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VIABILITY OF HOME EQUITY CONVERSION MORTGAGE IN KENYA

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

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List of abbreviations

HECM	Home Equity Conversion Mortgage
NNEG	No Negative Equity Guarantee
CPI	Consumer Price Index
CBK	Central Bank of Kenya
HUD	Housing and Urban Development

1. INTRODUCTION

1.0 Background of the study

Housing wealth as a source of retiree income is normally neglected. This form of wealth could have an incremental value on the homeowner's retirement income if they could be able to leverage this ownership as collateral for capital. Releasing home equity may result in a marked increase in consumption, a drop in public pension liability and access to long-term care facilities. This may also ease the tax burden imposed by the increasing population ageing on the traditional state-funded retirement provisions.

1.1 An overview of Home Equity Conversion Mortgage

The conversion of home equity into cash while the homeowner is still alive is referred to as home equity conversion (Phillips & Gwin, 1993). Home Equity Conversion Mortgage is one of the Equity Release Products (ERPs) that enables the elderly, retired people to use their houses which have no financial liability as a source of income while they continue to reside in them, thereby seeking to address constraints of the life cycle hypothesis (Luiz & Stobie, 2010). It is a relatively new concept in the field of home wealth and is one of the emerging issues, mostly common in the United States of America and Canada. Unlike mortgages, home equity conversion mortgage is a type of a reverse mortgage which allows one to borrow money using the equity in their home as security. This mortgage enables those who own their homes to receive income regularly as a means of drawing down home equity slowly (Kutty, 1996) and as reported by the American Association of Retired Persons (AARP, 2001), the conversion of the home equity into cash can be done without the homeowner moving out or repaying the loan each month. Repayment of the principal and interest is only required once the borrower dies or moves out of the home. The initial mortgage amount, the interest rate accruals, the duration of the loan and rate of home price appreciation are taken into account so as to prevent the loan amount from exceeding the value of the home over the life of the loan. It is a requirement that there be no other liens against the home. Offsetting of any existing liens on the home is a prerequisite before entering into the reverse mortgage contract.

Reverse mortgage payments can be made out in several options. The option of a lump sum at once, a tenure plan in the form of monthly annuity payments for as long as the borrower resides in the house, monthly annuity for a fixed term, a credit line of the

borrower's choice, or the option of combining these options (Ma & Deng, 2006). The determinants of the amount that can be borrowed through reverse mortgage are the borrower's age and the value of the home. According to Redfoot et al (Redfoot, Scholen, & Brown, 2007), the funds that can be offered as loan advances increase with an increase in the age of the borrower.

1.2 Impediments to the success of reverse mortgage

Due to their non-recourse nature, a low home equity could entail a loss for the lender. Such a loss may arise when the value of the property is less than the value of the loan during sale. This result in lenders basing the maximum percentage of equity that can be borrowed on the life expectancy of the individual, the probable property price movements and the expected interest rates (Mitchell, Olivia, & Piggott, 2004).

There is also the risk of default whereby the borrower remains in the house after the loan balance which has amortized negatively exceeds the value of the house. This is a crossover risk and can be reduced by the use of an explicit reverse mortgage pricing model which allows for evaluation of this crossover option. Alternative means involve setting up insurance mechanisms and securitization which are viewed as secondary markets channels. The lenders also have to set a limit to the amount of loan that can be offered.

Potential clients may be unwilling to take up this mortgage as they will no longer be eligible for additional sources of income from the state. Golant claimed that depending on one's state of residence, these reverse mortgage loan advances may affect one's ability to qualify for some of the supplementary sources of income and benefits from welfares (Golant, 1992).

Another major hindrance to the growth of the reverse mortgage market is the fact that reverse mortgage entails a borrower borrowing his or her own money in the form of housing equity, and paying out a substantial amount of interest and loan charges in return which renders reverse mortgages considerably expensive way of generating cash income especially during periods which interest rates are high.

There is also the need to leave a form of inheritance to one's dependants. Caplin suggested that a strong motive for bequest may cause homeowners to avoid the reverse mortgage market (Caplin, 2000). According to Mayer and Simons, many elderly people who have children would still want to pass on their assets to them even when their liquid wealth is meager and reverse mortgage could help improve their situation especially in an emergency (Mayer, Simons, & Christopher, 1994). This might also be a great hindrance to development of the reverse mortgage as most elderly homeowners

are greatly attached to their homes and view them as a bequest to be passed down to their heirs.

Potential appreciation of the value one's house determines their eligibility for reverse mortgage. A lender would not want to have a loss due to lower appreciation rates of the house as compared to outstanding loan balance rate. In his work, Golant found that reverse mortgages were particularly beneficial to persons living alone, especially the very old with lower incomes, may. However, most of the people in this very group live in low-valued homes which have a low appreciation potential as a result of declining neighborhoods, and are therefore not considered as potentially attractive for a reverse mortgage (Golant, 1992).

Proper maintenance of the houses in question is an integral part of the success of any reverse mortgage arrangement. For instant, the Housing and Urban Development Department's reverse mortgage contract has a provision which requires the borrower to maintain their house (Office of Policy Development and Research, 1993). However there is the risk of difficulties in enforcing such contract provision which declares that failure to maintain the house constitutes a default on the loan. Case in point is the speculations around whether the HUD is able to enforce such a clause and whether the courts would allow them to enforce the contracts if they are bold enough to.

Rosenbaum et al (Rosenbaum, Goren, & Jacobs, 1995) argued that the requirement by reverse mortgage lenders that the liability for home maintenance fall on the borrower is unrealistic. This is because such a clause might be difficult to enforce given the target market of reverse mortgage which in HUD's case is persons over the age of sixty two. Case in point is their argument that proving to a court the reason as to why a ninety year old widow must install a new twenty-year roof can prove to be an uphill task. They claim that homeowners may not be able to take up property management and maintenance responsibility.

Despite its potential risks, a reverse mortgage's repayment schedule and its non-recourse nature gives it a competitive edge over the other means of tapping into home equity. The various payment options offered also allow gives the borrowers flexibility with respect to the type of income stream they would require as this is determined by the purpose for which the cash will be used and varies from one person to another. The fact that interest and principal payments do not have to be made during the term of the loan makes it more attractive to most homeowners. The loan is repayment is on the sale of the house by either the borrower or the lender when the homeowner moves permanently or dies. Bayer and Harper reported that 95 percent of Americans age 75 and above had the desire to remain in their current home for as long as possible (Bayer & Harper, 2000). This repayment feature enables those who are unwilling to move out of their homes to tap into their home equity.

A condition for a successful reverse mortgage market is that the people must own their own homes as people who rent lack the equity to convert to current consumption.

The high percentage of wealth which elderly people have tied up in property is one of the factors facilitating the development of the Equity Release Products (Gadner, 2003)

1.3 Motivation for the study

In most cases in developing countries, the gap between income before retirement and post-retirement income is normally huge and the pension received is never enough to cater for the various expenses incurred. Such cases are rampant among the middle-income and low-income earners whose savings and pensions is still not enough to cover their expenditure.

Better lifestyle and improved health among Kenyans has resulted in a longer life expectancy and the ability to maintain an active lifestyle into retirement. The life expectancy in Kenya rose from 57.8 to 59.6 in 1985 where it hit a snag and had dropped to 50.8 in 2000 after which it has been consistently rising to 61.6 as at 2014 (UNDP , 2015)

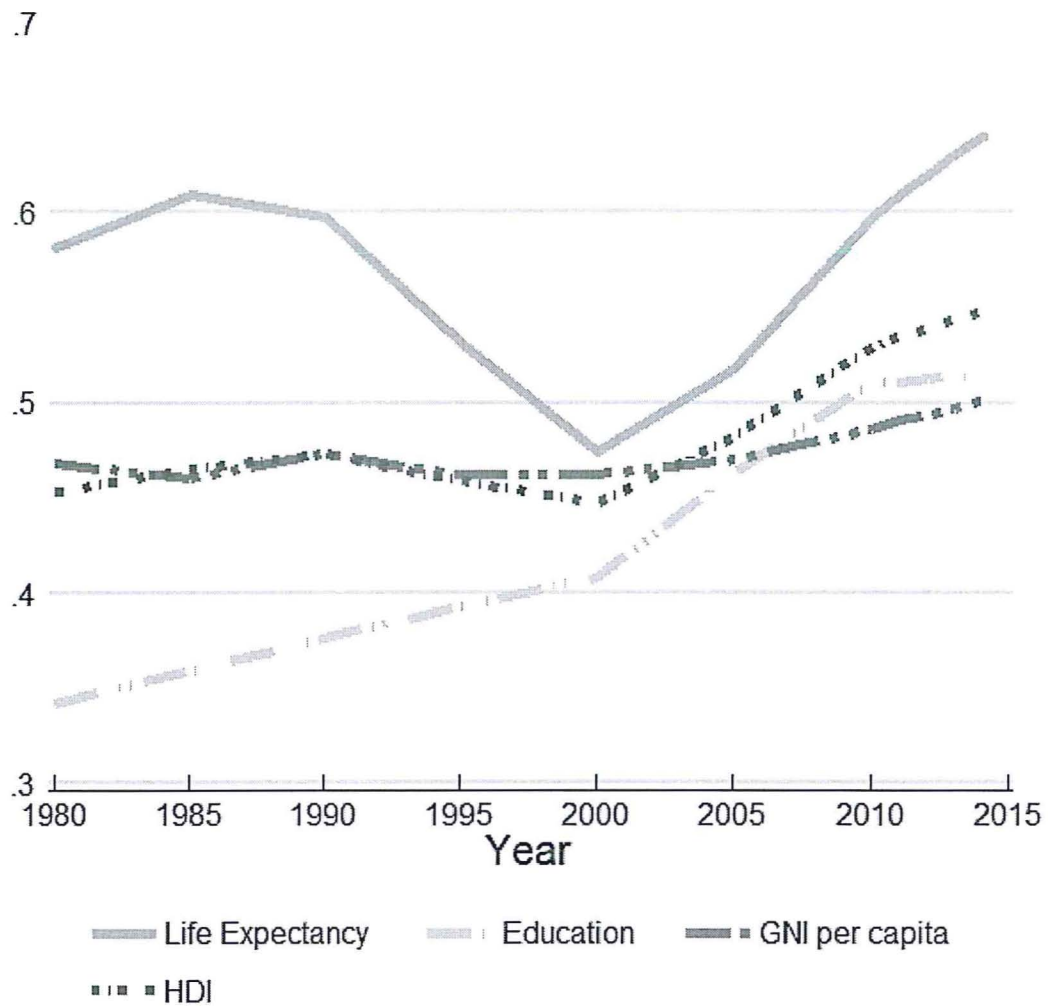


Figure 1: Trends in Kenya's Human Development Index component indices 1980-2014

The ratio of retirees to the working-age population in Kenya has also been increasing over time due to the increase in life expectancy, the fact that some people opt to retire earlier than the age of 60 and a drop in the fertility rates as most women opt have children past the age of 30 due to prior commitments such as education and career advancement. This significant increase in population ageing has put strain on the public purse due to the increasingly heavy dependency on government-funded benefits. Early retirement and population ageing tend to result in a narrower tax base and drainage of public resources. According to the Pensions Act (The National Treasury), the pension in Kenya is earnings-related and is calculated by taking one-four hundred eightieth of the

final pensionable salary for each completed month of pensionable service, subject to a maximum of the highest pensionable salary drawn by the officer in the course of his service.

This pension income is considerably low as evidenced by the current retirement benefits replacement rate. Despite the Retirement Benefit Authority's aim of increasing the figure to 35% from 20% as at 2009, Kenya's estimated overall retirement benefits replacement rate still falls far below then International Labor Organization recommended rate of 40% per couple. This is quite low as compared to those of developed countries which average 60% - 70% such as in Denmark, Sweden, Australia and Germany (Chirchir, 2010). This results in a pension income that is unable to meet the needs of the retirees.

This combination of demographic aging, early retirement, low pension income and earnings-based pension system result in an increase in pension costs and may necessitate an overall restructuring of the national pension system with time to meet the increasing costs. However many countries are constrained in terms of their budget. This brings to light the need for an alternative means of financing old-age consumption which supplements the existing pension plans while still tailored to the needs of the elderly. Such an alternative is the home equity conversion mortgage.

This study focuses on the feasibility of such a mortgage in Kenya. The main proposition of this study is that Home Equity Conversion Mortgage can be a viable source of post retirement income which will increase consumer spending after retirement thus stimulating the economy.

1.4 Problem statement

The current pension in Kenya is quite low and does not adequately provide for retirement income especially in cases where unexpected but significantly high bills such as medical costs arise. This situation is set to become worse due to an increase in demographic aging. The projected increase in population post retirement will result in a further strain on the already low pension budget. The table below shows the anticipated changes in the older age groups projected in the report based on the current demographic aging trend (U.S. Department of Commerce).

Absolute and Percent Change in Older Age Groups: 1989 to 2020
(Absolute numbers in thousands)

Year	55 and over	65 and over	75 and over
1989	1,243	509	132
% change	(88)	(95)	(109)
2005	5,335	995	276
% change	(90)	(90)	(103)
2020	4,440	1,895	559

These result in the need for alternative source of financing that supplements the pension income. A possible way to minimize this disconnect is by offering reverse mortgage to this group. This product could provide feasible alternative or additional income in retirement without getting home owner into debt especially in Kenya where people have a rural and urban home. The problem then is to test whether a Home Equity Conversion Mortgage is feasible in the Kenyan market.

1.5 Research objective

The objectives of this study is to determine the feasibility of Home Equity Conversion Mortgage in Kenya

1.6 Research question

Is Home Equity Conversion Mortgage feasible in the Kenyan market?

1.7 Research Hypothesis

The research hypothesis is:

H_{01} : HECM is not feasible in the Kenyan market

H_{A1} : HECM is feasible in the Kenyan market

2.0 Literature review

This section provides an overview of the previous studies on the feasibility, terminations and the risks faced in the implementation of the Home Equity Conversion Mortgage.

2.1 Feasibility of HECM

Housing equity had remained an untapped source of wealth for quite some time until recent years when reverse mortgage programs gained some popularity. The survey by Bayer and Harper showed that many people prefer staying in their homes for as long as possible (Bayer & Harper, 2000). According to Bishop and Shan, the willingness and ability of homeowners to consume their housing wealth is one of the determinants of the degree to which housing equity should be considered as retirement savings. They claim that reverse mortgages can improve the welfare especially in cases where the homeowners have strong psychological attachment to their homes as they generate additional income and liquid wealth for elderly homeowners and at the same time enabling them the continual residence in their homes (Bishop & Shan, 2008).

Findings by the Health Insurance Association of America suggest that home equity conversion plans serve as useful mechanisms for financing long-term care (LTC) expenses as most of the people over the age of sixty five own their own homes and that eighty percent of these homes have no mortgage (The Health Insurance Association of America, 1992). The report states that older women are most likely to incur significant long-term care expenses due to greater longevity and lower incomes than men and that a substantial number of elderly women could meet their long term care expenditures through home equity conversions due to the fact that some of these older women own their own homes, and the others will inherit their husbands' homes.

Venti and Wise looked into the potential effects of reverse annuity mortgages in increasing the current income of the elderly. They found that the elderly who are single and have a low income would be able to get an approximate fifty percent increase in their income. However the chances of this group having housing equity was very low (Venti & Wise, Aging and the income value of housing wealth, 1991). In their subsequent work, they concluded that home equity of the elderly could serve as a supplement to their current income (Venti & Wise, 1993). Burns & Widdows, and Hogarth also concluded that that the inclusion of home equity wealth to generate income and reduce expense in the estimation of savings needed for the retirement would cause a reduction in the rates of saving that is required (Burns & Widdows, 1990), (Hogarth, 1991).

Mayer and Simons (Mayer, Simons, & Christopher, 1994) looked at both income increases and debt reductions effect of HECMs and they found that a large portion of homeowners in the U.S. could increase their effective monthly income by at least twenty percent. The numbers were quite an improvement in the uptake of reverse mortgage in comparison to the previous work by Merrill et al. (Merrill, Finkel, & Kutty, 1994) who found that only a small number of elderly who they had surveyed and who owned their homes could benefit substantially from reverse mortgages using the 1989 American Housing Survey (AHS).

Williams and Kao (Williams & Kao, 1997) also examined the supplementary effect of the amount of funds which had been availed from home equity conversation on elderly people with different characteristics. They analyzed the 1989 Survey of Consumer Finances and found that income flow could be increased by \$427 monthly if the term reverse mortgage plan were used and \$305 if the tenure reverse mortgage procedure were used, noting that home equity through reverse mortgages would be a significant income supplement to elderly householders' current level of income regardless of type utilized.

However, despite its possible supplementary effects on post retirement income, the reverse mortgage market has had a slow growth. One of the main reasons as to the slow pickup rate of reverse mortgages is the bequest motive. Studies by Mayer and Simons (Mayer, Simons, & Christopher, 1994) and Caplin (Caplin, 2000) find that a strong motive for bequest could lead to avoidance of the reverse mortgages. This however does not fully explain the low demand for reverse mortgage due to the fact that some homeowners have no children. Such is the case whereby Mayer and Simons (Mayer, Simons, & Christopher, 1994) also estimate that more than 1.3 million homeowners have no children yet are still unwilling to take up reverse mortgage.

A possible explanation is the need to protect oneself against unprecedented occurrences such as sudden and unexpectedly high medical expenses, a frequent occurrence in old age. This form of insurance against health expenses is brought out in the report by Munnell et al (Munnell, Alicia, Mauricio, & Jean-Pierre, 2007) after conducting a survey on homeowners between the age of 50 and 65. Half of the 2,673 respondents who were not planning on tapping their housing equity in retirement gave this form of self-insurance as the reason.

Despite the possible impediments, HECMs have had favorable outcome. In their evaluation report of the HECM progress to Congress, Rodda et al (Rodda, David, Christopher, & Hin-Kin, 2000) concluded that the demonstration phase of HECM had been successful as evidenced by the growing loan volumes, borrowers having been satisfied with the program, projected increase in premium collections in excess of insurance claims, and a continual drop in the average costs paid by borrowers to originate a HECM loan. This

makes HECM a viable venture with potentially positive impacts on consumption habits and income smoothing past retirement.

2.2 Reverse mortgage model and termination.

DiVenti and Herzog investigated the actuarial aspects of HECM by attempting to estimate the amount of the level payment of tenure HECM (Diventi & Herzog, 1991). They used a statistical model based on Herzog and Rubin (1984) and incorporated a wide range of assumptions and variations associated with the key parameters of the model. They found that HECM programs whereby future appreciation is shared equally between the lender and the borrower or ones in which only one of the parties get a hundred percent of the nominal appreciation are both viable. They also found that the monthly payments are slightly higher in the latter case.

Szymanoski (Szymanoski E. , 1990) examined reverse mortgage loan terminations. He carried out an analysis of the risks involved with reverse mortgage insurance and looked at the pricing model developed for the Home Equity Conversion Mortgage which was being offered by the U.S. Department of Housing and Urban Development. He noted that having had no prior program experience, HECM insurance had been priced based on untested assumptions which were reasonable. The 1989 model had assumed that with regard to mortality and voluntary terminations, the termination rate would be 1.3 times of the female borrowers' mortality rate. Szymanoski, DiVenti, and Chow found that the HUD had underestimated total terminations, consequently overestimating loan survival rates especially for the younger borrowers at the onset of the loans. They noted that HUD's termination experience had not been able to distinguish between mortality and move-out due to the fact that it does not collect complete data on borrowers' deaths (Szymanoski, Chow, & DiVenti, 2007).

Davidoff and Welke's findings of quicker termination of the reverse mortgage borrowers and subsequent exit from their homes as compared to similar homeowners with no HECM contrast expectations of adverse selection in the HECM program, where reverse mortgages is entered into by the borrowers who expect to stay in their homes longer, thereby taking advantage of the insurance feature of the product that results from the balance on the mortgage exceeding the house value. They suggest that reverse mortgage borrowers tend to have a stronger desire to extract home equity through both reverse mortgage and sale on the increase in housing values (Davidoff & Welke, 2005).

2.3 Risks

Like any other financial product, HECMs are exposed to certain types of risks. These include longevity risk, interest rate risk, crossover risk, selection and moral hazard.

Some homeowners may use the fact that the risk of poor performance of their homes is borne by investors as an incentive to neglect the maintenance of their home values especially when it is costly to do so which may result in some serious future losses. Shiller and Weiss present a calibrated model for assessing such moral hazard risk. Their model assumes that individuals are fully aware of their actions and they act in a manner that is in their own self interest (Shiller, Robert, & Weiss, 2000).

Boehm and Ehrhardt developed and applied a valuation model that quantified the risks associated with fixed-rate reverse mortgage loans. They found that the difference between the risk of a reverse mortgage and that of a typical coupon bond or a regular mortgage is extremely large, with reverse mortgage having the higher interest rate risk. (Boehm & Ehrhardt, 1994).

Davidoff and Welke looked into selection and moral hazard in the reverse mortgage market (Davidoff & Welke, 2005). Their findings contrast the belief that reverse mortgage lenders are likely to be influenced by adverse selection on the basis of their mobility and moral hazard on the basis of home maintenance. Their model of reverse mortgage demand concludes that reverse mortgage debt's effect on maintenance is ambiguous, moral hazard is likely to operate on mobility and that selection based on mobility can be advantageous.

HECMs also have a crossover risk which as defined by Chinloy and Megbolugbe is the risk that the value of the equity may be exceeded by the outstanding loan balance (Chinloy & Megbolugbe, 1994). According to Wang et al, the factors which influence crossover risk are interest rates, house prices and mortality rates (Huang, Wang, & Miao, 2011). They designed a crossover bond which enables the partial transfer of crossover risks by reverse mortgage to those who hold the bonds.

3. METHODOLOGY

3.0 Data sources

This study makes use of inflation, interest rate and housing value data which are collectible from secondary sources. The primary source of the information on property price movements and inflation will be the HassConsult property index database. The interest rate used to approximate the risk-free rate shall be the 91-day Treasury bill day rates and shall be obtained from the Central Bank of Kenya (CBK) database.

3.1 The model set up

These payment models are based on DiVenti and Herzog's work which investigates the actuarial aspects of HECMs and attempts to estimate the amount of the level-payment of tenure HECM (Diventi & Herzog, 1991) and the Interim Report to Congress on Home Equity Conversion Mortgage Insurance by the U.S. Department of Housing and Urban Development (Szymanoski E. , 1990).

3.2 Assumptions

Both assume an insurance premium structure which consists of;

- 2 percent of the appraised value of the property payable at origination
- Annual insurance fee of 0.5 percent of the actual outstanding loan and is payable Monthly

The future property values appreciation follow a random walk.

The move-out factor is approximately similar to the move-out factor when the U.S HECM program was set in motion (owing to the lack of data on the current move-out factor in Kenya).

DiVenti and Herzog (1990) assume that the insurer/mortgagee has a share of any future appreciation of the house.

3.3 Predicting future property values

Future property values cannot be predicted as they are a geometric Brownian motion process which follows a random walk. The assumption therefore is that these values can be simulated by a stochastic geometric Brownian motion process since stochastic specification allows future property values to vary considerably about their expected values without violating the model's actuarial assumptions. Non-stochastic models can also be used. However they would be poor because property values must be predicted many years into the future. A stochastic model therefore manages insurance risk more

effectively and captures expected losses more accurately than a non-stochastic model would, and thereby places less reliance on the contingency reserve to cover unexpected losses.

DiVenti and Herzog (1990) state that non-stochastic estimates of the annual rate of the nominal appreciation may not be precise because the rate may vary widely from year to year and from neighborhood to neighborhood and that the expenses involved in annual appraisals on individual houses is quite impractical.

This is justified by the interim report by considering the property that has been mortgaged a zero-coupon real asset which assumes the return on the owner-occupied housing does not include rent and includes the expected price inflation, μ and a stochastic term σ , to describe deviations from expected inflation. The resulting differential equation;

$$\frac{dh}{h} = \mu dt + \sigma dz$$

Where dh , dt and dz are the differential of the house value, time and a stochastic variable which is normally distributed with a mean of 0 and a standard deviation of 1 respectively.

Under the random walk assumption, each property's annual appreciation rate is treated as an independent observation of a normally distributed random variable with constant mean, μ and standard deviation, σ (interim report, 1990)

$$H(t) = H_0 e^{\gamma(t)}$$

Where $H(t)$ is the property value at some future time, t

H_0 is the initial property value

$$\Upsilon(t) = \mu(t) + \psi(t)$$

$\mu(t)$ is the expected inflation, from the property index or drift and $\psi(t)$ is a Weiner process, with;

$$E[\psi(t)] = 0$$

$$\text{var}[\psi(t)] = \sigma^{2t} .$$

Owing to the fact that a standard Brownian motion is $\psi(t)$ normally distributed for all $t > 0$, the distribution of $H(t)$ is log-normal for all $t > 0$

However, unlike the random walk model, the serial correlation model supports the argument that the annual percentage rates of change are not independent. Case and Schiller (1989) looked into the efficiency of the real estate market to see whether price changes are independent or they are serially correlated. They found evidence of correlation in city-wide price indices over short time periods. Their findings were however not conclusive with regard to accepting or rejecting the random walk model for predicting individual house price changes as the volatility of individual house prices was found to be of far greater magnitude than the serial correlation found in the index.

3.4 Expected Mortgage Insurance Premium

This is to protect the lender from the probability of the outstanding loan being greater than the house value. It is the present value of the expected losses.

$$MIP(t) = \max[L_T - (1 - \gamma)H_T, 0]$$

Where $MIP(t)$ is the scheduled Mortgage Insurance Premium in month t ,

H_T is the value of the property at time T

L_T is the outstanding loan balance at termination

γ is the proportional transaction costs, and

L_{x+t} is the probability that a HECM loan originated by a borrower with initial age x is still in force t months after origination.

The expected present value of the mortgage insurance premiums is:

$$\sum_0^t m_s L_{x+t} MIP(t)$$

m_s is the discount rate

Kenya Mortality Tables (KE 2001 – 2003) are used to compute the L_{x+t} . The female table is used because female life expectancy is longer than that of males and most HECM applicants are expected to be single females (Interim report, 1990).

The figures can be adjusted to produce the required monthly probabilities. They are also adjusted for loan terminations for reasons other than death of the borrower by multiplying them by a hypothetical "move-out factor". We use the HECM's move-out factor of 30percent which is sufficiently conservative owing to the fact that it is less than the 47 percent for mortality for those 85 and over which was estimated by Jacobs (1988). These adjusted figures can then be converted into monthly loan survival probabilities using the equation;

$$L_{x+t} = \left(S_{i,j} \left[\frac{S_{i,j+1}}{S_{i,j}} \right]^{\frac{r}{12}} \right)^{1+m}$$

Where

i =initial age in years= $\{62, 63, \dots, 99\}$,

j = attained age in full years= $\{i, i+1, \dots, 100\}$,

x = initial age in months= $12i$,

t =attained age minus initial age in months= $12(j-1)+r$

r =months between attained ages j and $j+1 = \{0, 1, \dots, 11\}i$

and m is the move-out rate expressed as a decimal = 0.3

3.5 Expected losses

This is the present value of expected insurance claim losses. A loss results when the outstanding balance exceeds the house value.

Letting $B(t)$ represent the outstanding balance on the mortgage at time t , if the mortgage is terminated during time t and if the value of the house is greater than $B(t)$, then there is no loss. But if the house value is less than $B(t)$, there is a loss. The magnitude of the loss, which is the difference between the amount $B(t)$ and the conditional expected value of the house given that the value is less than $B(t)$, is denoted $L(t)$.

The expected loss for each month into the future denoted $E[L(t)]$ is estimated to be the probability of termination multiplied by the difference between the house value less the transaction costs and the loan amount given that the loan has survived to that date, evaluated at time t . The probability of loan termination $d(t)$ at a given time is similar to the calculation of the probability of death from an actuarial survival table.

The expected loss at time t is given by;

$$E[L(t)] = \{B(t) - E[H(t)]\} d(t)$$

3.6 The principal limit method

Loan advance payments are calculated using a principal limit factor which is a measure of the percentage of the maximum claim amount that is available to the borrower once the mortgage is in effect and contains within it an assumption about how long the borrower will live and the appreciation rate of the property. It is the present value of the mortgage benefits that can be received by a borrower.

The principal limit at any time t is given by:

$$PL(t) = F(x, R) MCA (1+c)^t$$

Where;

$PL(t)$ is the principal limit at time t

$F(x, R)$ is the principal limit factor for a borrower of age x and fixed interest rate r which is the expected rate

MCA is the maximum claim amount

c is the periodic compounding rate which equals the expected rate r plus the 1/2 percent annual mortgage insurance premium charge converted to a monthly rate

t is the number of months after loan origination $0 \leq t \leq T$, with T being the value of t for which the borrower turns 100 years old.

The net principal limit is the amount that can be borrowed at any other time given that one has already taken out a portion of their housing equity before. It is given by:

$$NPL(t) = \max[0, PL(t) - B(r, t)]$$

Where $NPL(t)$ is the net principal limit at time t

$PL(t)$ is the principal limit given by the previous equation

$B(r, t)$ is the actual loan balance at time t including cash advances, interest accrued and MIP .

For borrowers who opt for a line-of-credit, $NPL(t)$ is the maximum cash advance available at each time t . Once the net principal limit goes to zero, the line-of-credit is exhausted.

For those who wish level monthly cash advances, either for a specified term, or for as long as the borrower retains in occupancy of the property, the monthly advance is given by:

$$P(t, m) = \frac{NPL(t)(1+c)^m}{(1+c)^{m+1} - (1+c)}$$

Where;

$P(t, m)$ is the monthly cash advance beginning in month $t+1$ and continuing for a term of m months

$NPL(t)$ is the net principal limit at time t

c is the monthly compounding rate given by the expected rate r plus the 1/2 percent annual MIP charge converted to a monthly rate

$m = (T - t)$ for tenure, where T is the value of t for which the borrower turns age 100, $0 < m, (T - t)$ for term, with m chosen by the borrower.

3.7 Findings

The housing appreciation rates in Kenya are quite low as compared to the interest rates hence the loans grow at a faster rate than the house value. The figures below show the values for the principal limit factors and Mortgage Insurance Premium for the given ages and terms. The initial house value is four million.

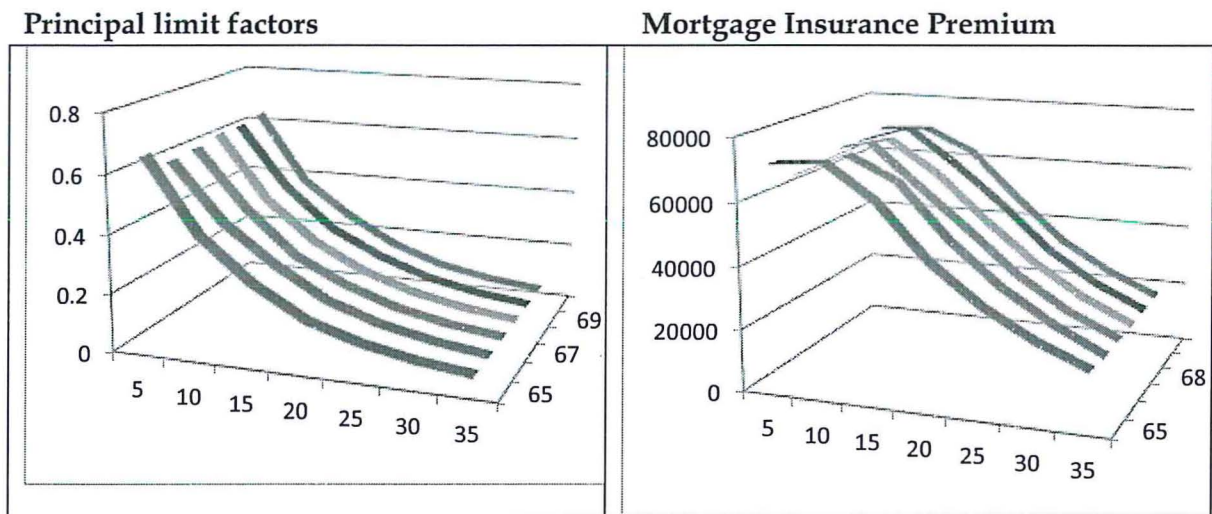
Figure 3: A table showing the principal limit factors

Principal limit factors							
Age	Loan term (years)						
	5	10	15	20	25	30	35
65	0.651	0.4	0.256	0.154	0.099	0.065	0.044
66	0.597	0.397	0.268	0.164	0.104	0.067	0.041
67	0.605	0.404	0.249	0.163	0.102	0.065	0.042
68	0.622	0.393	0.252	0.161	0.103	0.066	0.042
69	0.62	0.399	0.254	0.167	0.104	0.066	0.042
70	0.634	0.385	0.26	0.163	0.101	0.066	0.044
71	0.619	0.402	0.257	0.157	0.102	0.067	0.042
72	0.633	0.415	0.256	0.163	0.105	0.066	0.041
73	0.654	0.39	0.256	0.164	0.101	0.064	0.041
74	0.623	0.395	0.257	0.165	0.1	0.064	
75	0.635	0.397	0.259	0.165	0.102	0.068	
76	0.621	0.396	0.254	0.159	0.104	0.063	
77	0.628	0.394	0.248	0.164	0.102	0.065	
78	0.619	0.41	0.243	0.168	0.106	0.063	
79	0.618	0.402	0.266	0.165	0.103	0.069	
80	0.638	0.388	0.246	0.164	0.103		
81	0.628	0.398	0.253	0.164	0.105		
82	0.64	0.406	0.259	0.161	0.102		
83	0.613	0.401	0.255	0.162	0.11		
84	0.613	0.397	0.26	0.161	0.098		
85	0.648	0.412	0.262	0.162			
86	0.608	0.385	0.253	0.163			
87	0.636	0.394	0.258	0.156			
88	0.634	0.384	0.25	0.163			
89	0.634	0.418	0.261	0.163			
90	0.651	0.417	0.265				

Figure 4: A table showing the MIP

Mortgage Insurance Premium							
Age	Loan term (years)						
	5	10	15	20	25	30	35
65	71363.65	72599.63	61681.44	44697.69	32558.42	23676.58	17102.05
66	64979.88	71998.14	64581.2	47462.78	34269.04	24213	16147.03
67	65843.26	73332.17	60135.27	47149.42	33776.3	23599.56	16305.88
68	67709.32	71377.62	60839.4	46648.62	33921.55	23742.19	16213.51
69	67479.47	72493.72	61137.39	48459.93	34140.51	23865.57	16419.17
70	69045.05	69903.65	62602.4	47323.8	33393.58	23974	16962.14
71	67334.38	72921.84	61942.17	45577.36	33499.28	24116.39	16531.1
72	68868.9	75394.45	61826.69	47261.72	34525.54	23947.58	16092.26
73	71189.85	70719.95	61756.93	47605.62	33217.55	23209.76	16120.28
74	67831.18	71710.93	61883.79	47759.57	33081.18	23138.37	
75	69155.18	72027.61	62391.38	47754.54	33487.89	24753.27	
76	67618.98	71960.01	61321.41	46022.22	34177.02	22916.73	
77	68352.76	71511	59707.16	47647.65	33492.69	23419.5	
78	67410.64	74417.84	58703.28	48663.8	34988.24	22656.39	
79	6723.055	72917.37	64086.65	47750.04	34126.7	24904.65	
80	69487.12	70375.14	59200.01	47630.85	34022.95		
81	68369.7	72322.85	60969.07	47650.32	34708.59		
82	69689.2	73785.83	62475.63	46623.68	33559.38		
83	66747.68	72804.9	61588.07	47034.43	36186.11		
84	66743.2	72070.34	63768.73	46807.07	32447.14		
85	70515.5	74717.8	63134.37	46844.18			
86	66202.54	69956.78	61020.18	47287.71			
87	69170.25	71534.7	62277	45254.47			
88	68950.1	69744.09	60189.71	47240.85			
89	68982.52	75948.58	62893.34	47223			
90	70875.58	75790.39	63900.57				

Figure 5: A comparison of the PLFs and MIPs



In cases, the longer the term the lower the amount that can be lent and the lower the amount of Mortgage Insurance Premium that is charged.

3.8 Conclusion

Given the fact that the rising life expectancy in Kenya will inevitably increase the public pension burden with time, the use of Home Equity Conversion Mortgage as a means of unlocking housing equity so as to supplement the pension income should be considered.

Home Equity Conversion Mortgage can be viable especially if the house value appreciation rates increases further. This option should be considered especially with the recent capping of interest rate which has resulted in the regulation of the interest rates

These mortgages are also viable at high principal limits given the mortality rates and the mortgage insurance premium which protects the lender in the case of crossover risk.

This product should be exempt from capital gains and transaction tax so as to encourage its uptake. Clear legal framework should also be build around this product so as to enable both parties to be safe and secure in their transactions and to minimize fraudulent actions such as intentional default on the part of the lender.

Additional research should be done into such a product as this is a simplistic version and a more comprehensive model built that incorporates other factors such as additional sources of risk and for mortgage insurance pricing so as to come up with an efficient product which will help reduce the tax payers burden with regard to pension liability.

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