GENDER AS PROHIBITED RISK FACTOR IN INSURANCE

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Abstract

There are significant differences between females and males in their accident risk and mortality risk. The costs of providing insurance products that cover these risks, including motor insurance, private medical insurance, life insurance and pension annuities, differ between men and women. Gender is used in addition to, and in combination with other risk factors and, for some products, gender is, after age, the second-most important factor. This paper brings analysis of the impact of a ban on the use of gender in insurance, with special stress on life insurance and pension annuities, according to the requirements of the European Court of Justice.

Key words: gender, risk factor, premium, pension

JEL Code: C 13, G 22

Introduction

Article 5 of Council Directive 2004/113/EC of December 2004 implementing the principle of equal treatment between men and women in the access to and supply of goods and services regulates the use of actuarial factors related to sex in the provision of insurance. Article 5(1) provides that, for new contracts concluded after 21 December 2007, the use of sex as a risk factor in the calculation of premiums and benefits must not result in differences in individual premiums and benefits. Article 5(2) provides for derogation from this rule by allowing Member States to maintain proportionate differences in individual premiums and benefits where the use of sex is a determining factor in the assessment of risk based on relevant and accurate actuarial and statistical data.

However, on 1 March 2011, the European Court of Justice (ECJ) declared Article 5(2) incompatible with Articles 21 and 23 of the Charter of Fundamental Rights of the European Union, and thus invalid with effect from 21 December 2012. The unisex rule contained in Article 5(1) must be applied without any possible exception in relation to the calculation of individual premiums and benefits in new contract. National governments of Member States will be obliged to change their laws accordingly by this date. For more information see, for example (Official Journal of the European Union, 2012).

In fact, there is substantial evidence to demonstrate that, next to age, sex is the most important risk factor for life expectancy. Men have higher mortality rates than women at all ages, even before birth. The difference between the sexes remains even when other factors, such as marital status, accupation, socio-economic status and smoking habits are taken into account. There are differing views in the scientific literature (Chen, Chih-Chuan et al.,2012; Murasko, Jason E., 2006; Saito, Masashige et al., 2012; Wilson, Sven E., 2012) as to the causes of the sex differences in mortality, but, whatever the causes, sex remains a significant predictive factor for life expectancy. Sex is also a significant risk factor for disability and, at young ages, for motor accidents.

This paper is organized as follows: in the first part we recall two factors which impact the size of premium in life insurance and also the size of future pension annuities – EU Gender Directive and actuarial calculation of net annual premiums of life insurance and of the expected present values and accumulated future values of annuities payable annually and *m*-thly per year. In the second part we analyze the size of the individual premiums according to gender and unisex life tables, as well. At the end, we give some remarks and schemes of our next investigation.

1 Preliminaries

Women generally pay less for life insurance, but more for insurance in the event of survival and pension annuities than men of the same age because their life expectancy is greater. Women generally pay more than men for income protection insurance, because rates of disability are higher for women than for men.

We recall the main actuarial formulas for deeper understanding of our work. It can be written as follows. You can find below mentioned formulas, expressed by commutation functions, for example in (Gerber, 1997; Sekerová, Bilíková, 2007; Špirková, Urbaníková, 2012).

1.1 Pure Endowment insurance

Pure Endowment insurance is a policy under which its face value is payable only if the insured survives to the end of the stated endowment period; no benefit is paid if the insured dies during the endowment period. The standard formula for calculating of net annual premium $P_{x,\overline{n}|}$ for x-aged insured with insured sum in the size of one monetary unit is given by

$$P_{x,\overline{n}|} = \frac{{}_{n}E_{x}}{\ddot{a}_{x,\overline{n}|}}, \qquad (1)$$

where $${}_nE_x = \frac{D_{x+n}}{D_x} \qquad (2)$$

is a single net premium of Pure Endowment insurance on the one monetary unit of the insured sum, and

$$\ddot{a}_{x,\overline{n}|} = \frac{N_x - N_{x+n}}{D_x} \qquad (3)$$

represents a net single premium of yearly annuities payable in advance during n years; expressed by corresponding commutation functions.

1.2 Life insurance

Life insurance is a contract between an insurance policy holder and an insurer, where the insurer promises to pay a designated beneficiary a sum of money (the "benefits") upon the death of the insured person. Net annual premium of the term life insurance for x-aged insured during insured period n years is given by

$$P_{x,\overline{n}|} = \frac{A_{x,\overline{n}|}}{\ddot{a}_{x,\overline{n}|}}, \qquad (4)$$

where $A_{x,\overline{n}|} = \frac{M_x - M_{x+n}}{D_x}$ represents the net single premium of term life insurance.

1.3 Pension insurance

The basic formulas related to evaluation pension annuities are as follows. The net single premium of the yearly term life annuities in advance in the size of the one monetary unit for x-aged insured is given by (3). The net single premium of the yearly whole life annuities in advance in the size of the one monetary unit for x-aged insured is given by

$$\ddot{a}_x = \frac{N_x}{D_x}. \qquad (5)$$

The net annual premium of whole life annuities and also other actuarial functions are usually evaluated for integer ages and terms, assuming that cash flows are payable annually. However, annuities are very often paid more frequently than annually, namely monthly, quarterly, but also semi-yearly. We can find in various sources well known formulas on evaluating of certain and expected annuities which are paid more frequently than annually.

Present value of m-thly paid annuities $\ddot{a}_x^{(m)}$, and its extension $\ddot{a}_x^{(m)*}$ influence the size of future pension annuities. In our model we evaluate the accumulated value of certain annuities in advance as future accumulated value of funds, from which pension annuities will be paid

out. We introduce a model of basic formulas for determination of monthly annuities from the third pillar pension. Monthly pension annuities can be determined as follows

$$P^{(m)} = \frac{A \cdot \ddot{s}_{\overline{n}|}^{(m)} \cdot (1-p)}{m \cdot \ddot{a}_x^{(m)}}, \qquad (6)$$

where the accumulated value of temporary certain annuities of $1/m$ monetary unit $\ddot{s}_{\overline{n}|}^{(m)}$ which are payable in advance during *n* years is as follows

$$\ddot{s}_{\overline{n}|}{}^{(m)} = \frac{1}{m} \cdot q^{\frac{1}{m}} \cdot \frac{q^n - 1}{q^{\frac{1}{m}} - 1}, \qquad (7)$$

where $q = (1+i)$ is an accumulated factor with a technical interest rate $i = 2.5$ % p.a. and

$$\ddot{a}_x^{(m)} \approx \ddot{a}_x - \frac{m-1}{2m} \qquad (8)$$

is the expected present value of the whole annuity of one per year, payable to the entry aged *x* with $1/m$ at the beginning of each *m*-thly period, where $\ddot{a}_x$ is the present value of whole life yearly annuities in the amount of 1 monetary unit. It can be expressed by the commutation functions as follows $\ddot{a}_x = \frac{N_x}{D_x}$; *A* is a monthly payment of annuities during *n* years, $A \cdot \ddot{s}_{\overline{n}|}^{(m)}$ represents real accumulated value over duration time *n*, *p* represents the first higher pension (in percent).

Remark 1. For more precise evaluation we can apply a precise formula for *m*-thly pension annuities which is given by

$$P^{(m)*} = \frac{A \cdot \ddot{s}_{\overline{n}|}^{(m)} \cdot (1-p)}{m \cdot \ddot{a}_x^{(m)*}}, \qquad (9)$$

where

$$\ddot{a}_x^{(m)*} \approx \ddot{a}_x - \frac{m-1}{2m} - \frac{m^2-1}{12m^2} \cdot (\mu_x + \delta) \qquad (10)$$

represents extended version of the formula (6), where μ_x as the force of mortality at time *t* for an individual age *x*. The value $\delta = \ln(1+i)$ represents the so-called force of interest.

Remark 2. *m*-thly paid pension annuities can be modified according to the requirements of clients. For example, they can be expressed as follows

$$P^{(m)\circ} = \frac{A \cdot \ddot{s}_{\overline{n}|}^{(m)} \cdot (1-p)}{m \cdot \left(\ddot{a}_x^{(m)} + z \cdot \ddot{a}_{\overline{n}|}^{(m)} A_x\right)}, \qquad (11)$$

where z is the coefficient of the survivor´s pension arrangements, the value A_x is the net single premium of whole life insurance for x-aged client with the policy value of one monetary unit. It can be expressed by commutation functions as follows $A_x = \frac{M_x}{D_x}$, $M_x = \sum_{i=0}^{\omega - x} C_{x+i}$ and $C_x = d_x \cdot v^{x+1/2}$ is discounted number of deaths at age x.

2 Analysis of premiums

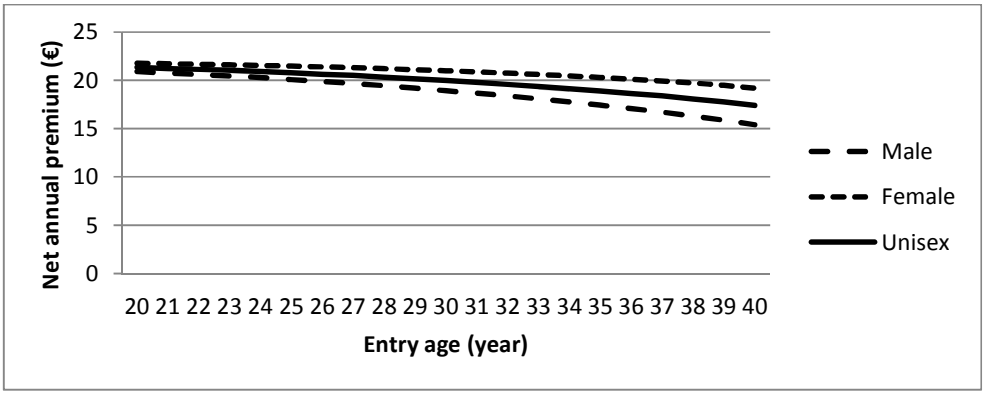
The investigation covers three of the main products where such differentiation applies in the European insurance sector: endowment insurance, term life insurance, pension insurance.

In our analysis we assume an insurance on the policy sum in the size of the 1,000 euros and insurance duration $n = 30$ years. We calculate net annual premiums by life tables of the Slovak Republic separately for male, female and unisex tables, which were determined with respect to a technical interest rate $i = 2.5$ % p.a., (Mortality tables, 2012).

2.1 Endowment insurance

Statistically, women live longer than men. Fig.1 shows the dependence of the net annual premium for Endowment insurance according to entry age of insured person. Based on the data available for the Slovak Republic women (aged 20 to 40 years) could see a reduction in net annual premiums of around 5.14 % or more on average; men could see premiums rise of around 6.18 % or more on average in comparison with unisex.

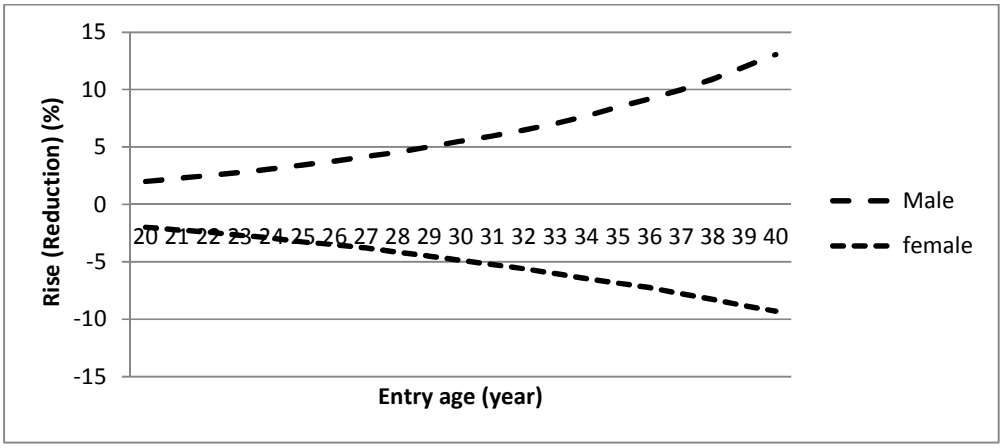
Fig. 1: Net annual premium for Endowment insurance according to entry age



Source: own construction

In Fig. 2 we can see the rise (reduction) of net annual premium for Endowment insurance with using unisex life tables according to entry age.

Fig. 2: Rise (reduction) of net annual premium for Endowment insurance

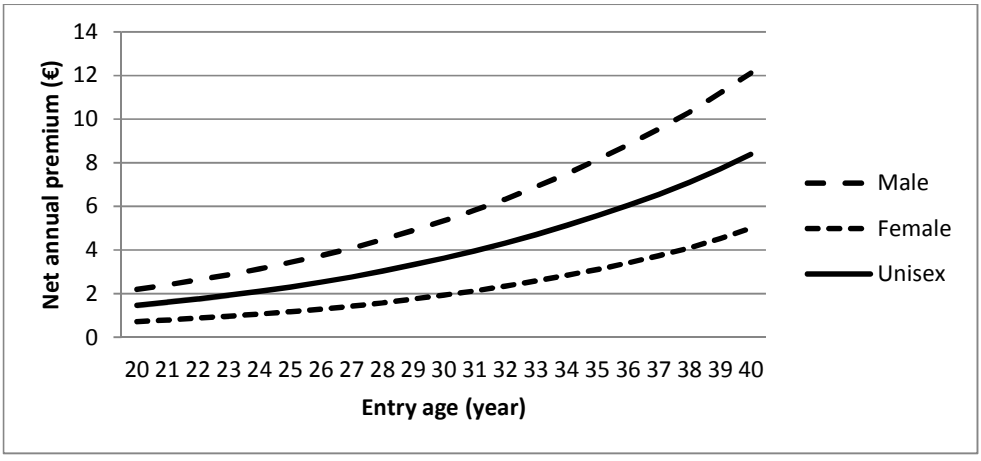


Source: own construction

2.2 Life insurance

With unisex pricing, there would be large differences between the expected lifetime benefits from term life insurance policies for men and women, as men have a higher mortality risk for any given ten year period than women. In Fig. 3 are graphs of dependence of net annual premium for term life insurance according to entry age with respect to male, female and unisex life tables.

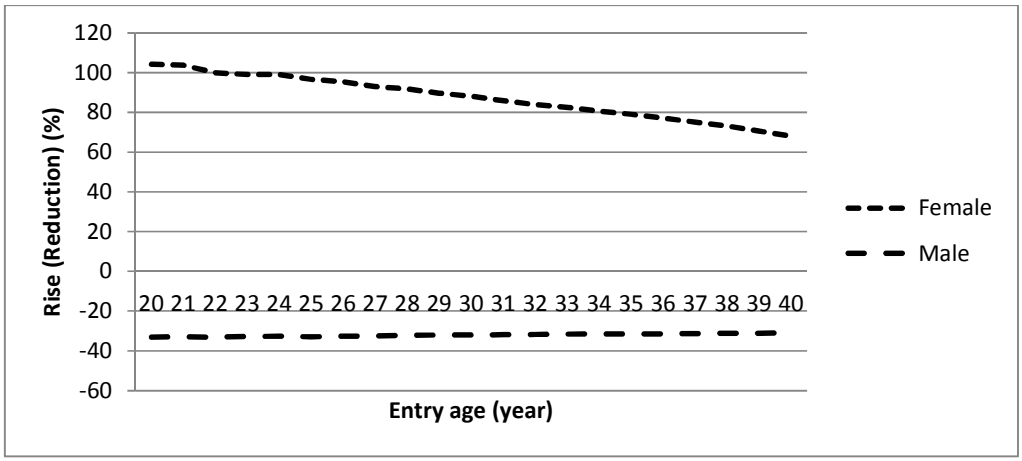
Fig. 3: Net annual premium for Life insurance according to entry age



Source: own construction

Based on the data available for the Slovak Republic women (aged 20 to 40 years) could see a rise in net annual premiums of around 87.45 % on average; men could see premiums a reduction of around 32.06 % on average with respect to unisex, see Fig. 4.

Fig. 4: Rise (reduction) of net annual premium for Life insurance

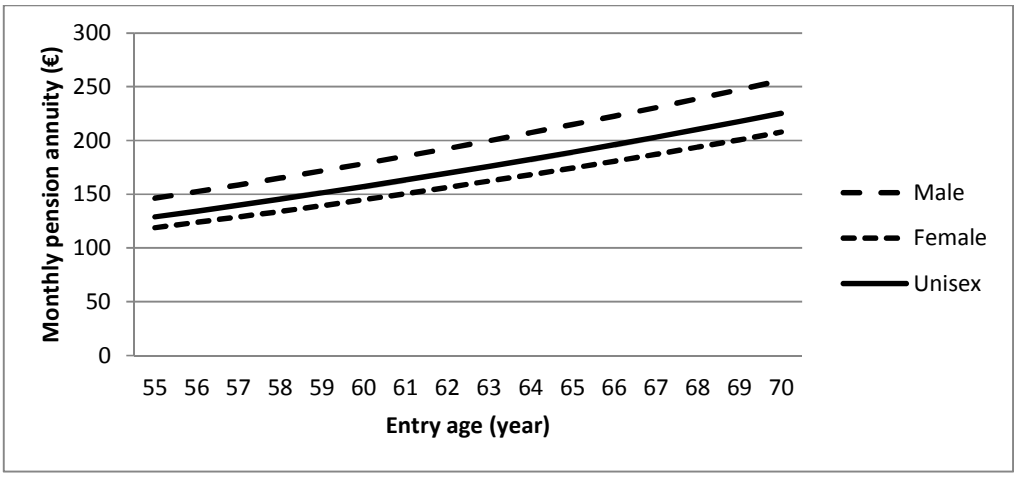


Source: own construction

2.3 Pension insurance

In our model we assume that insured person at the age of 18 saves monthly 30 euros in a pension company during whole duration time until retirement.

Fig. 5: Monthly pension annuity according to entry age



Source: own construction

In Fig. 5 you can see dependence of the size of monthly pension according to entry age separately for male, female and unisex according to (6). Based on the data available for the

Slovak Republic with technical interest rate 2.5% p.a. men (aged 55 and more) could see a reduction in pension income from pension annuities of around 12 % or more on average; women (aged 55 and more) could see pension income rise by around 8 % or more on average. Moreover, additional costs could arise from insurers applying a gender mix risk premium due to the risk of adverse selection. There could also be additional marketing costs due to a ban on the use of gender.

Conclusion

According to Van Dijk, Reinder (2012) on average, insurance actuaries expect the difference in male and female life expectancy in Europe to persist in the future. Thus, there will continue to be a difference in life expectancy for new customers of life products and hence with gender based pricing, premiums will better reflect the personal risk of each insured individual than in the case of a single unisex premium. In our next investigation we want to determine so called common unisex life tables by aggregation of male and female life tables with respect to different weights for individual sexes. All values and graphs were evaluated and constructed by VBA MS Office Excel 2010 system.

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