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Japanese Life Insurance Companies' Balance-Sheet Structure and Japanese Government Bond Investment

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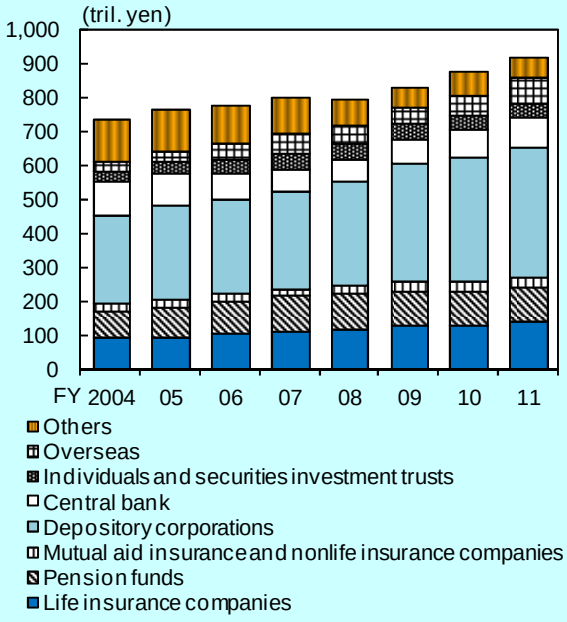
Japanese life insurance companies hold a large amount of Japanese government bonds (JGBs) as long-term investments. Recently, their holdings of super-long-term JGBs have been increasing especially significantly, and the presence of life insurance companies in the super-long-term JGB market has grown. At life insurance companies, future insurance payment accounts for a large part of liabilities, and thus the period until they make insurance payment (the maturity of liabilities) is long. The period of investment for asset management (the maturity of assets) is long accordingly to anticipate insurance payment. The maturity of liabilities has lengthened moderately as a whole and has remained longer than that of assets. The need to resolve such duration mismatch by lengthening the maturity of assets is one factor behind life insurance companies' active investment in super-long-term JGBs. However, future demographic changes may shorten the maturity of liabilities, and therefore demand for super-long-term JGBs from life insurance companies is likely to change accordingly.

Introduction

Japanese life insurance companies generally hold a large amount of bonds as long-term investments and are stable holders of JGBs (Chart 1). Recently, their holdings of super-long-term JGBs have been increasing especially significantly, and the presence of life insurance companies in the super-long-term JGB market has grown. Future insurance payment accounts for a large part of these companies' liabilities, and thus the maturity (duration) of liabilities is long. In view of asset liability management, life insurance companies need to hold long-term assets whose maturities match those of liabilities. Many factors such as developments in JGB yields affect JGB investment by these companies, but an additional factor behind the large amount of JGB investment has been the long maturity of their liabilities.

In the following, we examine the background to Japanese life insurance companies as major holders of super-long-term JGBs from the viewpoint of the companies' balance-sheet structure, especially the maturities of assets and liabilities. We first outline developments in JGB investment by life insurance companies, and then estimate the degree of mismatch between the maturities of assets and liabilities after calculating the maturity of liabilities based on the structure of insurance products provided by the companies. Lastly, we discuss the effects of demographic changes on future developments in the maturity of liabilities.

[Chart 1] JGB holdings by type of investor[1]

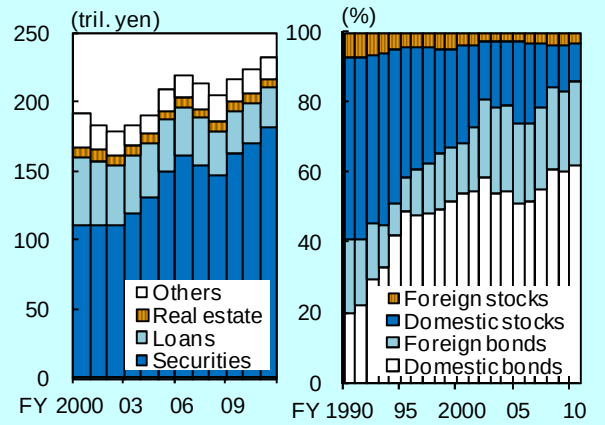


Note: *1*. JGBs, Fiscal Investment and Loan Program agency bonds, and treasury discount bills are counted.
Sources: Ministry of Finance; BOJ; published accounts of each entity.

Japanese Life Insurance Companies' Investment in Super-Long-Term JGBs

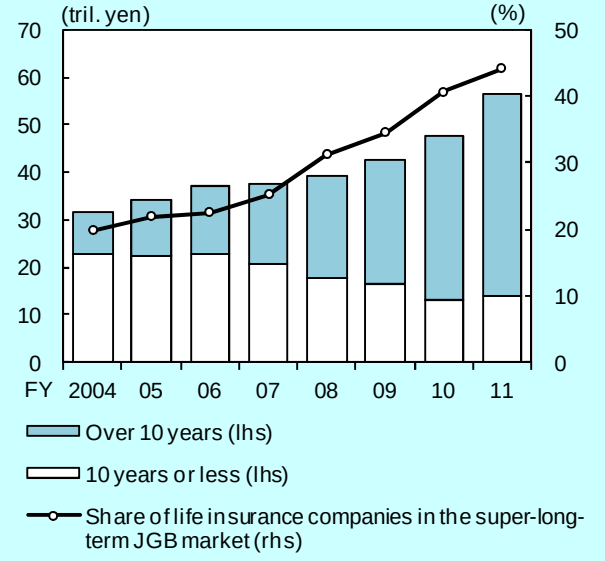
Japanese life insurance companies have continued to increase their JGB investment. They have increased investment in domestic and overseas bonds, while reducing loans and investment in stocks (Chart 2). In particular, they have substantially increased investment in super-long-term JGBs with a maturity of over 10 years (Chart 3). As a result, the share of life insurance companies in the super-long-term JGB market recently exceeded 40 percent, and these companies have become major holders of super-long-term JGBs.

[Chart 2] Amount outstanding of assets[1]



Note: 1. Members of the Life Insurance Association of Japan except for Japan Post Insurance are counted.
Sources: Life Insurance Association of Japan; Japan Post Insurance.

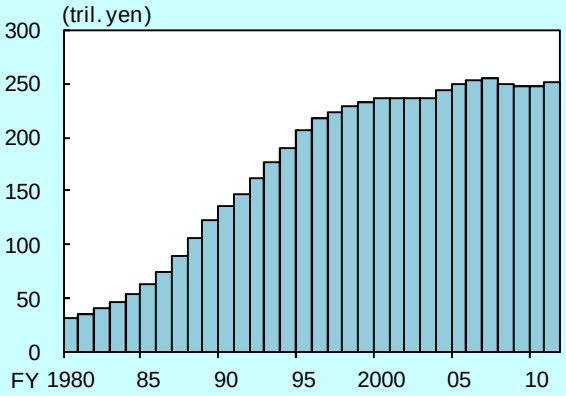
[Chart 3] JGB holdings by remaining maturity and the share of life insurance companies in the super-long-term JGB market[1]



Note: 1. Members of the Life Insurance Association of Japan except for Japan Post Insurance are counted.
Sources: Ministry of Finance; Life Insurance Association of Japan; Japan Post Insurance.

Such active investment in super-long-term JGBs is mainly attributable to the nature of Japanese life insurance companies' liabilities. They accumulate reserves (liability reserves) for future insurance payment. Liability reserves largely account for their liabilities, and reached 250 trillion yen as of fiscal 2011 (Chart 4). Since many insurance products they sell have long maturities until payment, the companies' maturity of liabilities is accordingly long. It is therefore important in terms of these companies' asset liability management for them to hold long-term assets whose maturities match those of liabilities. In the following section, we explain in detail the relation between insurance products of life insurance companies and the maturity of the companies' liabilities, and then estimate the maturity of liabilities.

[Chart 4] Liability reserves

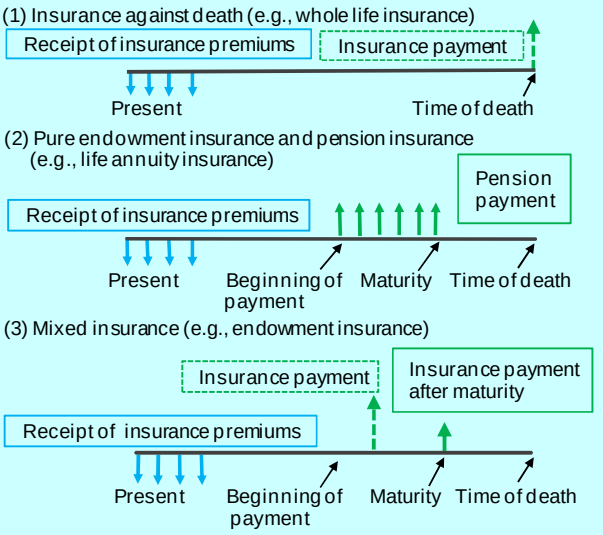


Source: BOJ, "Flow of funds accounts."

Nature of Insurance Products and Maturity of Liabilities

The maturity of liabilities for life insurance companies is determined by the nature of insurance products that they sell. Insurance products are broadly classified by type of payment: (1) insurance against death; (2) pure endowment insurance; and (3) mixed insurance (Chart 5). As in the case of fixed-coupon bonds, the maturity of each insurance product is the remaining maturity, which is the weighted average of the future cash flow payments for each age group of policyholders (see the Box for the calculation method of the maturity of liabilities). However, unlike the case of fixed-coupon bonds, the cash flow changes as the policyholders' lifespan (or the timing of death) changes, and this needs to be taken into account when calculating the maturity of liabilities.

[Chart 5] Insurance payment by product[1]



Note: *1*. The dashed lines indicate payment at the time of death, and the solid lines indicate insurance payment made when policyholders are alive.

Insurance against death

Insurance against death is insurance in which insurance payment is made when policyholders die. Typical examples are whole life insurance, term life insurance, and whole life insurance with term rider. Whole life insurance is insurance in which policyholders pay insurance premiums regularly when they are alive and receive insurance payment only once at the time of their death. In this case, the period until insurance payment -- that is, the life expectancy of policyholders from the time when they take out insurance until their death -- generally matches the maturity of liabilities. Based on the results of calculation with certain assumptions such as setting the surrender ratio at zero, the maturity of liabilities for whole life insurance is estimated to be about 32 years (Chart 6). This is the longest maturity among insurance products.

Term life insurance is non-refundable insurance, and payment is not made if policyholders die after a certain point in time. Thus, the maturity of term life insurance is estimated to be shorter than that of whole life insurance and to be about 5 years on the whole.

Whole life insurance with term rider is insurance that combines whole life insurance and term life insurance. If policyholders die before a certain point in time, insurance payment for whole life insurance is made in addition to that for term life insurance, whereas if policyholders die after a certain point in time, only insurance payment for whole life insurance is made. The maturity of whole life insurance with term rider is about 18 years, a period that lies between the maturity of whole life insurance and that of term life insurance.

[Chart 6] Examples for the calculation of maturity by type of insurance product[1]

(years)

Overall liabilities	15
Insurance against death	
Whole life insurance	32
Term life insurance	5
Term life insurance with a maturity of 20 years	6
Term life insurance with a maturity of 10 years	3
Whole life insurance with term rider	18
Pure endowment insurance	
Life individual annuity	20
Term individual annuity	12
Mixed insurance	
Endowment insurance	8
Term endowment insurance	6

Note: *1*. The data are as of end-March 2011.
Sources: Ministry of Internal Affairs and Communications, "Population census"; National Institute of Population and Social Security Research, "Population projections for Japan"; Japan Institute of Life Insurance, "Life insurance survey."

Pure endowment insurance

Pure endowment insurance is insurance in which insurance payment is made when policyholders are alive; a typical example is annuity insurance. In the case of annuity insurance, policyholders pay insurance premiums regularly from a young age and start receiving insurance payment when they reach a certain age. Under the standard type of annuity insurance, a certain amount of payment is made regularly. In the case of life individual annuity, insurance payments are made to policyholders until the time of their death, whereas term individual annuity limits the period of payment.

The maturity of pure endowment insurance is calculated by reflecting the life expectancy rate in the period of insurance payment made while policyholders are alive. The maturity of life annuity insurance is calculated to be about 20 years, while that of term individual annuity insurance is about 12 years, shorter than that of life annuity insurance.

Mixed insurance

Mixed insurance is insurance that combines insurance against death and pure endowment insurance. Policyholders receive payment for insurance against death when they die before a certain point in time, and receive maturity proceeds for pure endowment insurance when they live until a certain point in time. There are many types of mixed insurance, and a typical example is endowment insurance. The

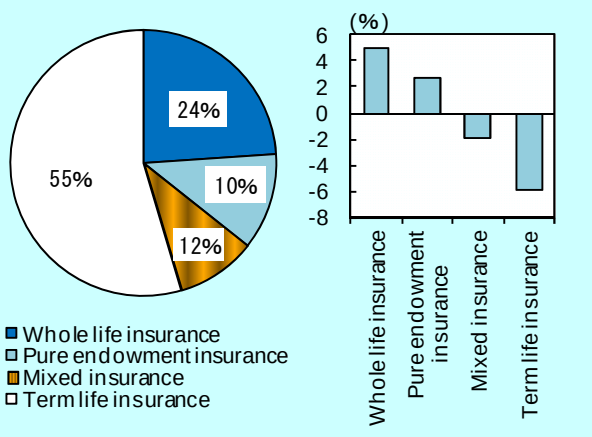
payment pattern of endowment insurance is similar to that of term life insurance, but the maturity is longer because insurance payment is made when policyholders live until maturity. The maturity of endowment insurance as a whole is estimated to be about 8 years.

Maturity of liabilities for life insurance companies

The maturity of liabilities for overall life insurance companies is estimated to be about 15 years, calculated based on the maturity and the amount outstanding of each insurance product. Given that the maturity of liabilities for banks is less than 1 year, the maturity of liabilities for life insurance companies is extremely long.[1] This is because, in the case of Japanese life insurance companies, the weight of insurance products with long maturities -- namely, whole life insurance and life individual annuity -- is large (Chart 7).

Since the maturity of insurance products differs significantly by product type, policyholders' choice of products substantially affects developments in the maturity of overall liabilities. In the case of insurance, the maturity of liabilities is not fixed in advance due to various uncertainties. For example, the maturity tends to shorten when the mortality rate of policyholders rises. The rise in the surrender rate also exerts downward pressure on the maturity. Thus, a range of factors affects the maturity of insurance products.

[Chart 7] Share of insurance contracts[1]



Note: *1*. Whole life insurance with term rider is proportionally allocated to whole life insurance and term life insurance. The data are as of end-March 2011. The right chart shows the accumulated rate of change from fiscal 2005 to fiscal 2010. The nine major life insurance companies are counted.
Sources: Published accounts of each life insurance company.

Duration Mismatch and Interest Rate Risk

Duration mismatch between assets and liabilities

As mentioned earlier, life insurance companies lengthen the period of investment for asset management in accordance with the maturity of liabilities. They used to employ stocks as a major long-term investment tool, but from the latter half of the 1990s they substantially reduced the share of stock investment (Chart 2). This is because the profitability of stocks declined significantly after the bursting of the bubble economy and these companies intensified their stance of reducing risks associated with stockholdings, reflecting a revision of accounting standards.[2]

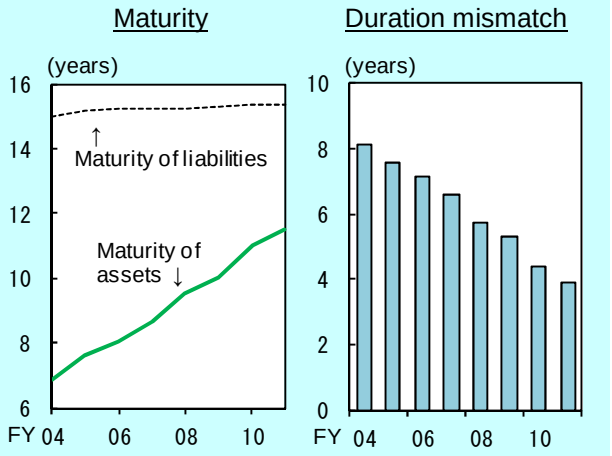
On the other hand, bond investment replaced stock investment as a major long-term investment tool, but the maturity of assets was shorter than that of liabilities since the holdings of super-long-term JGBs were small. To resolve the mismatch, life insurance companies have lengthened the maturity of assets in recent years by increasing their investment in super-long-term JGBs. As a result, the maturity of their assets has lengthened, but it is still shorter than that of liabilities and the duration mismatch persists (Chart 8).

Interest rate risk faced by life insurance companies

The duration mismatch between assets and liabilities is the source of interest rate risk. When the maturities of assets and liabilities match, the change in the market value of assets and liabilities is almost the same if interest rates of all maturities rise at the same pace. Thus, the market value of net assets -- calculated by subtracting liabilities from assets -- does not change. On the contrary, when the duration mismatch is large, fluctuations in the market value of net assets increase due to an interest rate change.

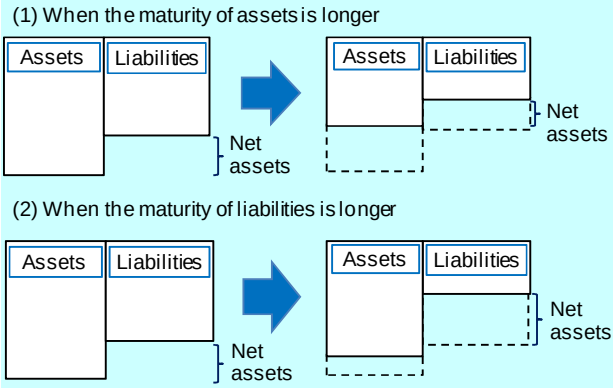
When the maturity of assets is longer than that of liabilities, a rise in interest rates reduces the value of net assets since the market value of assets decreases more than that of liabilities (Chart 9). This is true in the case of banks. In contrast, since the maturity of liabilities for life insurance companies is long, a rise in interest rates reduces the market value of liabilities more than that of assets, and consequently net assets increase.

[Chart 8] Maturities of assets and liabilities and duration mismatch[1]



Note: *1.* Duration mismatch is calculated by subtracting the maturity of assets from that of liabilities. The nine major life insurance companies are counted.
Sources: Life Insurance Association of Japan; published accounts of each life insurance company.

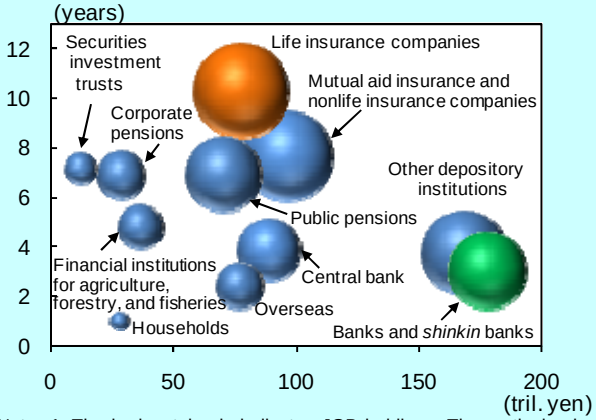
[Chart 9] Interest rate rise and changes in market value of net assets



In fact, based on a calculation of the amount of interest rate risk (the amount of decline in the market value when interest rates with all maturities rise by 1 percentage point) borne by life insurance companies both on the asset and liability side, the amount of interest rate risk on the asset side has expanded reflecting the rise in investment in super-long-term JGBs, and the amount of interest rate risk associated with life insurance companies' JGB investment is the largest compared with other industries (Chart 10). On the other hand, the amount of interest rate risk on the liability side has exceeded that on the asset side. The market value of net assets therefore increases at the time of a rise in interest rates (Chart 11). However, when interest rates decline, the market value of net assets decreases.[3] Such movements are the reverse for banks and *shinkin* banks, whose maturity of assets is longer than that of liabilities.

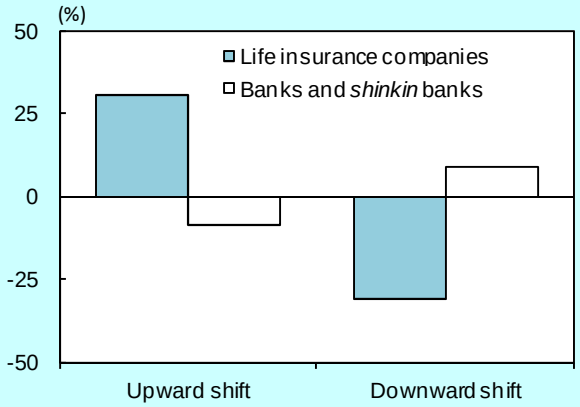
The aforementioned interest rate risk is calculated based on changes in the market value of assets and liabilities, but the solvency margin ratio for Japanese life insurance companies does not reflect the market value of liabilities.[4] Nevertheless, partly reflecting the introduction of the solvency requirements in Europe against the background of introduction of mark-to-market accounting in the assessment of liabilities and discussions about revising international accounting standards, it has become an important issue in terms of asset liability management for Japanese life insurance companies to match the maturities of assets and liabilities based on the market value.

[Chart 10] Interest rate risk associated with JGB investment by sector[1]



Note: *1.* The horizontal axis indicates JGB holdings. The vertical axis indicates the duration of the JGBs. The size of circles shows the amount of interest rate risk (100 basis point value) associated with JGB holdings. The data are as of end-March 2012.
Sources: Ministry of Finance; Japan Securities Dealers Association; QSS Report; published accounts of each entity; BOJ.

[Chart 11] Changes in net assets with an upward or downward shift in the yield curve[1,2]



Notes: *1.* A parallel shift scenario is assumed in which interest rates for all maturities shift upward or downward from the current yield curve by 0.5 percentage point. The data are as of end-March 2012.
2. The vertical axis indicates the ratio of net assets to real net assets for life insurance companies and the ratio of net assets to Tier I capital for banks and *shinkin* banks.
Sources: Published accounts of each entity.

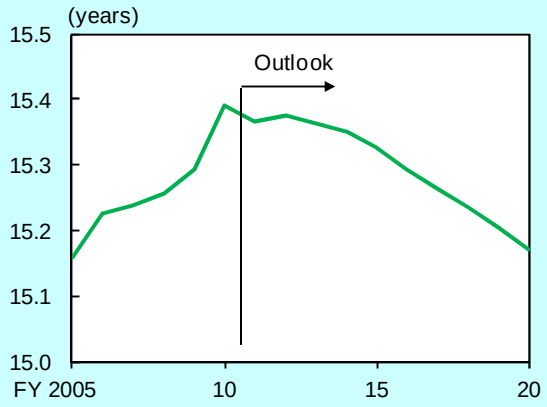
Risk associated with surrender at the time of a rise in interest rates

In our estimation that net assets of life insurance companies increase with a rise in interest rates, we assume that policyholders will not surrender their insurance contracts even if interest rates rise. However, if the yields on other financial products increase in line with the rise in interest rates, policyholders may surrender their contracts and shift to these products. Moreover, depending on the situation, life insurance companies may need to sell their assets to allocate the funds to pay surrender charges. It should be noted that such surrender by policyholders may affect the maturities of assets and liabilities.

Effects of Future Demographic Changes on the Maturity of Liabilities

As mentioned earlier, the current maturity of liabilities for life insurance companies is estimated to be about 15 years, and the maturity has been lengthening since 2005, albeit moderately (Chart 12). This is because the numbers of policyholders of whole life insurance and life individual annuity have increased due to the growing demand for insurance for whole life, while those of term life insurance and endowment insurance with shorter maturities have decreased (Chart 7).

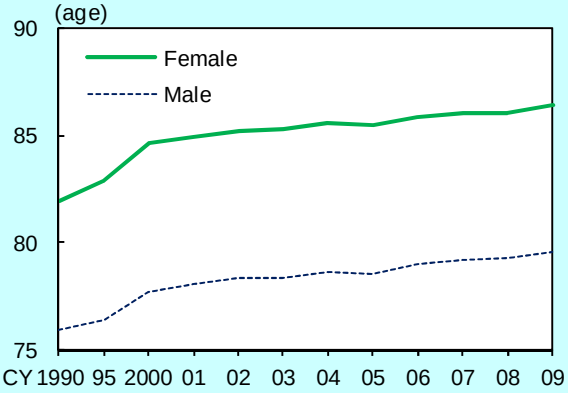
[Chart 12] Estimates on the maturity of liabilities[1]



Note: *1*. The nine major life insurance companies are counted.
Sources: Ministry of Internal Affairs and Communications, "Population census"; National Institute of Population and Social Security Research, "Population projections for Japan"; Japan Institute of Life Insurance, "Life insurance survey"; published accounts of life insurance companies.

The average life expectancy has been on an uptrend, albeit moderately, due to the progress in medical technologies. This has also contributed to the lengthening of the maturity of overall liabilities (Chart 13). Furthermore, it seems that the decline in the policyholders' surrender rate has also contributed to the lengthening of the maturity of liabilities, although this has not been factored into our estimation (Chart 14).[5] The surrender rate has declined because there was greater stability in the business conditions of life insurance companies compared with the latter half of the 1990s and the early 2000s, when successive failures of life insurance companies occurred, and attractive investment products were scarce because of the continuing low interest rate environment.

[Chart 13] Average life expectancy[1]



Note: *1*. The period is shown in a 5-year span prior to 2000.
Source: Ministry of Health, Labour and Welfare, "Abridged life tables."

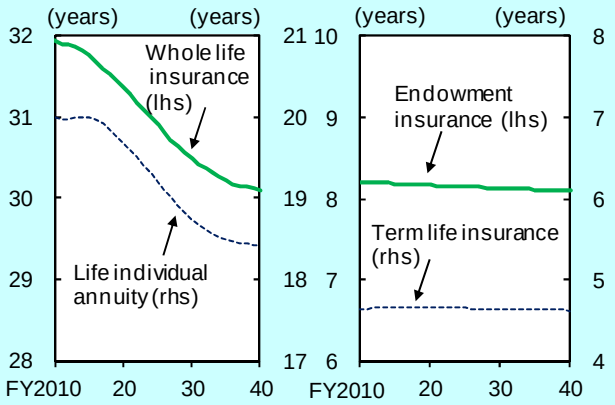
[Chart 14] Surrender rate[1]

Note: *1*. Members of the Life Insurance Association of Japan except for Japan Post Insurance are counted.
Sources: Life Insurance Association of Japan; Japan Post Insurance.

Nevertheless, future demographic changes may shorten the maturity of liabilities at a moderate pace (Chart 12).[6] This is because the share of new policyholders has been declining in accordance with the decrease in the number of young people, while the share of the existing policyholders has been increasing. Since the life expectancy of young people is longer than that of the elderly, the decline in the share of young policyholders shortens the average life expectancy of overall policyholders. This impact is especially noticeable in the case of whole life insurance (Chart 15). However, if the mortality rate declines faster than expected, the maturity of liabilities may grow longer than estimated.[7] Our estimation should be interpreted with some latitude since it is based on a range of assumptions, such as the

fixed composition of insurance products and exclusion of the surrender rate.

[Chart 15] Maturity of liabilities by type of insurance product



Sources: Ministry of Internal Affairs and Communications, "Population census"; National Institute of Population and Social Security Research, "Population projections for Japan"; Japan Institute of Life Insurance, "Life insurance survey."

A shortening of the maturity of liabilities may help life insurance companies in restraining interest rate risk by resolving the duration mismatch. On the other hand, the resolution of duration mismatch may lead to a slowdown in the growth of demand for super-long-term JGBs among these companies. Furthermore, if the population declines, premium income, which is the source of JGB investment, may decrease due to the decline in demand for new insurance.

Conclusion

Developments in insurance contracts, which are liabilities for Japanese life insurance companies, significantly affect the companies' JGB investment and the amount of interest rate risk that they bear. The maturity of liabilities is affected by a range of factors such as the composition of insurance products, the mortality rate, and the surrender rate. In addition, future demographic changes may shorten the maturity of liabilities. Thus, it is possible that the life insurance companies' stance on JGB investment will change in accordance with developments in the maturity of liabilities. The duration mismatch persists at life insurance companies to a considerable extent and -- although potential demand for super-long-term JGBs is likely to remain strong for the time being -- developments in the super-long-term market in the medium to long term warrant attention since the share of life insurance companies in the market is large.

[Box] Calculation Method of the Maturity of Liabilities

The maturity of liabilities is calculated by the weighted average of maturity by age group and insurance product.[8] The maturity of liabilities is the average period of insurance payment at present, and is calculated by using (1) a discount rate for each age group, (2) a mortality rate in the case of insurance against death and a life expectancy rate in the case of pure endowment insurance for each age group, and (3) insurance payment for each age group (Box Chart 1). In the calculation, yields on JGBs are used as the discount rate, and projections for population and mortality in the population projections for Japan released by the National Institute of Population and Social Security Research are used as the mortality rate or the life expectancy rate by age group (Box Chart 2). The future maturity of liabilities is calculated as the weighted average of maturity by age group and insurance product and the weight is the future amount outstanding of the number of insurance contracts. The future amount outstanding of insurance contracts is calculated by assuming that the rate of application and insurance payment per policyholder by age group and insurance product stay at the same levels from fiscal 2010, and by multiplying the figure by an estimate of future population by age group. It should be noted that the surrender rate is assumed to be zero, and thus it is possible that the maturity of liabilities is overestimated. In addition, insurance products come with a range of special contracts in response to customer needs, such as special medical contracts, and this has not been factored into our estimation.

[Box Chart 1] Formulas for estimating the maturity of liabilities by age group and insurance product

Maturity of insurance against death

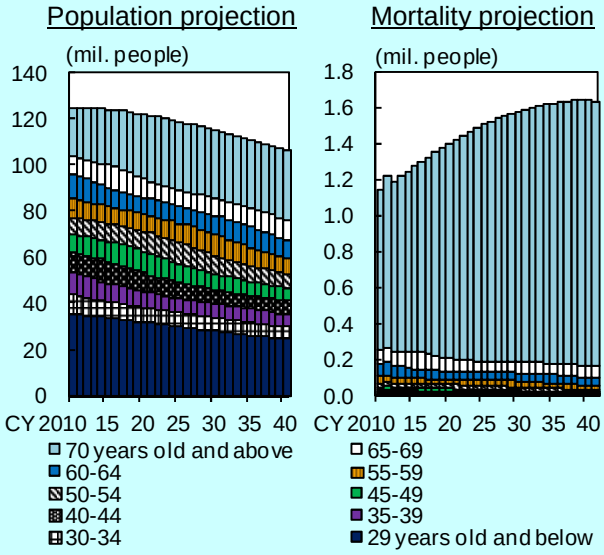
$$\frac{1}{\text{Market value of insurance contracts}} \sum_{t=0}^{T} t \times \text{Discount rate}_t \times \text{Mortality rate}_t \times \text{Amount of insurance payment}_t$$

Maturity of pure endowment insurance

$$\frac{1}{\text{Market value of insurance contracts}} \sum_{t=0}^{T} t \times \text{Discount rate}_t \times \text{Life expectancy rate}_t \times \text{Amount of insurance payment}_t$$

$t = 0$: present, $t = T$: Life expectancy of policyholders

[Box Chart 2] Projections for population and mortality



Source: National Institute of Population and Social Security Research, "Population projections for Japan."

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[*] Currently at the International Department.

[1] When outflows of demand deposits are assumed to take place within 3 months, banks' maturity of liabilities is estimated to be less than 1 year. For details, see the October 2012 issue of the *Financial System Report*.

[2] In 2000 mark-to-market accounting was introduced, and from the financial results of March 2012 the risk coefficient for changes in domestic stock prices was raised from 10 percent to 20 percent, after a review of the solvency margin ratio.

[3] During the period of declining interest rates from the 1990s to the 2000s, yields on assets declined significantly when insurance products with high yields remained on the liability side, and induced negative spreads. This led to deterioration in business conditions at life insurance companies, as evidenced by the bankruptcy of some of the companies.

[4] The market value of assets is only partly reflected in the accounting. Specifically, securities that are categorized as held-to-maturity securities and policy-reserve-matching bonds are basically not assessed under mark-to-market accounting.

[5] When the surrender rate is taken into account, the maturity of liabilities after reflecting the surrender option inherent in insurance contracts is estimated to be longer than the case where the rate is not taken into account.

[6] In this paper, we only take into account the effects of demographic changes on the maturity of liabilities for life insurance companies. However, the maturity of liabilities appears to be affected by various factors other than demographic changes, such as risk preference of households and changes in the financial environment.

[7] The risk of policyholders living longer than expected is called longevity risk. For the effects of longevity risk on the macro financial front, see International Monetary Fund, *Global Financial Stability Report*, April 2012.

[8] For the conceptual background to the calculation method, see Briys, E. and F. de Varenne, "On the Risk of Insurance Liabilities: Debunking Some Common Pitfalls," *Journal of Risk and Insurance*, 64 (4), 1997.

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