Volume Title: The Economic Effects of Aging in the United States and Japan

Volume Author/Editor: Michael D. Hurd and Naohiro Yashiro, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-36100-4

Volume URL: http://www.nber.org/books/hurd96-1

Publication Date: January 1996

Chapter Title: Improvement of After-Retirement Income by Home Equity Conversion Mortgages: Possibility and Problems in Japan

Chapter Author: Yukio Noguchi

Chapter URL: http://www.nber.org/chapters/c8466

Chapter pages in book: (p. 195 - 213)

8 Improvement of After-Retirement Income by Home Equity Conversion Mortgages: Possibility and Problems in Japan

Yukio Noguchi

8.1 Introduction

Population aging is usually regarded as a gloomy phenomenon, exemplified by an increase in taxes to finance increased social security payments. It must be noted, however, that an aged society is typically a society in which a large amount of assets has been accumulated. If these assets are properly utilized, many of the problems associated with the aging of the population can be handled. This is especially true of income support of the elderly. Since a considerable share of assets is held by the elderly, it would be possible to support their after-retirement lives without relying too heavily on public pensions if these assets could be liquidated for consumption purposes.

In many cases, however, the elderly hold their assets in the form of housing, which is difficult to liquidate partially. Thus it is necessary to introduce a system by which residential assets can be liquidated step by step to meet the needs of after-retirement life.

Reverse mortgage programs, or home equity conversion mortgages (HECMs) in general, are schemes designed for this purpose. These are programs by which a person borrows a certain amount of money (usually in the form of an annuity) using his or her residential asset as collateral and repays the loan by selling the house when the contract is terminated.

These schemes are useful because they expand available alternatives for the elderly. Unlike the sale of a house, these schemes have the advantage of allowing the elderly to continue to live in their own homes. Moreover, unlike the case of conventional private pensions, it is possible to reflect future capital gains that can be expected from residential assets.

The potential usefulness of these schemes is greater in Japan than in other

Yukio Noguchi is professor of economics at Hitotsubashi University.

countries because land prices are extremely high. According to the government's *White Paper on Life* (Kokumin Seikatsu Hakusho; Economic Planning Agency 1990), the share of real assets in total household assets is 63.9 percent in Japan (as opposed to 39.2 percent in the United States), and the share of land assets in real assets is 83.4 percent in Japan (36.0 percent in the United States). As a matter of fact, HECMs are already available in Japan in the form of private pension programs offered by trust banks and loan programs offered by local governments. However, these programs are not widely utilized. It is necessary to examine why they are unpopular: Is it because the amount of available loans is not enough to support after-retirement life? Or are there other reasons? This paper examines these issues.

Although there is some Japanese literature on HECMs, there are few studies concerning the problems mentioned above.

This paper is organized as follows. In section 8.2, we review the HECM programs that are presently available in Japan. In spite of their potential usefulness, the programs are not widely utilized mainly because of the objections of heirs. In section 8.3, we review the income and asset holdings of households by age group of household head. We find that the elderly typically live in more spacious houses than younger people. In sections 8.4 and 8.5, we examine the possibilities of HECMs in Japan. We find that the income obtained from HECMs exceeds annual consumption under reasonable assumptions. This is very different from the situation in the United States, and the major reason is the extraordinarily high value of residential assets in Japan in relation to income or consumption. The uncertainty about the future value of housing assets is examined in section 8.5. The conclusion from a simulation analysis is that it is possible to borrow a large fraction of the initial asset value because the expected rate of appreciation is higher than the interest rate. In this regard, too, the situation in Japan is considerably different from that in the United States.

8.2 The Present State of HECMs in Japan

Several HECM programs are already available in Japan. They can be classified into two categories: those provided by trust banks and those provided by local governments.

8.2.1 HECMs Provided by Trust Banks

Several trust banks offer programs by which a person can receive an old-age pension by utilizing his or her residential asset. There are two kinds of schemes: The first type uses the house as collateral, and hence property rights remain with the borrower. The second type is called a "trust scheme," under which the residential asset is entrusted to the bank.

Table 8.1 shows the outlines of the programs that are now available. The common features are as follows: Most programs are directed to relatively old people (aged 60–70) and require that dwellers be single or a couple (i.e., that

Table 8.1 HECMs Offered by Trust Banks

	Mitsui	Mitsubishi	Sumitomo	Yasuda
Borrower	Over age 65 Single or couple	Over age 60 Single or couple	Over age 60	Over age 70 Single
Asset	Land or condominium over 100 million yen	Land over 200 million yen	Land over 100 million yen	Real estate
Borrowing limit	Less than 60% assessed land value or 40% of condominium	Less than 50% of land value		Less than 50% of assessed value
Borrowing period	Less than 15 years (land) or 10 years (condominium)	5–15 years		10 years

Source: Pamphlets from each trust bank.

there be no other occupants in the house). The housing asset must be an owner-occupied house built on owned land (only the scheme offered by the Mitsui Trust Bank takes condominium-type houses). This reflects the fact that the land, rather than the structure, is regarded in Japan as the reliable asset.

In many cases, the amount that can be borrowed is less than 50 percent of the assessed value of the house. Payment usually takes the form of a fixed-term annuity rather than a lump sum or lifetime annuity. The borrowing period is less than 15 years (no bank offers lifetime annuities). The interest rate is the long-term prime rate. The contract terminates when the period is over or the borrower dies. Repayment of the loan is supposed to be accomplished by selling the house.

Most banks ask for the consent of the heirs in order to avoid trouble associated with bequests. This reflects the fact that the objection of heirs is the most common and serious obstacle to such schemes.

Unfortunately, no data are available concerning the actual use of these programs. It is said, though, that they are not widely used. The most serious obstacle is said to be difficulty in obtaining the consent of heirs. The unavailability of lifetime annuities and the absence of insurance programs to cope with default risk may also be obstacles to more extensive use of such programs.

8.2.2 HECMs Provided by Local Governments

Some local governments offer HECMs. The most representative program is the one provided by the city of Musashino (a city in the suburbs of Tokyo). This program is so famous that similar programs provided by other local governments are usually called "Musashino schemes."

In Musashino's program a person can receive a certain (lifetime) annuity by using his or her house as collateral. The money is supposed to be used for various welfare programs provided by the city as well as for general living and medical expenses. The welfare programs include a catering service, a care service, and assistance for general housekeeping. The program started in April 1971.

The borrower must be a resident of Musashino (one year of residence is required) and must be a participant in one or more of the city's welfare programs.

The lending rate is 5 percent per annum. The amount of money that can be borrowed is less than 80 percent of the assessed value in the case of land and less than 50 percent in the case of a condominium. When the contract is terminated, the fund must be repaid by the heirs or by selling the house.

As of March 1991, the number of borrowers was 42 households, or 60 persons. This is about 17.8 percent of those who make welfare contracts with the city. The average annual amount of the annuity is about 2.4 million yen per household.

The number of households that have thus far terminated the contract through death or because of other reasons is 21. As of 1990, the average amount of debt per household was 24 million yen (of which 5 million yen was interest). In 20 of the 21 cases, the debt was repaid by the heirs rather than by selling the house.

Why do children tend to "undo" the reverse mortgage by paying off the debt rather than selling the house? One important reason is the tax advantage. If a house is sold, a capital gains tax is imposed. The inheritance tax burden is also significantly different. If the asset is in the form of real estate, it is assessed at a value significantly lower than the market value, whereas if the house is sold, the financial asset is assessed at face value.

Another question is, Why do children not simply pay their parents during their lifetimes rather than let them use a reverse mortgage? One answer to this question is the uncertainty associated with the total amount of payments. If children commit to paying their parents, the total amount could exceed the value of the house if their parents live very long. On the other hand, the amount that the parents can use is limited to less than the house value if they use a reverse mortgage.

8.3 Asset Holdings of the Elderly

There are several surveys and studies concerning the asset holdings of the elderly (e.g., Tokyo Metropolitan Government 1991). Most of them point out the importance of residential assets. In this section, we confirm this point using data from the 1989 National Survey of Family Income and Expenditures (Zenkoku Shohi Jittai Chosa) conducted by the Statistics Bureau.[1]

Table 8.2 shows income, consumption, and assets by age groups of house-

1. Sample size is about 59,000 households. The first survey was conducted in 1959 and the subsequent surveys have been conducted every five years. The 1989 survey was the seventh.

Table 8.2 Income, Consumption, and Assets by Age Group (1,000 yen and percent)

Age	A Ratio of OOH[a]	B Annual Income	C Consumption	D Financial Assets	E Debt	F Residential Assets	G[b] F/(D+F−E)
Under 30	25.09	5,003	2,944	5,567	6,047	41,670	101.17
30s	56.81	6,124	3,260	6,789	6,163	45,290	98.64
40s	79.35	7,419	4,020	10,094	5,930	50,120	92.33
50s	86.9	8,482	4,343	13,879	4,303	63,040	86.81
60s	90.57	6,335	3,435	18,401	2,295	69,440	81.17
70s and over	88.93	5,514	2,927	20,550	2,632	92,190	83.73
Average	75.43	7,136	3,790	12,500	4,722	58,460	88.26

Age	H Residential Expenditures	H/B	H/C	I Household Members	Three Major Metropolitan Areas[c] OOH	Three Major Metropolitan Areas[c] Residential Asset
Under 30	91.66	1.83	3.11	3.55	25.28	60,940
30s	67.03	1.09	2.06	4.48	54.69	70,740
40s	78.04	1.05	1.94	4.37	76.57	76,490
50s	117.47	1.38	2.7	3.62	82.63	106,080
60s	139.4	2.2	4.06	3.17	85.5	130,190
70s and over	128.81	2.34	4.4	2.98	85.76	166,340
Average	98.33	1.38	2.59	3.89	71.82	96,350

Source: 1989 National Survey of Family Income and Expenditure.

Note: Columns B through I are national average figures for households living in owner-occupied houses.

[a]OOH (owner-occupied houses).

[b]The weight of residential assets is the ratio of residential assets to net assets (= financial assets + residential assets − debt). The number for ages under 30 exceeds 100 percent because net financial assets are negative.

[c]The three major metropolitan areas are Keihin, Chukyo, and Keihanshin.

hold head.[2] Column A shows the ratio of households living in owner-occupied houses (national average figure). The ratio becomes higher for higher age groups of household heads except for the oldest. For the 60 and over age groups, the ratio is about 90 percent.

Columns B through I are for households living in houses that they own (national average figures). The numbers in column F are the values of residential assets, which include structures and land. The value of land was assessed using the government's benchmark land price. The average absolute amount of resi-

2. Income includes salary income, business income, property income, and social security benefits. Consumption expenditures do not include the following: imputed rents of owner-occupied houses, imputed service of wives, and tax payments.

dential assets for all age groups is about 58 million yen (about $580,000). The amount increases as the age of the household head rises. It as high as 92 million yen for household heads aged 70 and over. This is about 17 times their average annual income, or about 32 times their annual consumption.

Note that the increase in residential asset value as age increases is not necessarily a result of the accumulation of life-cycle savings in the form of residential assets. Rather, it can be interpreted as a reflection of the simple fact that in many cases older generations were able to purchase more spacious residences in more convenient locations because land prices were lower in the past. In other words, the trend observed in the table is mainly due to the cohort effect rather than to the life-cycle effect.

The share of residential assets in net assets (financial assets + residential assets − debt) is very high for all age groups. The average ratio is about 88 percent. The ratio declines as the age of the household head increases up to the 60s age group and rises slightly from the 60s to the 70s and over.

The last two columns in table 8.2 are for the three major metropolitan areas: Keihin (the greater Tokyo area), Chukyo (the greater Nagoya area), and Keihanshin (the greater Osaka area). The ratio of households living in owner-occupied houses in these areas is slightly lower than the national average (except for the age group under 30). But the difference is not significant. On the other hand, the value of residential assets of households living in owner-occupied houses is considerably higher than the national average. On the average, the former is 1.6 times the latter. For the 70 and over age group, the ratio is 1.80. The absolute value of residential assets in these areas exceeds 100 million yen for the 50 and over age groups and becomes as high as 166 million yen for the 70 and over age group.

Column H in the table shows residential expenditures.[3] The ratio to income (H/B) is higher for higher age groups. The ratio to consumption (H/C) also rises with age for those who are 40 and over. For the 60 and over age groups, the annual expense is about 140,000 yen (about $1,400), or over 4 percent of total consumption. If property tax payments (not shown in the table) are added, over 8 percent of total consumption is used for residential purposes.

Column I shows the average number of dwellers per house. This number reaches its peak of 4.37 during the 30s age group and decreases for older age groups. The number becomes less than three for the 70 and over age group. This fact, together with the trend in residential expenditures mentioned above, suggests that on average elderly people live in houses that are too spacious for their needs, at least relative to younger people.

Table 8.3 shows the breakdown by income class. In this table, income classes have been reconstructed from the original data in such a way that about 30

3. "Residential expenditures" in the survey include (1) house and land rents and (2) repairs and maintenance (material costs and service charges). In this paper, only expenditure 2 is considered.

Table 8.3 Income, Consumption, and Assets by Age Group and Income Class (10,000 yen)

		Income Class		
	Average	Low	Middle	High
50s				
Ratio of households (%)		30.5	41.6	27.9
A. Annual income	848.2	410.2	788.5	1,414.6
B. Annual consumption	434.3	294.4	419.2	609.6
C. Financial assets	1,387.9	813.2	1,169.6	2,314.1
D. Debt	430.3	226.4	367.4	742.2
E. Net assets	957.6	586.8	802.2	1,571.9
F. Residential assets	6,304.0	3,656.7	5,111.6	10,919.9
(weight of F; %)	(86.8)	(86.2)	(86.4)	(87.4)
F/A	7.43	8.91	6.48	7.72
60s				
Ratio of households (%)		35.6	40.2	24.2
A. Annual income	633.5	280.7	576.4	1,246.2
B. Annual consumption	343.5	238.0	346.7	492.9
C. Financial assets	1,840.1	1,109.5	1,745.7	3,026.1
D. Debt	229.5	61.6	170.0	563.3
E. Net assets	1,610.6	1,047.9	1,575.7	2,462.8
F. Residential assets	6,944.0	3,835.0	6,430.5	12,253.9
(weight of F; %)	(81.2)	(78.5)	(80.3)	(83.3)
F/A	11.04	13.70	11.16	9.83
70 and over				
Ratio of households (%)		33.9	37.1	29.0
A. Annual income	551.4	207.8	422.3	1,118.0
B. Annual consumption	292.7	184.5	282.7	432.0
C. Financial assets	2,055.0	871.0	1,809.8	3,692.9
D. Debt	263.2	25.4	166.9	646.1
E. Net assets	1,791.8	845.6	1,642	3,046.8
F. Residential assets	9,219.0	4,839.9	9,130.3	14,412.1
(weight of F; %)	(83.7)	(85.13)	(84.75)	(82.55)
F/A	16.73	23.37	21.63	12.89

Source: 1989 National Survey of Family Income and Expenditure.
Note: Table gives national average figures for households living in owner-occupied houses.

percent of households belong to the "low" class, about 40 percent to the "middle" class, and about 30 percent to the "high" class.

For the low income class, the value of residential assets of the 70 and over age group is about 1.32 times that of the 50s age group. Interestingly, the corresponding figure for the high income class is also 1.32. This may be interpreted to support the conjecture made earlier that the increase in residential assets as age increases is due mainly to rises in land prices rather than life-cycle savings. On the other hand, while the average income of the high income class does not drop significantly as the households get older (the average income of the 70 and over age group is about 79 percent of that of people in their 50s), that of the low income group shows a significant drop (the average income of the 70 and over age group is only about 51 percent of that of people in their 50s).

Consequently, the relative value of residential assets becomes higher for the low income class of higher age groups. For the low income group aged 70 and over, the ratio of housing value to income is as high as 23.4. The average value of houses that the elderly in this group possess is about the same as that for middle-income people in their 50s. On the other hand, the annual income of the former is only about one-fourth that of the latter. This observation reinforces the conjecture mentioned above that the houses of the elderly are too valuable compared with their needs. Thus, the relative increment of income obtained by liquidating residential assets is larger for older people in the lower income group.

8.4 Improvement of After-Retirement Income by HECMs

The observations in the preceding section suggest that HECMs are potentially highly effective in Japan. In this section, we consider a hypothetical program and evaluate the extent to which after-retirement income can be improved by HECMs.

The method is essentially the same as that used by Venti and Wise (1991). We consider the following setting: A borrower receives money in the form of either a lump-sum payment or a lifetime annuity. The contract terminates when the borrower dies, and the loan is repaid. (It may be more natural to assume that the surviving spouse continues the contract and the contract terminates when the surviving partner dies. This assumption, however, is not adopted in the present calculation.)[4] We assume that the borrower is a male household head.

Let L be the maximum amount that can be borrowed at the time the contract is made. L is equal to the expected housing value at the termination of the contract. In this calculation, the discount rate is the mortgage rate (the lending rate of the financial institution), which we denote by m. We calculate the expected value because the termination of the contract is a random phenomenon.[5]

4. Most actual contracts are terminated when the borrower moves out of the house. This condition is not considered in the present calculation.

5. Let $d(n)$ be the death rate for age n defined by (number of deaths at age n)/(age n population). In the present calculation, we use the male death rate. Let $l(a, n)$ be the probability that a person who was alive at age a is still alive at age n, and let $c(a, n)$ be the probability that a person who was alive at age a dies at age n. Then,

$$l(a, a) = 1,\ l(a, n) = l(a, n-1) \times [1 - d(n)], \quad \text{and } c(a, n) = l(a, n-1) \times d(n) \text{ for } n > a.$$

The probability $c(a, n)$ is used for calculating the expected present value of the residential asset at the termination of the contract, and $l(a, n)$ is used for calculating the expected present value of the annuity.

In this section, we assume no uncertainty in the future value of the residential asset and assume that the value will appreciate at a constant rate g. Needless to say, this is an unrealistic assumption. To compensate for possible overestimations of the amount that can by borrowed, we assume that the amount the financial institution lends is qL, where q is a fraction not greater than 1. In this section, we assume rather arbitrarily that $q = 0.5$.

In the case where the borrower receives the money in the form of an annuity, the expected present value of the annuity should be equal to qL. In this calculation, the discount rate is the rate of return on private pensions, which we denote by r.

The most crucial parameters are the rate of appreciation of housing values and the interest rate. If the former is greater than the latter, the maximum amount that can be borrowed (L) is greater than the current value of the residential asset.

Table 8.4 shows the amount that can be borrowed on a house with initial value 10,000, in terms of both a lump-sum payment ($L/2$) and an annuity, for various combinations of g and m where r is 5 percent. If g is greater than m, L is greater the younger the contract age. For example, if $g = 10$ percent and $m = 7$ percent, $L/2$ is 10,418 for age 55 and 6,709 for age 75. This is because the benefit of real appreciation of the residential asset is greater for a longer expected contract period. The relationship is reversed if g is smaller than m.

The annuity amount tends to be greater for an older contract age because the expected period in which the annuity can be received becomes shorter. For example, if m is equal to g, the annuity amount for age 75 is about twice as large as that for age 55. However, if g is enough higher than m, the relationship is reversed. This happens in the table when m is 5 percent and g is higher than 10 percent.

Table 8.4 **Amount That Can Be Borrowed from an HECM**

Contract Age: 55			Contract Age: 75		
g	*m* = 7%	*m* = 5%	*g*	*m* = 7%	*m* = 5%
		Lump Sum Payment			
12	17,452	30,809	12	8,262	10,421
10	10,418	17,894	10	6,709	8,345
7	5,000	8,186	7	5,000	6,090
5	3,167	5,000	5	4,161	5,000
		Annuity			
12	1,246	2,199	12	1,890	1,374
10	743	1,277	10	885	1,101
7	357	584	7	659	803
5	226	357	5	549	659

Note: g is the rate of appreciation of asset value, and m is the lending rate of the financial institution (%). The rate of return of the annuity (r) is assumed to be 5 percent. The initial value of the house is assumed to be 10,000, and q (the fraction that can be borrowed) is assumed to be 0.5.

The annuity amount is very sensitive to the difference between g and m. For example, the amount becomes less than one-half if g is lowered from 10 percent to 7 percent when m is 7 percent and the contract age is 55. The sensitivity becomes smaller for a higher contract age. This is because the expected period in which the contract is exposed to variations in g is shortened.

Thus, a longer contract period is desirable from the point of view of borrowers (assuming g is greater than m), while it is undesirable from the point of view of lenders (assuming that they are risk averse).

In Japan, the value of residential assets consists mostly of land value, rather than the value of the structure. According to the National Survey of Family Income and Expenditures, about 90 percent of residential asset value is accounted for by the land. The ratio is higher for relatively old houses in urban areas where land prices are high. Thus, in this paper, we assume that the rate of increase in residential value is given by that in land prices.

Table 8.5 shows the trend of residential land prices in urban areas as represented by the government's benchmark price.[6] The average annual growth rate in the greater Tokyo area was 11.6 percent for the period 1971–92. As seen in the table, there was a big fluctuation in land prices during the late 1980s due to speculation, and prices still may be falling. If this period is excluded and the average is taken for the period 1971–86, the average growth rate in the greater Tokyo area was 10.0 percent. The national average for the same period was 9.5 percent. This is greater than the average value of the long-term interest rate (the average contracted rate of loans and discounts of all banks) during the same period, which was 7.4 percent.[7]

Considering the above data, we assume in the following calculation that the annual growth rate of land prices (g) is 10 percent, the lending rate of the financial institution (m) is 7 percent, the rate of return of the annuity (r) is 5 percent, and the fraction q is 0.5.[8]

Under the above assumptions, the annuity amount has been calculated for various age groups of household heads using data from the 1989 National Survey of Family Income and Expenditures. The results are shown in table 8.6. The relative annuity amount is evaluated by the following four indices:

H: ratio to current annual income, which is shown in column A in table 8.3

6. It is usually said that the government's benchmark price underestimates the actual fluctuation of land prices. This is especially true when land prices are rising.

7. The difference between the average rate of increase in land prices and the average interest rate does not necessarily imply the absence of arbitrage since the variance of the former is much greater than that of the latter.

8. The average difference between the lending rate (long-term prime rate) and the deposit rate (time deposit rate) of financial institutions over the past 25 years has been about 2 percentage points.

Table 8.5 **Rate of Increase of Land Prices and Interest Rate (%)**

Year	Greater Tokyo	Greater Osaka	Nagoya Nagoya	Three Major Areas	Regional Cities	National Average	Interest Rate
1971	19.9	22.0	18.5	20.3	–	20.3	7.69
1972	15.1	14.9	14.6	15.0	11.0	14.8	7.04
1973	35.9	30.1	30.1	33.7	28.6	33.3	7.18
1974	35.4	31.8	29.0	33.9	43.5	34.7	9.11
1975	−11.5	−9.3	−8.8	−10.4	−7.5	−8.9	9.09
1976	0.6	0.5	0.7	0.6	0.9	0.8	8.25
1977	1.7	1.6	2.6	1.8	2.1	1.9	7.56
1978	3.5	2.8	4.1	3.4	3.2	3.3	6.30
1979	8.8	6.8	8.2	8.1	5.1	6.5	6.36
1980	18.3	13.5	14.2	16.3	9.0	12.3	8.34
1981	14.1	12.6	12.3	13.4	9.8	11.4	7.86
1982	7.4	9.3	7.9	8.0	8.5	8.3	7.31
1983	4.1	5.3	4.5	4.5	5.6	5.1	7.12
1984	2.2	3.6	2.4	2.6	3.5	3.0	6.74
1985	1.7	3.0	1.6	2.0	2.4	2.2	6.60
1986	3.0	2.6	1.4	2.7	1.7	2.2	6.02
1987	21.5	3.4	1.6	13.7	1.2	7.6	5.20
1988	68.6	18.6	7.3	46.6	1.9	25.0	5.03
1989	0.4	32.7	16.4	11.0	4.4	7.9	5.28
1990	6.6	56.1	20.2	22.0	11.4	17.0	6.86
1991	6.6	6.5	18.8	8.0	13.6	10.7	7.53
1992	−9.1	−22.9	−5.2	−12.5	2.3	−5.6	6.15
Average							
1971–92	11.6	11.2	9.2	11.1	7.4	9.7	7.0
1971–86	10.0	9.4	9.0	9.7	8.0	9.5	7.4
Standard deviation							
1971–92	17.1	16.0	9.9	13.7	10.4	10.8	1.1
1971–86	12.3	10.7	10.1	11.6	11.8	11.3	0.9

Sources: For land prices, National Land Agency, *The Government Benchmark Land Price* (Tokyo, various years); for interest rates, Bank of Japan, *Annual Economic Statistics* (Tokyo, various years).
Notes: Land price is the government benchmark price for residential land. The interest rate is the average contracted rate on loans and discounts (before 1978, on loans) of all banks (Zenkoku Ginko), calendar year.

I: ratio to after-retirement income (ARI), which is defined to be the same as the present income of those aged 70 and over in the same income group

J: ratio to current annual consumption, which is shown in column B of table 8.3

K: Ratio to after-retirement consumption (ARC), which is defined to be the same as the present consumption of those aged 70 and over in the same income group

Table 8.6 Improvement in Income from an HECM

	Income Class			
Improvement Ratios	Average	Low	Middle	High
50s				
G. Annuity (10,000 yen)	468.9	272.0	380.2	812.3
H. Ratio to income (%)	55.3	66.3	48.2	57.4
I. Ratio to ARI (%)	85.0	130.9	90.0	72.7
J. Ratio to consumption (%)	108.0	92.3	90.7	133.3
K. Ratio to ARC (%)	160.2	147.4	134.5	188.0
60s				
G. Annuity (10,000 yen)	550.5	304.0	509.8	971.4
H. Ratio to income (%)	86.9	108.3	88.4	77.9
I. Ratio to ARI (%)	99.9	146.3	120.7	86.9
J. Ratio to consumption (%)	160.3	127.7	147.0	197.1
K. Ratio to ARC (%)	188.1	167.8	180.3	224.9
70s				
G. Annuity (10,000 yen)	816.0	428.3	808.1	1275.6
H. Ratio to income (%)	148.0	206.1	191.4	114.1
I. Ratio to ARI (%)	–	–	–	–
J. Ratio to consumption (%)	278.8	232.1	285.9	295.3
K. Ratio to ARC (%)	–	–	–	–

Notes: The parameters g = 10 percent, m = 7 percent, r = percent, and q = 0.5 are assumed. Improvement ratios are based on the data in table 8.2.

People in the 50s age group are assumed to make the contract at age 55. Similar assumptions are made for the other age groups.

ARI (after-retirement income) and ARC (after-retirement consumption). Definitions are given in the text.

The calculated annuity exceeds annual consumption for almost all groups. The maximum ratio is 295 percent for the high income group aged 70 and over. This implies that HECMs can provide more than enough after-retirement income in Japan.

In most cases, the ratio of residential asset value to income is higher for lower income groups. Thus the improvement ratio is higher for lower income groups within the same age group. In terms of the ratio to annual consumption, the improvement ratios for higher income groups are high.

Within the same income group, the improvement ratio is higher for higher age groups in terms of both the ratio to income and the ratio to consumption. This is a reflection of the fact that elderly people live in large houses relative to their income or consumption because of the difficulty of liquidating residential assets.

The same trend can be observed when the after-retirement income or after-retirement consumption concepts are used.

According to Venti and Wise (1991), the income of typical married couples in the United States would be affected very little by HECMs. Even for a low-income couple and even under the assumption that q = 1, a reverse annuity mortgage would mean only a 4 percent increase in income for the 55–66 age group and about a 10 percent increase for the 65–70 age group. The ratio becomes 35 percent only for the 85 and over age group (the assumptions were m = 10 percent, r = 5 percent, and g = 5 percent). The improvement ratios in Japan are considerably higher because of the relatively high value of residential assets.

The results depend heavily on the assumed values of parameters. Sensitivity analyses can be performed using the data in tables 8.3 and 8.4. Table 8.7 shows the results for people in their 70s with respect to changes in g (the rate of appreciation of asset values). The ratio of annuity to consumption exceeds 100 percent even when g is as low as 5 percent.

There are of course several qualifications to the above results. First of all, we must note that the entire picture of the elderly is not necessarily captured by the National Survey of Family Income and Expenditures because the "elderly" in the survey are only those who are household heads. The elderly who live with their children and are not heads of households do not explicitly appear in the data. Indeed, the number of households whose heads are aged 65 or over is only 1.6 percent of the total number of households in this survey. The ratio is considerably lower than the ratio of people aged 65 or over, which was 12.1 percent in 1990.

For those elderly who are not heads, it would be difficult to put their houses into HECM programs because of the objections of their children. Even for the elderly who are heads, a similar problem may exist because there are, in many

Table 8.7 Improvements in Income from an HECM for People in Their 70s

		Income Class		
g (%)	Average	Low	Middle	High
Annuity (10,000 yen)				
12	1742.4	914.7	1725.6	2723.9
10	815.9	428.3	808.0	1275.5
7	607.5	318.9	601.7	949.8
5	506.1	265.7	501.3	791.2
Ratio to income (%)				
12	316.2	440.2	408.6	243.6
10	148.1	206.1	191.3	114.1
7	110.3	153.5	142.5	85.0
5	91.9	127.9	118.7	70.8
Ratio to consumption (%)				
12	595.3	495.8	610.4	630.5
10	278.7	232.2	285.8	295.2
7	207.6	172.9	212.8	219.9
5	172.9	144.0	177.3	183.2

Notes: The parameters m = 7 percent, r = 5 percent, q = 0.5 are assumed. Calculations are performed as in table 8.6

cases, household members other than the elderly couple. (As we have seen, the average number of household members is about three even when the age of the household head is 70 or over.) In fact, as mentioned, the most serious obstacle to HECMs in Japan is said to be the objections of children who expect to inherit their parents' houses.

It must be noted, however, that HECMs can be used even when there are household members other than the elderly couple because, if the heirs repay the loan in cash, they can continue to live in the house. In fact, as mentioned later, this is the typical way of repaying HECM loans in Japan.

The second point is that the above calculations are for average figures. The distribution of assets is fairly unequal. According to Takayama (1992), inequality in asset holding is greater than in income. This is especially true of real estate: there are households that do not own their houses, and the difference in the value of assets is quite large even among households living in owner-occupied houses.

Third, it must be noted that a fixed annuity amount has been assumed in the above demonstration. It may be argued that we should consider a rise in consumer prices because we are assuming a rise in land prices.

There are also some technical problems associated with the specific method used here. For example, in 1989, the year in which the survey was conducted, land prices were fairly high as a result of speculative bubbles. In fact, as shown in table 8.4, recent land prices have been lower by about 5–20 percent. This may have introduced an overestimation bias into the above result.

However, even when the recent fall in land prices is taken into consideration, the potential effectiveness of HECMs in Japan is still very high.

Note also that the above calculations are for national averages. In the major metropolitan areas, where the value of housing assets is greater than the national average, the improvement ratio is higher than in the above calculations. Moreover, the assumed interest rate of 7 percent may be somewhat high considering the recent trend of interest rates shown in table 8.5. If a lower value is assumed for m, the improvement ratio is higher.

8.5 Uncertainty about Future Housing Values

In the preceding section, we assumed that housing values will appreciate at a constant rate. As mentioned before, this is a highly unrealistic assumption. In fact, as shown in table 8.5, the standard deviation of the rate of land price increases is greater than the mean value. In this section, uncertainty in asset appreciation is examined.[9] The model used here is based on Szymanoski (1990).

9. In addition to the uncertainty discussed in this section, there may be structural changes in the trend of land prices. In particular, it is argued that the demand for houses will decline in the future as the relative number of elderly people increases. This issue is not explored in this paper.

We assume that the asset value in year t is given by

$$H(t) = H(0)\exp[gt + f(t)],$$

where $H(0)$ is the value when the contract is made ($t = 0$), g is a constant, and $f(t)$ is a random variable that is normally distributed with zero mean and variance s^2t.[10]

On the other hand, we assume that a lump-sum amount qL is borrowed at the time of the contract and that the interest rate is a constant. Therefore, the outstanding debt increases with certainty as time passes. As before, we assume that the contract is terminated when the borrower dies.

To cope with the situation in which the value of the house is less than the outstanding debt at the termination of the contract (let us call this situation "default"), an insurance program is introduced. A fraction (denoted by p_1) of L is collected as the insurance premium when the contract is made, and a fraction (denoted by p_2) of the outstanding amount of debt is collected each year. If the value of the residential asset is greater than the outstanding debt at the termination of the contract, the entire amount of the loan is repaid by the borrower or his heirs (by selling the house), as before. If, on the other hand, the amount of debt is greater than the housing value at the termination, the difference is paid by the insurance program.

The fraction q is computed by an iterative method in the following way: First, we set the fraction q at a certain value. Using this, the time trend of the outstanding debt is calculated. On the other hand, the probability of default and the conditional expected value of the residential asset given that default occurs are calculated for each year.[11] Based on the probability that the contract is terminated because of death, the expected receipt of the insurance premium and expected payment of the insurance program are calculated for each year. In this way, the time trend of the insurance fund is calculated, and the expected outstanding fund in the final year (assumed to be the year when the borrower's age becomes 100) is calculated. If this amount becomes negative (positive), the fraction q is changed to a smaller (greater) value and the same calculation is repeated until the final fund becomes zero. In the present calculation, we assume that the interest rate (the discount rate) is 7 percent. We also assume that $p_1 = 2$ percent and $p_2 = 0.1$ percent, which seem to be modest rates.

Table 8.8 illustrates the time path of a model HECM and insurance program for a specific set of parameter values. The borrower makes the contract at age

10. Whether this is an appropriate formulation is debatable. In particular, the data in table 8.5 seem to suggest that the growth rate is serially correlated. However, this issue is not examined in detail in the present paper.

11. (1) The probability of default is given by the area under the normalized normal distribution curve from minus infinity up to U, where $U = [\ln b(t) - mt]/s\sqrt{t}$, $b(t) = B(t)/H(0)$, and $B(t)$ is the loan balance. (2) The expected value of the residential asset in year t is given by $E[H(t)] = H(0)\exp[mt + s^2t/2]$ (3) The expected value of the residential asset conditional on default is given by $E[H(t)]S/A$ where S is the area under the normalized normal distribution curve from minus infinity up to $U - s\sqrt{t}$ and A is the probability of default calculated in step 1.

Table 8.8 **Time Path of Model HECM and Insurance Program**

Age	End Balance (1)	Expected Value of House (2)	Default Probability (3)	Conditional Expected Value (4)	Probability of Survival (5)	Expected Premium (6)	Expected Loss (7)
75	104,200	100,000	0.0000	–	1.0000	2,000	0
76	111,844	111,071	0.5475	103,001	0.9494	105	155
77	120,048	123,368	0.4514	108,246	0.8957	107	202
78	128,855	137,026	0.3942	114,497	0.8387	108	238
79	138,307	152,196	0.3525	121,514	0.7787	108	270
80	148,453	169,046	0.3195	129,222	0.7161	107	298
81	159,343	187,761	0.2920	137,633	0.6517	105	321
82	171,031	208,548	0.2685	146,729	0.5865	102	338
83	183,578	231,637	0.2480	156,554	0.5218	98	348
84	197,044	257,281	0.2299	167,152	0.4587	93	351
85	211,499	285,765	0.2137	178,536	0.3979	88	348
86	227,014	317,402	0.1992	190,812	0.3403	81	340
87	243,667	352,542	0.1859	204,035	0.2864	74	326
88	261,541	391,572	0.1739	218,172	0.2368	66	308
89	280,727	434,924	0.1628	233,378	0.1923	58	284
90	301,320	483,074	0.1527	249,808	0.1532	51	255
91	323,424	536,556	0.1433	267,312	0.1196	43	225
92	347,149	595,958	0.1347	286,068	0.0913	36	194
93	372,615	661,937	0.1267	306,255	0.0680	29	163
94	399,949	735,220	0.1192	327,983	0.0495	23	134
95	429,288	816,617	0.1123	351,347	0.0350	18	106
96	460,779	907,025	0.1058	376,142	0.0240	13	83
97	494,580	1,007,442	0.0999	403,317	0.0160	10	61
98	530,861	1,118,977	0.0943	431,477	0.0103	7	45
99	569,803	1,242,860	0.0890	462,356	0.0064	5	32
100	611,602	1,380,457	0.0841	495,405	0.0000	2	53

Note: The g = 10 percent, s = 10 percent, m = 7 percent, q = 1.042, p_1 = 2 percent, p_2 = 0.1 percent, and contract age = 75 are assumed. Initial asset value is 100,000.

75, and the initial residential asset value is 100,000. We assume that g = 10 percent and s = 10 percent. The value of q is chosen as 1.042 (this is the value that makes the final fund zero).

The initial insurance premium of 2,000 (2 percent of 100,000) is subtracted from the lump-sum payment in the first year (hence the borrower receives 102,200). From the second year, an insurance premium of 0.1 percent of the balance and the interest payment are added to the loan balance.

The expected value of the residential asset, which is shown in column (2), grows at the rate $g + s^2/2$. The probability of default is shown in column (3), and the conditional expected value of the housing asset given that default occurs is shown in column (4). Column (5) shows the probability that the borrower is alive and hence that the contract is continued at the corresponding age. The number is calculated from the male death rate (see n. 5). This probability is less than 50 percent after age 84 and less than 10 percent after age 92.

Expected collection of the insurance premium, shown in column (6), is calculated as 0.1 percent of the end balance times the probability that the contract is continued. The expected loss of the insurance program, shown in column (7), is calculated as (end balance − conditional expected value of the housing asset) × (probability of default) × (probability that the contract will be terminated in the year). The probability of termination is given by the decrement in the probability of survival from the preceding year.

In this particular example, the probability of default is high for several years after the contract is made because q is greater than 1. However, the difference between the loan balance and the conditional expectation is not so large during these years. Hence, the expected loss can be covered by the initial insurance premium. Since the rate of appreciation of the asset is assumed to be greater than the interest rate, the expected housing value grows faster than the loan balance. The former becomes greater than the latter, and the probability of default becomes less than 0.5 after age 77. The probability becomes less than 0.1 after age 97. Thus, although the conditional expected value of the asset becomes considerably lower than the loan balance, the expected loss decreases.

The calculated value of q is shown in table 8.9 for several combinations of g and s. For reasonable values of g and s, the value of q becomes fairly high. For example, if g = 10 percent and s = 10 percent, it is possible to set q = 1.042 when the contract age is 75. In many cases shown in the table, the value of q exceeds the 50 percent assumed in the previous section. This means that in Japan, a considerable amount of residential assets can be liquidated by HECMs because the rate of land price increases is high relative to the interest rate.

If the value of g is greater than the interest rate and q is not very large, the value of q is higher for a younger contract age. For example, in the case where g = 10 percent and s = 10 percent, q is 125.5 percent for age 55 and 104.2 percent for age 75. This is because the period in which real appreciation of residential assets is enjoyed becomes longer for a longer contract period.

However, this trend is reversed when the value of g is lower than the interest rate. For example, in the case where g = 4 percent and s = 10 percent, q is 35.2 percent for age 55 and 58.6 percent for age 75. This is because the default risk increases as the period of the contract becomes longer.

The value of q for the same value of g and the same age is higher for a higher value of s. For example, when g = 10 percent, q is 152.3 percent for s = 5 percent, 125.5 percent for s = 10 percent, and 98.0 percent for s = 15 percent (when the contract age is 55). This is a natural result, since the default risk increases as the uncertainty becomes greater.

In the United States, where the mean value of asset appreciation is relatively low and the interest rate is high, the value of q is low. Szymanoski (1990) shows that the value is somewhere around 0.3–0.4 assuming that g = 4 percent, s = 10 percent, m = 10 percent, p_1 = 2 percent, and p_2 = 0.5 percent.

We mentioned in the previous section that the degree of improvement of

Table 8.9 **Ratio q for Various Values of Mean and Standard Deviation**

		Age of Contract				
s	g	55	60	65	70	75
5.0	12.0	186.4	165.7	149.8	137.0	127.6
	10.0	152.3	140.7	131.4	123.7	118.0
	8.0	112.2	109.6	107.5	105.9	104.8
	6.0	70.6	74.2	78.0	82.1	86.2
	4.0	41.6	47.0	53.1	59.8	67.0
	2.0	25.0	30.0	36.0	43.2	51.4
10.0	12.0	163.4	146.5	133.9	123.8	116.5
	10.0	125.5	118.0	112.1	107.5	104.2
	8.0	87.3	87.1	87.2	88.0	89.3
	6.0	55.9	59.6	63.7	68.3	73.2
	4.0	35.2	39.9	45.4	51.6	58.6
	2.0	22.5	26.5	32.3	38.8	46.4
15.0	12.0	133.6	121.2	113.0	106.1	101.4
	10.0	98.0	93.9	91.0	89.0	88.4
	8.0	67.0	68.1	69.7	72.0	74.7
	6.0	44.3	47.8	51.9	56.6	61.8
	4.0	29.4	33.4	38.3	44.0	50.5
	2.0	19.9	23.6	28.3	34.1	41.0
20.0	12.0	105.2	97.7	92.1	88.2	86.0
	10.0	75.3	73.6	72.8	73.0	74.2
	8.0	52.1	53.9	56.2	59.2	62.8
	6.0	35.8	39.0	42.8	47.3	52.5
	4.0	24.9	28.3	32.5	37.6	43.6
	2.0	17.6	20.8	24.9	30.0	36.2

Notes: The numbers in the table are 100 q, where q is the ratio of the amount that can be borrowed to the initial asset value; g is the mean growth rate, and s is the standard deviation (%).

The interest rate (the discount rate) is assumed to be 7 percent, p_1 = 2 percent, and p_2 = 0.1 percent.

after-retirement income by HECMs is higher in Japan than in the United States. The basic reason for this result is that the value of houses relative to income is higher in Japan. The results obtained in this section reinforce the conclusion because the ratio of the amount that can be borrowed to the initial asset value is also higher in Japan. The basic reason for this result is that both the profitability and the safety of residential assets relative to financial assets are greater in Japan.

8.6 Concluding Remarks

The major findings of this paper can be summarized as follows: First, HECMs are potentially highly important in Japan as a means of providing funds for after-retirement life because the value of residential assets is in general very high compared to income or consumption and is expected to increase at a fairly high rate, at least in urban areas. Second, in spite of this, HECMs are not widely utilized mainly because of the objections of heirs. This also reflects the high value of residential assets in Japan. Therefore, ironically, the factor that makes HECMs a potentially important tool at the same time becomes an obstacle to their implementation.

It can be argued that the present situation is inequitable in the sense that people who could more than afford to support themselves after retirement if they were to utilize HECMs receive the full amount of their public pensions and are able to leave their residential assets to their heirs, for whom the burden of supporting their parents has been reduced by the social security program. This is inequitable because (1) most of the increase in land values is due to external economic effects such as the concentration of population in urban areas, rather than to the owners' efforts, and (2) the public pension program is financed largely on a pay-as-you-go basis, rather than being fully funded.

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