co-) funded, we conclude with some proposals related to the current pension framework in Cyprus that

can compensate for some of the adverse effects on pension obligations, resulting from the documented decrease in mortality over the past years.

2. Data and Results

We use historical population and mortality data from the Cyprus Statistical Service[1]. Since the 1974 invasion disrupted the Cypriot population, we focus on the period after 1974 for our analysis, in which period population statistics refer to the Cypriot areas controlled by the Cypriot government. All our data have been collected from the website of the Cyprus Statistical Service, or by hand-collecting data from previous reports which were available only in print.

2.1 Aggregate Mortality in US, UK and France.

In figure 1 we show the number of deaths per 100,000 people in the population for three developed countries: the US, UK and France in the period 1900-2005.[2] Overall, we observe a decreasing trend in mortality for all three countries over all years, with the exception of the periods around the two World Wars and the 1918 influenza. Several academic studies have documented and modeled trends in mortality (i.e. Cairns et al. 2006a; Cairns et al. 2006b; Ballotta and

[1] Data source: www.mof.gov.cy/cystat

[2] Data source: The Human Life Table database (www.lifetable.de) for data between years 1900-1999 and the Human mortality database (www.humanmortality.de) for data between years 2000-2005.

FIGURE 1

Figure 1: Mortality Trends in US, UK and France (190-2005)

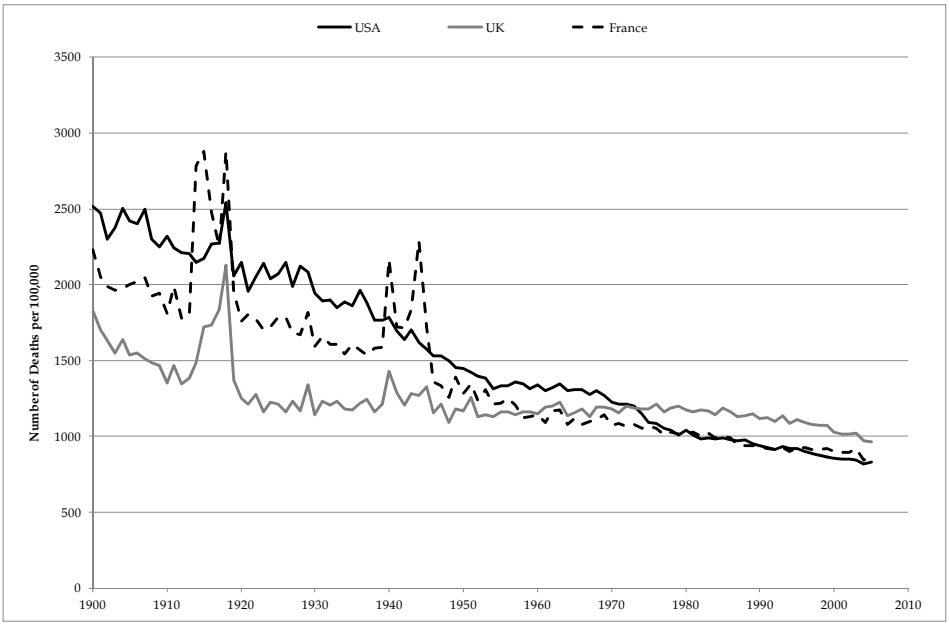
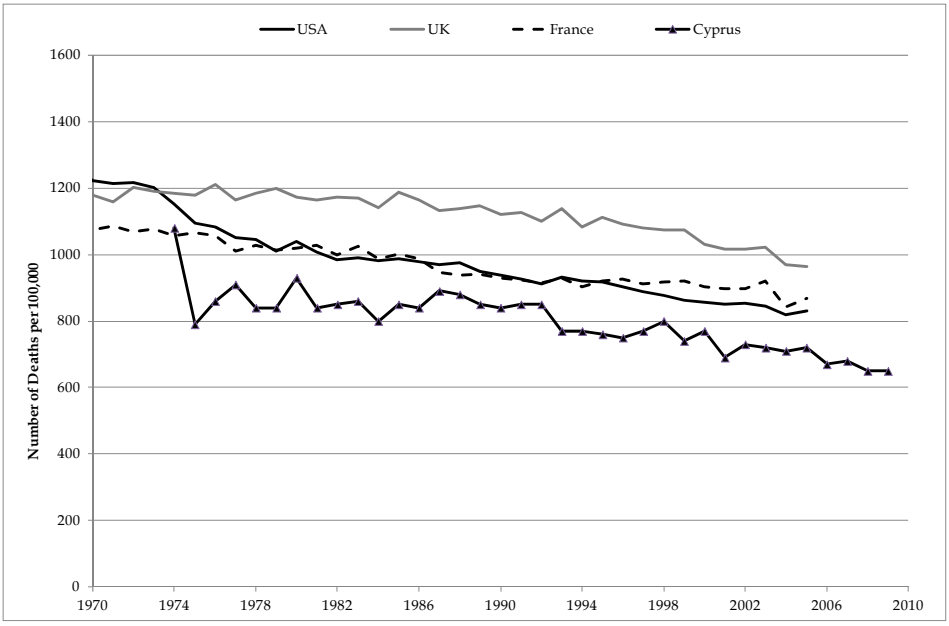


FIGURE 2

Figure 2: Mortality Trends in Cyprus (1974-2009)



Haberman, 2006; Lin and Cox, 2008; Milidonis et al. 2011) and have offered solutions for hedging this risk (Cox and Lin, 2007).

2.2 Aggregate Mortality in Cyprus.

In figure 2 we present the case of Cyprus. Our data begins in 1974 and extends to 2009. When comparing to US, UK and France we note two significant facts. First, mortality in Cyprus decreases over time in a similar fashion to mortality in the remaining countries. Second, the level of mortality in Cyprus is lower for all years after 1975 (up to and including 2005) than those of US, UK, and France.

2.3 Mortality by Age and Gender in Cyprus.

To measure changes in Cypriot mortality we use the detailed life tables from the earliest mortality table available on the website of the Cyprus Statistical Service (2003) and the most recent one (2009). Both life tables are given in age cohorts of five years, from age zero to age eighty five. For the purpose of our study we transform the life tables from five-year cohorts to individual-age cohorts, using linear interpolation. Additionally, using the same method for people of age eighty-five, we assume that there are no people alive at age 100.

We show the differences in the two life tables by estimating the expected future lifetime of a person of age x. We estimate the (curtate) expected future lifetime by summing together ${}_kp_x$, where $0 < k \leq 100 - x$, for all ages greater than or equal to age x . ${}_kp_x$ is the probability of survival of a person of age "x" for the next "k" years. This approximation is widely used in the actuarial literature (Bowers et al., 1986)

TABLE 1

Expected Future Lifetime in 2003 and 2009

	Female		Male	
Expected Future Lifetime (years) at:	2003	2009	2003	2009
Age 0	81.53	82.81	77.18	78.14
Age 60	22.55	23.48	18.88	19.73
Age 65	17.89	18.78	14.5	15.34

In table 1 we show the estimated expected future lifetime at ages 0, 60 and 65, for males and females using the 2003 and 2009 life tables. We observe that a female newborn in year 2009 is expected to live about 1.28 years longer than a female newborn in 2003. The respective increase for males is 0.96 years. Focusing on the age close to retirement, we estimate that a sixty-year old female is expected to live 0.94 years longer in 2009 than in 2003, while a sixty-five year old female about 0.90 years. For males the respective increases in expected future lifetime are 0.86 and 0.84 respectively.

2.3 Impact of Change in Mortality on Pension Benefits.

To provide an estimate of the impact of the decrease in mortality risk on pension benefits, we assume that the following pension framework applies to the average Cypriot male and female. We assume that a person retires on his 65th birthday with an annual retirement benefit of €1 payable at the end of each year (i.e. on his 66th, 67th birthday e.t.c.). We assume interest rates of 2% per annum.

To estimate the impact on retirement benefits, we then estimate the actuarial present value (APV) of this life annuity. APV means that the entire stream of payments, conditional on survival (i.e. using the respective life table for each year), will be paid as a lump-sum on the 65th birthday of the individual, while no additional annual pension payment, will be made.

We find that the actuarial present value (APV) of a Cypriot male in 2003 amounts to €13.61 and in 2009 it increases by 4.95% to €14.29. Similarly, the APV of the retirement benefit for a Cypriot female in 2003 would be €15.36 and it would increase by 3.78% in 2009 to €15.94.[3] These numbers mean that for every €1 of pension payment expected to be paid at the end of every year after retirement, the retiree is entitled to a check of €13.61 (that is, for a male in 2003), at age 65.

To make our numbers more realistic let us assume that the annual payment is estimated using the retiree's final salary at retirement, which is estimated at around €40,000.[4] Assuming a 70% replacement ratio for each retiree, then in 2009 the APV for a Cypriot male and female is close to €400,000 and €446,000 respectively.

In Cyprus, there were about 15,000 state employees and about 560 retirements in 2011 (PSC, 2011). Therefore, using the increase in the actuarial present values estimated above, and the number of

[3] If interest rates are set at 0% (4%) per annum, the respective increase in the APV for males is 4.11% (3.45%) and for females is 5.64% (4.33%).

[4] Source: Cyprus Statistical Service.

retirements (for the 15,000 state employees), we estimate that the "cost" of longevity to public finances over the years 2003-2009 amounts to 9.8 million euros. This estimation assumes an equal number of male and female retirees at the end of the year, out of the 560.

An even more general calculation would include all employees in the "general government sector". According to the Cyprus Statistical Service, this number is 70,002 (2012; Q1). It is not obvious however, if all employees are entitled to defined benefit pension benefits. Still, the longevity cost corresponding to this population of employees, would be at least two or three times the (almost) €10 million, that corresponds to the state employees over the past six years in our analysis.

3. Proposals

In this section we propose a few potential changes to the pension system in Cyprus, related to defined benefit and contribution plans, as well as other measures that are currently either employed or discussed in other countries. Most of the suggestions are focused on retirement age.

Starting with defined benefit plans, which promise a certain benefit at retirement and resemble our stylized framework above, increasing the retirement age can compensate for the increase in life expectancy, assuming of course no other changes to the plan. An alternative solution to an increase in the retirement age could be to benchmark the retirement age onto the life expectancy of the population, so that retirement benefits are paid, on average, for the

same number of years regardless of changes in mortality risk. A third proposal would be to estimate retirement benefits on the average salary of the career of the employee, thus essentially decreasing retirement benefits or at least making them more predictable, than estimating benefits on the final salary. A fourth proposal would be to increase contributions on behalf of the employer. However, since in the case of Cyprus, the state bears most of the pension funding risk, then increasing the state's contributions would further worsen the state's financial condition.

Regarding defined contribution (DC) plans, retirement benefits are largely dependent on the balance in the account at retirement. Since the balance is largely dependent on the contributions of both the employer and the employee, then extending the period for which contributions are made, would compensate for the increase in life expectancy. This implies again an increase in the retirement age. An alternative solution to an increase in the retirement age, would be to adopt, *an optional retirement age*. Such a solution could be desirable in the following sense: if employees feel that they have accumulated enough in their DC plans, then they can opt to retire early. In the opposite case, employees may choose to work longer. It is not clear if forcing productive employees to retire at a specific age has a net gain for the society. Hence, if employees know how much they should have in their DC plans to retire comfortably (as explained in section 2.3), then why not let them decide when they are ready to retire?

A final proposal for the Cypriot pension system, especially those employees with a DC plan who bear the longevity risk, would be to

allow employees to set up their own individual retirement accounts (IRAs), as it is the case in the UK and US. IRAs would allow employees with insufficient retirement resources (DB and/or DC plans) to have an additional source of income at retirement.

4. Conclusion

In this paper we conduct a brief analysis of the impact of changes in Cypriot male and female mortality on the value of retirement benefits. We find that mortality in Cyprus has decreased (life expectancy has increased), thus causing an increase in the time period that retirement benefits will be paid.

Our proposals focus mostly on increasing the retirement age, since it would directly compensate for the increase in life expectancy. We discuss the implications of increasing the retirement age uniformly across the entire population, and also the possibility of allowing for an *optional retirement age.*

The Cypriot pension system is overdue for reform. Reform should revisit the issue of retirement age, however, it should also examine employer and employee contributions, the regulation of defined contribution plans (i.e. transferability; more investment options to employees) and other supplementary plans such as the institution of individual retirement accounts.

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