Social Welfare Policy: Building Farmland Reverse Mortgage for the Welfare of the Rural Elderly

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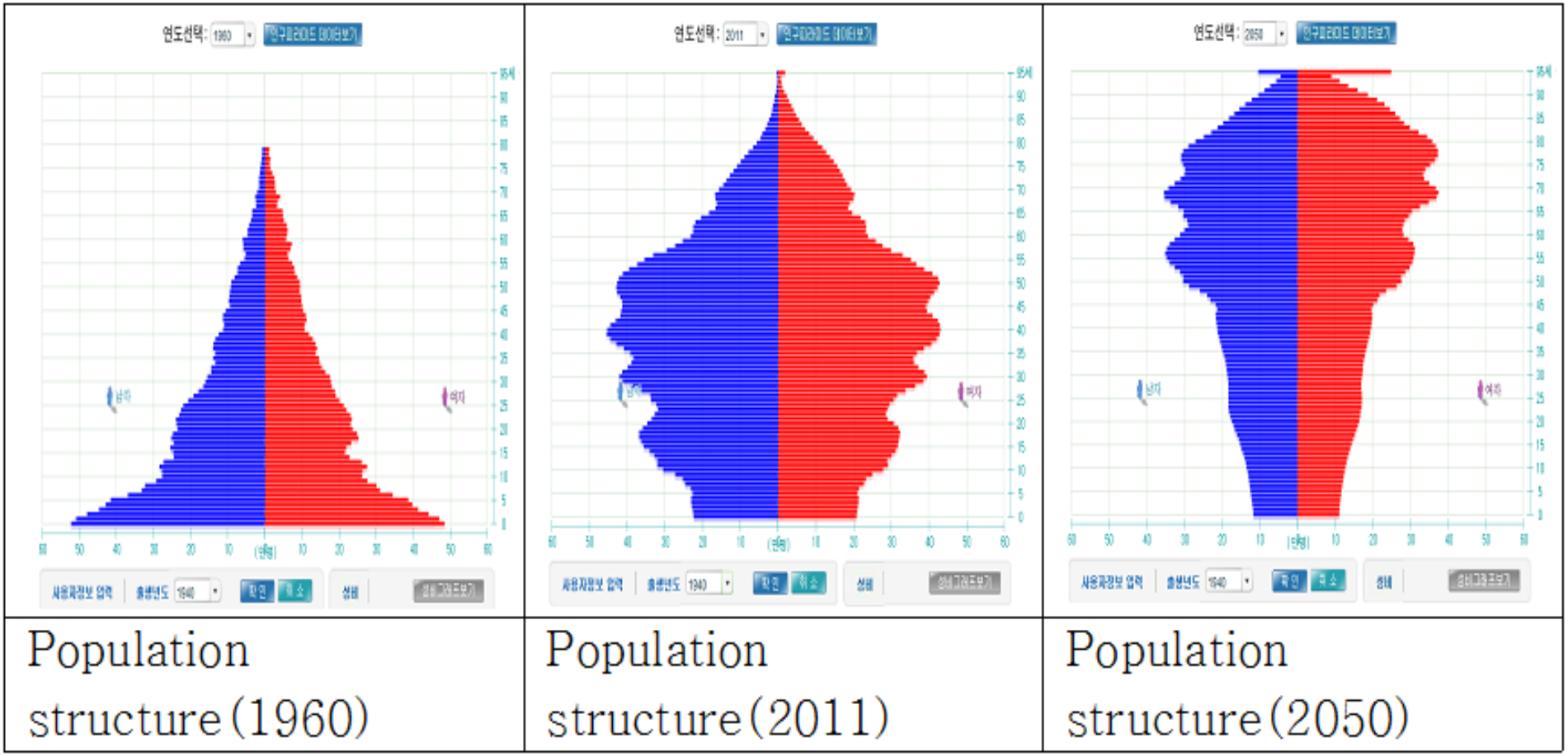
Research Background

- Elderly population(over 65 years old) has grown rapidly in South Korea. Population structure in Korea is classified as 'aging society'(32.1% out of total population in rural area is aging population in 2007).
- The welfare of the elderly in rural area is a critical issue in Korea because most of the elderly in rural area are not protected by the social security system such as national pension service(NPS).
- Even they are not qualified for the Basic Elderly Pension for the poor elderly because the value of farmland they own usually exceeds the threshold of the pension payment.
- Thus the prompt and considerable expansion of welfare for the rural elderly is required to meet the welfare demand of the elderly

Figure 1. The Change of Population Structure



Population structure (1960)	Population structure (2011)	Population structure (2050)

Note: Korea National Statistics Office (http://sgis.nso.go.kr/pyramid/view_country.asp)
2011

Research Question

- In order to resolve and relieve these welfare problems of elderly, this study elaborates the farmland reverse mortgage(FRM) for the first time in the world, based upon the Housing Pension in Korea. It comes from the HECM in U.S.A.

The FRM provides the elderly with the monthly annuity to enhance the quality of the life by liquidating their own farmland assets.

- It is a pilot study which develops the FRM through building an actuarial model for estimating the monthly payment and the risk which the payment provider could bear

- It estimates three key factors such as a farmland value, price rising rates, and interest rates in order to apply those factors to basic actuarial model.

- It also estimates the risk associated with the fluctuations of the interest rates and the farmland value rising rates.

Actuarial Model of FRM

This actuarial model is designed to estimate pmt(constant monthly payment) for the borrowers. The eligible applicants are farmland owners who are age 65 and over. Trial and error method is applied to estimate pmt. The amount of monthly payment for the farmland reverse mortgage is calculated under the condition that the presented value of total projected mortgage insurance premium(PVMIP) is equal to the present value of expected losses(PVEL).

$$PVMIP = UP_0 + \sum_{t=1}^{T(a)} \left[\frac{mip_t \cdot p_{a,t}}{(1+i)^t} \right]$$

$$= \sum_{t=1}^{T(a)} \left\{ \frac{\max[(OLB_t - H_t)q_{a+t}, 0] \cdot p_{a,t}}{(1+i)^t} \right\} = PVEL$$

PVMIP = present value of total projected mortgage insurance premium.

PVEL = present value of expected losses

Net Liability=PVMIP-PVEL

UP_0=up-front mortgage insurance premium at t=0

T(a)=the number of months left until 100 years old which is the limited age for the borrower

Actuarial Model

Mip $_t$=projected monthly secured premium at t

Mip $_t$ =(OLB $_{t-1}$ + pmt) * m

pmt= the annuity payment(constant monthly payment), m= rate of monthly secured insurance premium

***OLB $_t$* = expected outstanding balance of borrower at t**

OLB $_t$ = [(OLB $_{t-1}$ + pmt + mip $_t$)] (1+i)

P $_{a,t}$* = the probability of loan survival of the borrower at age *a* to his or her age *a+t

q $_{a+t}$* = the probability of monthly loan termination at age *a+t

***i* = expected interest rates (discount rates)**

***L $_t$* = expected farmland value at t**

L $_t$ = L $_0$ * (1+g)^t

***g* = average rising rate of farmland price**

Actuarial Model

1) Estimating Interest rates

PMT(constant monthly payment) is closely related to interest rates. Lower and stable interest rates can provide the elderly with more monthly payments due to the lower discount rate and less risk. To find out stable as well as lower interest rates, it examines the monthly interest rates such as Certificate of Deposit, National Bond, and Company Bond from 2000 to 2009, and figures out the average interest rates per year and their stability using Crystall Ball Predictor

Table 1. Average Expected Rates of Interest and its Stability

	Certificate of Deposit (90 days)	National Bond (3 years)	Company Bond (3 years)
Annual Average Interest Rates	4.78%	5.25%	6.18%
Standard Deviation	1.13	1.30	1.49
Theil's U	0.9847	1.01	1.01

Actuarial Model

2) Estimating the rising rates of farmland values

To estimate average farmland value rising rates per year, This paper uses quarterly fluctuation rates of officially assessed land price for farmland which is composed of dried field and rice field from 1989 to 2009.

Table 2) Estimation of the rising rates of farmland values

	Dried Field	Rice Field
Farmland Value Rising Rates (mean/ standard deviation)	0.7186/1.8339	0.6183/1.6069
Present Value	100,000,000 won	100,000,000 won
*Future Value	272,480,163 won	236,999,901
*Future value is the value that the borrower at age 65 reaches 100 years old.		

Actuarial Model

3) Loan Survival Probability

In estimating loan survival probability, It considers 20% as other loan termination reasons except for in the case of death. We use information on the number of survivors per 100,000 people in each age group in the mortality table to estimate the loan survival probability. It can be calculated through the following equation (2).

$$L_{x,t}=(S_{x,t}/S_{x,0})^{1+m} \quad \text{……..(2)}$$

$L_{x,t=}$loan survival probability at t
$S_{x,t}$=the number of survivors since age x until t
$_x$=eligible age for FRM=65
$_t$=years after the borrower join with FRM
$_m$=loan termination probability except for in the case of death=0.2

Actuarial Model

4) Loan Termination Probability

Annual loan termination probability is calculated by the following equation (3) which uses the estimated annual loan survival probability through the equation (2)

$$D_t = L_{x,t} - L_{x,t+1} \quad \text{.....(3)}$$

D_t = loan termination probability at t

As we see the equation (3), loan termination probability at 65 years is the value that the loan survival probability at 66 years old is subtracted from that at 65 years old.

Table 3. Basic Variables of FRM Estimation

Factors	Definition
Up-front mortgage insurance premium	2% of farmland value
Monthly mortgage insurance premium	$(OLB_{t-1} + pmt)*0.5/12$
Monthly Interest Rate	6.78%(certificate of deposit interest rate 4.78% + spread 200basis points)/12
Monthly Farmland value rising rate	2.87%/12
Probability of loan termination	Mortality rate extracted from National Statistics Office
Loan survival probability	(1-mortality rate)

Expected Monthly Payment

It estimates pmt, PVMIP, PVEL and net liability(NL) depending on the borrower's age 65, 75, and 85 when the borrower joins the FRM with 100,000,000 Won (about 86,956 U.S $) value farmland.

Table 4 shows PMT, PVMIP, PVEL and NL according to the borrower's age 65, 75, and 85.

Table 4. The Result Estimated of pmt, PVMIP, PVEL, NL(unit: Won)

Age	Up	m	pmt	PVMIP	PVEL	NL
65	2%	0.5%/year	144,759	5,447,271	5,447,258	-13
75	2%	0.5%/year	245,062	5,359,925	5,359,717	-208
85	2%	0.5%/year	467,289	4,758,731	4,758,672	-59

Risk Analysis

Table 5. Summary of Risk Analysis

	Age 65	Age 75	Age 85
Average PVEL	5,776,672	4,277,390	3,209,222
Average PVMIP	4,458,345	3,826,599	3,093,796
Average NL	1,328,327	450,791	115,426
80% VaR	5,166,286	2,398,316	915,330
90% VaR	8,701,905	3,991,469	1,478,638
95% VaR	12,060,197	5,483,259	1,985,908

Conclusion

- This study is a pilot study building an actuarial model for the farmland reverse mortgage which is initiated for the first time in the world
- It estimates a constant monthly payment under the condition that PVEL is equal to PVMIP, and predict the risk that the lender could bears depending on the fluctuation of interest rate
- By developing the basic annuity model, it can extend the model in various ways. It also can extend the model depending on who manage the FRM by changing up-front insurance premium and spread. We also can modify the model by changing payment-option such as lump-sum payment, and combination of lump-sum and pmt payment
- This study can contribute to solving the rural elderly welfare by providing a basic annuity plan model which could be extended to various optional models and its results can be applied to other countries for solving the problems of rural elderly welfare.