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Pemodelan Manfaat dari Kontrak Marriage Reverse Annuity dengan Asumsi Dependensi Menggunakan Copula Archimedean = Modeling the Benefits of a Marriage Reverse Annuity Contract with Dependency Assumptions Using Archimedean Copula

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Abstrak

Terkadang manfaat pensiun yang diberikan dari jaminan sosial tidak dapat mencukupi kehidupan masa pensiun. Salah satu strategi untuk menambah pendapatan masa pensiun bagi pasangan suami istri lanjut usia yaitu dengan membeli produk equity release, yaitu marriage reverse annuity contract. Marriage reverse annuity contract memberikan manfaat anuitas kepada pasangan suami istri lanjut usia ketika masih hidup (status joint life) bahkan terkadang setelah kematian dari salah satu pasangan (status last survivor) dengan mengonversi seluruh atau sebagian dari nilai real estate yang mereka miliki. Agar lebih realitistis, risiko kematian antarpasangan suami istri diasumsikan dependen karena pasangan suami istri terpapar risiko yang sama. Oleh karena itu, dimodelkan dependensi dari future lifetime pasangan suami istri dengan menggunakan copula. Berdasarkan teorema Sklar, copula adalah fungsi yang menghubungkan distribusi bivariat dengan fungsi kumulatif marginalnya. Salah satu copula yang populer digunakan yaitu copula Archimedean, di mana keluarga copula ini memiliki struktur dan perhitungan yang sederhana, serta memungkinkan berbagai struktur dependensi yang lebih luas. Jenis copula Archimedean yang akan digunakan pada skripsi ini yaitu Clayton, Gumbel, dan Frank. Data yang digunakan yaitu Tabel Mortalitas Indonesia IV, di mana distribusi marginalnya tidak diketahui sehingga estimasi parameter dilakukan dengan metode canonical maximum likelihood. Model marriage reverse annuity untuk status joint life dan last survivor diilustrasikan melalui model multiple state dan struktur probabilitas dikonstruksi menggunakan teorema Sklar dan fungsi survival copula. Berdasarkan hasil perhitungan manfaat kontrak menggunakan copula Clayton, Gumbel, dan Frank diperoleh bahwa nilai manfaat pada status joint life lebih besar daripada last survivor. Pada status joint life, nilai manfaat tahunan kontrak marriage reverse annuity berjangka terkecil diperoleh menggunakan asumsi dependensi dengan copula Frank, sedangkan pada status last survivor, nilai manfaat tahunan kontrak marriage reverse annuity berjangka terkecil diperoleh menggunakan asumsi independensi (tanpa menggunakan copula).

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Sometimes the retirement benefits from social security are insufficient for retirement life. One strategy to increase retirement income for elderly married couples is to purchase an equity release product, namely a reverse annuity marriage contract. A marriage reverse annuity contract provides annuity benefits to elderly married couples while they are still alive (joint life status) even after the death of one of the partners (last survivor status) by converting all or part of the real estate value they own. To be more realistic, the risk of death between husband and wife is assumed to be dependent because the husband and wife are exposed to the same risk. Therefore, the dependency model of the future lifetime of a husband and wife is modeled using copula. According to Sklar's theorem, the copula is a function that joins bivariate distribution to its marginal cumulative function. One of the most popular copulas used is the Archimedean copula, which has a simple structure and computation, and allows for a wider variety of dependency structures. The types of

Archimedean copula that will be used in this study are Clayton, Gumbel, and Frank. The Indonesian Mortality Table IV data is used, where the marginal distribution is unknown, so parameter estimation is executed using the canonical maximum likelihood method. The marriage reverse annuity model for joint life and last survivor status is illustrated through multiple state models and the probability structure is constructed using Sklar's theorem and the copula survival function. Based on the results of calculating the benefits of the contract using the copulas (Clayton, Gumbel, and Frank), it is obtained that the value of benefits in joint life status is greater than that of the last survivor. In joint life status the smallest annual benefit value of a term marriage reverse annuity contract is obtained using the dependence assumption with Frank's copula, whereas in last survivor status the smallest annual benefit value of a term marriage reverse annuity contract is obtained using the independence assumption (without using copula).