Bank of Japan Review

2004-E-4

Changing Investor Structure of Japanese Corporate Bond Market under Zero Interest Rate Environment

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December 2004

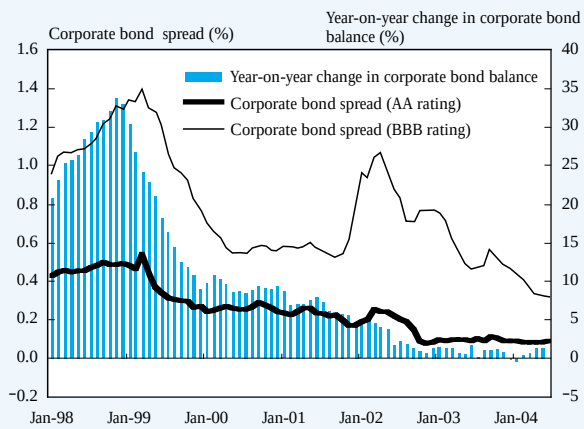
Since the financial instability during 1997-98 subsided, the Japanese corporate bond market has seen a substantial narrowing of credit spreads under the strong monetary easing by the Bank of Japan. With the narrowing of credit spreads, bond investors seem to have become cautious of a large potential capital loss once a reversal of credit spreads happens (i.e. negative skewness of bond return distributions). Theoretically, investors can be categorized into three types depending on the way they evaluate the risk-return profile of bond returns. The first type are risk-cautious investors who take into consideration the skewness risk. The second type are traditional investors who focus on the mean and the variance of the returns, but not necessarily the skewness. The third type are those who are interested solely in the mean of the returns. As credit spreads narrowed, particularly of relatively low-rated bonds, the first type like overseas investors and the second type such as domestic institutional investors may have become more cautious about investments in Japanese corporate bonds.

Introduction

The Japanese corporate bond market has seen a substantial narrowing of corporate bond spreads (credit spreads),[1] defined as the difference in returns between corporate bonds and government bonds, since the financial instability during 1997-98 subsided (Chart 1).[2] Strong monetary easing effects under the "zero interest rate policy" (ZIRP) and the subsequent "quantitative monetary easing policy" (QMEP) by the Bank of Japan have facilitated this trend. With the narrowing of credit spreads, however, bond investors seem to have become more cautious of a large potential capital loss in the event of a reversal of credit spreads.

This article attempts to investigate the changing structure of the Japanese corporate bond market, paying particular attention to the differences in preference toward risk-return profile of bond returns by investor type.

Chart 1: Corporate Bond Spreads and Year-on-year Change in Corporate Bond Balance



Note: Corporate bonds are corporate straight bonds.
Source: Japan Securities Dealers Association.

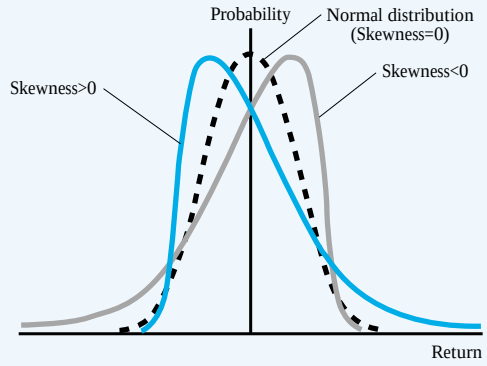
Skewness as a Risk Factor

In examining the risk-return of bond returns, we need to pay due attention to the risk stemming from negative skewness, in that lower returns than expected from normal distributions can be realized, although the probability of its occurrence is very low.

Skewness is an indicator that measures the asymmetry of probability distributions. Chart 2 illustrates the probability distributions that have the same mean and variance of returns, but differ in skewness. When the skewness is zero, then the

probability distribution corresponds to a normal distribution. On the other hand, when the skewness is positive (negative), then the probability distribution has a long-tail in the positive (negative) territory. Put differently, a positive (negative) skewness means that there is a possibility of making a large profit (loss), although the probability is low.[3]

Chart 2: Probability Distributions with Skewness



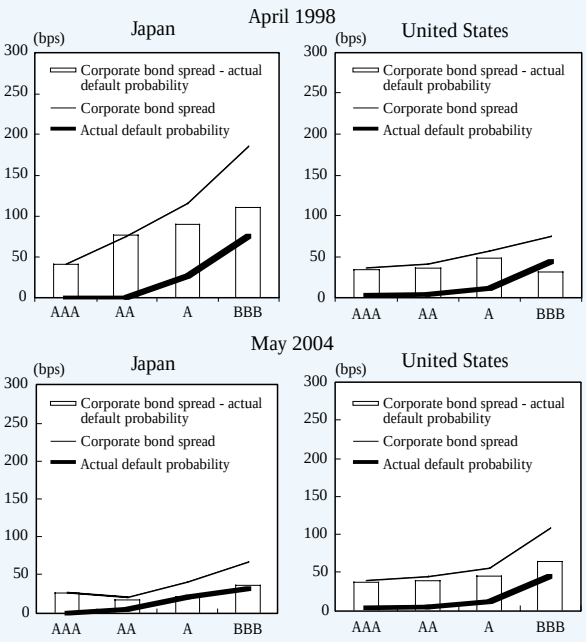
Generally, when interest rates (bond prices) decline (rise) to the extent that the room for further declines (rises) is limited, negative skewness tends to expand. This mechanism is basically applicable to returns on all financial assets. In the case of corporate bonds, however, negative skewness is inherent besides for the above mechanism due to default risk.[4] That is, although the probability may be small, investments in corporate bonds might end up with a large loss due to a default (See Box 1 for a comparison between credit spreads and actual default probabilities). Chart 3 depicts the relationship between the default probability and variance/skewness of a corporate bond return.[5] Evidently, a rise in the default probability is associated with a decline in skewness in the negative territory as well as a rise in variance.

Box 1: Comparison between Corporate Bond Spreads and Actual Default Probabilities

Actual default probabilities are widely used as a reference in evaluating the level of credit spreads. The right charts show a Japan-U.S. comparison between credit spreads and actual default probabilities. We can see that credit spreads have narrowed more substantially in Japan than in the United States, and have almost reached the actual default probabilities since the adoption of the ZIRP.

It should be noted, however, that the actual default probabilities we use here do not reflect the risk premium demanded by risk-averse investors* as well as the liquidity premium.** In fact, many credit pricing models that take into consideration a transition of credit ratings*** conclude that current credit spreads on Japanese corporate bonds do not cover the expected default probabilities.

Japan-U.S. comparison between corporate bond spreads and actual default probabilities



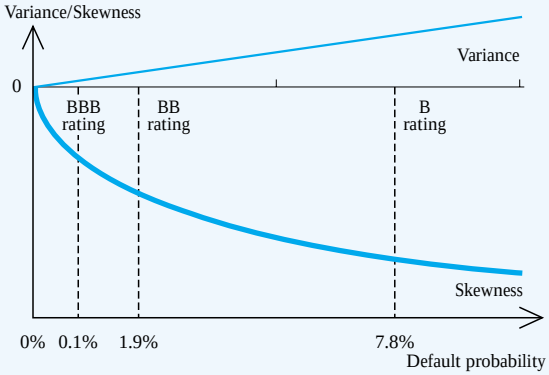
Source: Rating & Investment Information, Inc.

* Generally, investors are classified into the following three types in accordance with their risk preference: (i) risk-neutral investors, (ii) risk-averse investors, and (iii) risk-loving investors. Risk neutral investors are those who make investment decisions based solely on expected returns irrespective of the risk. On the other hand, risk-averse (risk-loving) investors are those who prefer the assets with lower (higher) risk if the expected returns are the same. Under the normal circumstances, investors are assumed to be risk-averse in finance literature.

** Liquidity premium is the premium investors additionally demand when securities cannot be traded at desired prices due to the limited number of investors in the market.

*** The credit ratings of companies undergo a transition. Probability distributions of the future state of specific companies should depend on all of their past history up to the point in time, since management capabilities and creditworthiness of companies reflect all aspects of the past events. If we model the probability distributions in this way, however, handling of the model would be extremely difficult. Thus, in practice, we use the transition matrix of the credit ratings that shows the probability of transition between credit ratings under the assumption that the probability distributions of the future state of the companies depend solely on their current state.

Chart 3: Variance and Skewness as a Function of Default Probability



Note: Default probability is the actual bankruptcy ratio in a one-year period.
Source: Rating & Investment Information, Inc.

Chart 4: Summary Statistics of Japanese Bonds

Jan.4,1996~Apr.6,2004

	Government bonds	Corporate bonds AAA rating	AA rating	A rating	BBB rating
Mean	0.034	0.047	0.032	0.030	0.017
Variance	0.005	0.008	0.004	0.004	0.013
Skewness	−0.541	−0.025	−0.171	−0.168	−1.483
Balance (Trillion yen, as of end-March 2004)	405.3	15.2	17.9	16.7	4.3

Source: Nikko performance index.

Chart 4 shows the sample mean, variance, and skewness of Japanese bond returns since the mid-1990s. From this chart, we can see that as a general tendency, (i) both mean and variance are very low, and (ii) skewness is negative, indicating that lower returns than expected from normal distributions were realized in this period. Also, note that the lower the credit rating of the bond, the lower the skewness. These observations imply that the above mechanisms of negative skewness have been actually at work in Japan.

Standard Risk Evaluation: CAPM World

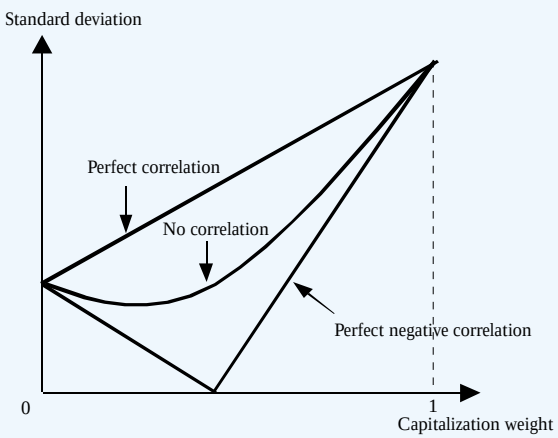
CAPM (see Box 2 for more details)[6], the most standard asset pricing model, evaluates risk by variance (or equivalently, standard deviation) of a return. Variance measures the degree of dispersion around the expected value of the return. The larger the variance, the larger the risk and thus a risk premium demanded by investors, which is defined as the excess return over the risk-free interest rate.

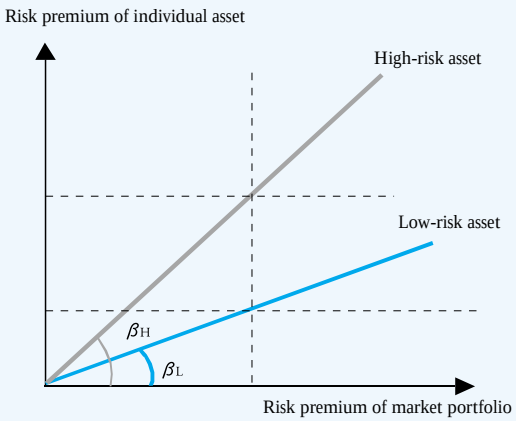
It should be noted, however, that investors do not demand a risk premium for all types of risks. Specifically,

Box 2: Diversification Effects and the Determination of Risk Premium under the CAPM

Diversification effects can be explained as follows. As the simplest case, we consider a portfolio consisting of two assets. Left chart below describes how the standard deviation of the portfolio changes with the capitalization weight. It shows that the lower the correlation between the two assets, the lower the risk of the portfolio measured by standard deviation.

As shown by this example, combining multiple assets enables investors to reduce the risk of the portfolio as a whole. As they increase the number of the assets, however, the correlation between the portfolio return and the market return becomes stronger. Thus, the higher the beta (β) that measures the correlation, the larger the risk premium. This is shown by right chart.





the larger the number of assets in a portfolio, the lower the individual or idiosyncratic risks since the capitalization weight of each asset becomes smaller. Thus, in efficient and perfectly integrated markets assumed by the CAPM,[7] investors do not demand a risk premium for such individual risks since those risks are diversifiable. A larger number of assets in a portfolio, on the other hand, implies a higher correlation between the portfolio return and the market return. Investors demand a risk premium for such a risk, since this type of risk cannot be diversified away. Consequently, the risk premium of an asset can be written as

Risk premium of an asset
= Beta (Variance risk)× Market risk premium

The beta in the above formula is the correlation coefficient between the return on an asset and the market return. Thus, the larger the beta of the asset, the larger the risk premium since the asset is regarded as riskier.

Risk Evaluation by Investors with Skewness Risk in Mind: Departure from the CAPM

We should note that the CAPM assumes the normality of return distributions with zero skewness.[8] In reality, however, the skewness of Japanese corporate bond returns has been negative in recent years, as shown by Chart 4. An issue of interest here is how the risk evaluation and thus the determination of a risk premium will change from the case of the standard CAPM, if we consider the risk from skewness.

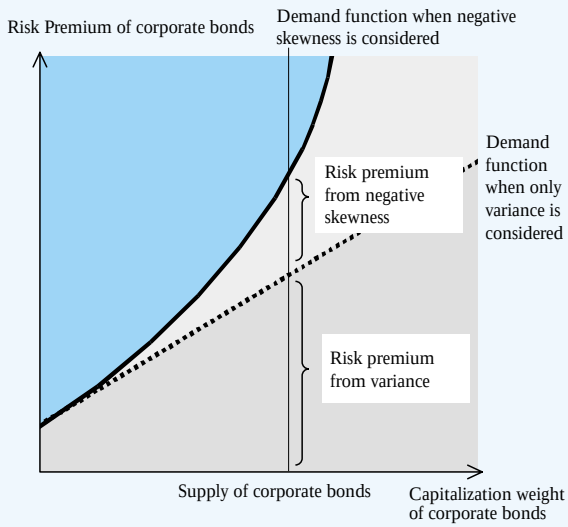
If a return has a positive skewness, that is, there is a low possibility that investors can make a large profit, investors will demand a lower risk premium than in the case of the CAPM since they view it positively. On the contrary, if a return has a negative skewness, investors demand a higher risk premium since they dislike the possibility of incurring a large loss even if the probability is very low.

Chart 5 illustrates the determination of a risk premium of corporate bonds whose returns have a negative skewness. The dotted line represents the demand function derived by the CAPM: when we consider only variance as a risk factor, as the capitalization weight of corporate bonds rises, the risk premium will rise linearly. When we consider negative skewness as an additional risk factor, however, as the capitalization weight of corporate bonds rises, the risk premium will rise increasingly.[9]

Consequently, the risk premium can be written as follows:

Risk premium of an asset
= [W× Variance risk + (1−W)× Skewness risk]
× Market risk premium

Chart 5: Risk Premium when Negative Skewness is Considered



Thus, the risk premium is expressed as the weighted average of the variance risk and the skewness risk. Nishioka and Baba [2004][10] show that the larger the degree of the relative risk aversion[11] (RRA) of investors, the smaller the weight of the variance (skewness) risk W (1-W).

An Empirical Analysis on Risk Premium of Corporate Bonds: Comparison between Japan and the United States

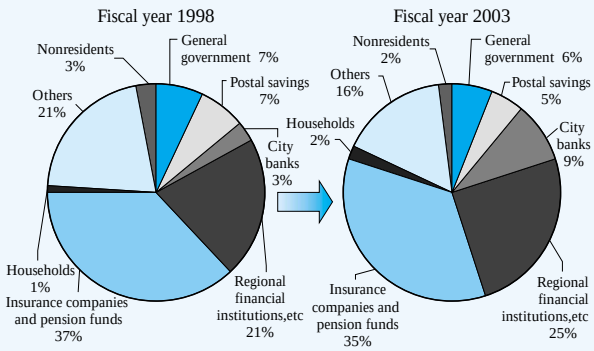
Chart 6 reports RRA and the associated weight of variance and skewness risk estimated by Nishioka and Baba [2004], which applied the above formula to government and corporate bond returns in both Japan and the United States. It shows that RRA implied by Japanese bond returns is much smaller than that implied by the U.S. bond returns, which leads to a smaller weight of skewness risk in risk premium of Japanese bonds. When BBB corporate bonds are included ("all assets" in the chart) in the sub-sample estimation that

Chart 6: Empirical Results on Risk Premium : Japan-U.S. Comparison

	Sample period	Asset Class	RRA	Weight of variance risk (W)	Weight of skewness risk (1−W)
Japan	Full sample (Jan.1,1996～ Apr.6,2004)	All assets	0.930	97.4%	2.6%
		Excluding BBB bonds	0.569	97.9%	2.1%
	Since the adoption of the ZIRP (Apr.1,1999～ Apr.6,2004)	All assets	−1.870	102.2%	−2.2%
		Excluding BBB bonds	1.596	94.0%	6.0%
United States	Jan.2,1995～ Apr.20,2004	All assets	23.994	87.5%	12.5%
		Excluding BBB bonds	13.247	92.4%	7.6%

Notes1: Return period is 60 business days.
2: All assets include government bonds and corporate bonds (AAA, AA, A, BBB ratings).
3: The Nikko performance index (Japan) and the Citigroup index (U.S.) are used as bond data.

Chart 7: Change in Corporate Bond Holders



Note: Corporate bonds include corporate straight bonds and convertible bonds with rights to convert into common stocks.
Sources: Bank of Japan "Flow of Funds Accounts" and "Banking Accounts of Domestically Licensed Banks".

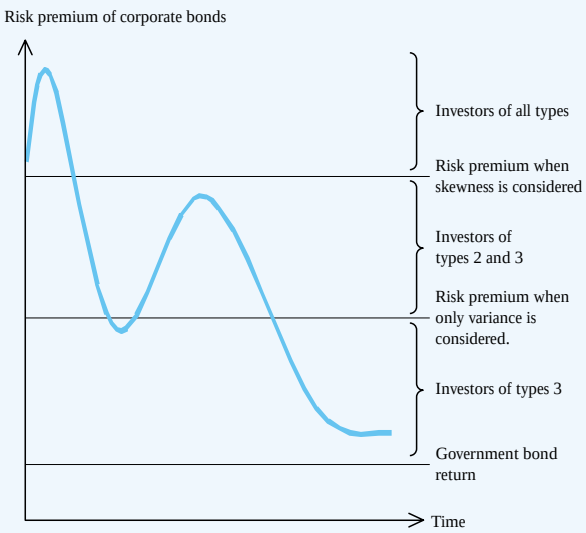
covers the period after the adoption of the ZIRP by the Bank of Japan, RRA and thus the weight of skewness risk are estimated to be negative. This result implies that some Japanese investors may have made investment decisions particularly in relatively low-rated corporate bonds without adequately considering the risk from negative skewness, compared with the investors in the U.S. bond markets.

On the flip side of the coin, we might interpret that unless we assume there are risk-loving investors with negative RRA, we cannot explain the decline in the risk premium of Japanese BBB-rated corporate bonds under the ZIRP and the QMEP. In fact, many Japanese institutional investors including life insurance companies and pension funds are not allowed to invest in corporate bonds with ratings of BBB or below due to internal regulations developed for risk management purposes. As a result, the market of Japanese corporate bonds with relatively low credit ratings has been dominated by regional financial institutions, investment trusts with active strategies, and retail investors, all of which are known as active risk takers in credit instruments. The empirical result reported in Chart 6 seems to be consistent with the structure of investor types inherent in the Japanese corporate bond market.

Investor Structure of the Japanese Corporate Bond Market

Based on the above empirical result and discussion, we attempt to examine the investor structure of the Japanese corporate bond market. First, Chart 7 compares the ratios of corporate bond holdings by investor type between the end of March 1999, which is around the time when the ZIRP was adopted, and the end of March 2004. From this chart, we can see that the ratios of city banks' and regional financial institutions' holdings rose in this period, while those of insurance companies and pension funds declined.[12] Also, the ratio of nonresidents' (overseas investors) holdings continued to be at a very low level.

Chart 8: Investor Types in Accordance with the Level of Risk Premium



Second, Chart 8 illustrates the investor structure of the Japanese corporate bond market implied by the above discussions in terms of the level of risk premium. Theoretically, investors can be categorized into the following three types depending on the way they evaluate the risk-return of corporate bonds in their investment decisions.[13] The first type are risk-cautious investors who consider the negative skewness risk that can be realized in the form of a large capital loss when

credit spreads reverse their course. Overseas investors and some domestic institutional investors may be categorized into this type. The second type are traditional investors who take into consideration the mean and the variance as assumed by the standard CAPM, but not the negative skewness. Most of the institutional investors such as life insurance companies and pension funds may be categorized into this type. The third type are those who are interested solely in the mean of the returns. Some regional financial institutions, investment trusts and retail investors may be categorized into this type. If the risk premium is large enough, the first type of investors can participate in the market. If the risk premium declines below a certain level, the first type will exit from the market and only the second and third type of investors will remain in the market. If the risk premium declines further, the second type will also exit and only the third type will remain. Put differently, as the negative skewness of corporate bond returns expanded in line with the decline in returns themselves, investors may have been crowded out from the market in order of their degree of risk aversion. The ZIRP and QMEP lessened the number of active first and second type investors, leading the third type investors to become more influential in price formation. As a result, corporate bond returns seem to be no longer properly reflecting the underlying credit worthiness of issuers.

Concluding Remarks

Since the financial instability that occurred from 1997 though 1998 subsided, credit spreads on Japanese corporate bonds have continued to narrow substantially. Strong monetary easing effects under the ZIRP and the subsequent QMEP have facilitated this trend. The narrowing of credit spreads is likely to have influenced investor behavior and the structure of the market. We need to closely monitor the possible effects of the change in investor structure caused by the narrowing of credit spreads on the behavior of the issuing companies.

[1] The risks associated with corporate bond investments can be broadly divided into interest risk and credit risk. Interest risk is the same as in the case of government bonds. Practically speaking, since we do not have to consider credit risk in the case of government bonds issued in developed countries, investors usually see credit spreads in evaluating the credit risk of specific corporate bonds.

[2] In the latter half of 2001, there was a series of events that heightened concerns over the creditworthiness of companies. Among the notable events is the filing of a petition for protection under the civil rehabilitations law by Mycal Inc. in September. These events temporarily brought about a widening of credit spreads on corporate bonds issued by companies with credit ratings of BBB or below.

[3] Lotteries and gambling are typical examples of probability distribution with positive skewness, while credit instruments such as corporate bonds and loans are those with negative skewness, as stated later.

[4] The situation of a company's being unable to fulfill its debt obligations is called default and the possibility of debt holders' incurring a loss when a company defaults is called default risk or credit risk in a narrow sense. On the other hand, even if the company does not actually default, there is a possibility of incurring a loss due to a decline in price and liquidity from the lowering of the creditworthiness caused by the deterioration in corporate performance and financing conditions. This is called credit risk in a broad sense.

[5] Chart 3 shows a simulation result under the assumption that default occurs with the same probability in each period and the loss given default is 100 percent of the principal.

[6] CAPM is an abbreviation for "Capital Asset Pricing Model."

[7] The key assumptions of the CAPM are as follows: (i) investors can freely lend and borrow funds at the risk-free interest rate; (ii) there are no taxes and transaction costs; (iii) expectations and investment horizon are identical across investors.

[8] This assumption seems to be valid when we look at stock returns over a long period in the order of several decades. If there is a possibility of downward jumps in the returns, however, investors need to consider negative skewness caused by the jumps.

[9] By analogy, in the case of the bonds whose returns have a positive skewness, as the capitalization weight rises, risk premium declines at an accelerated rate.

[10] Shinichi Nishioka and Naohiko Baba "Credit Risk Taking by Japanese Investors: Is Skewness Risk Priced in Japanese Corporate Bond Market?" Bank of Japan Working Paper No. 04-J-9, 2004.

[11] Risk averseness refers to the extent to which investors prefer risk. Put differently, it indicates how much cost investors are ready to bear to avoid risk. The higher the risk aversion, the smaller the preference of investors toward risk. Investors with a negative degree of risk aversion are called risk-lovers. Generally, two measures of risk averseness are used: the degree of the absolute risk aversion and the degree of the relative risk aversion. The degree of the absolute risk aversion has the property that the higher an investor's total wealth, the higher the degree. The degree of the relative risk aversion is preferred in financial studies due to the invariability irrespective of the size of total wealth.

[12] Chart 7 shows that the ratios of both city banks' and regional financial institutions' corporate bond holdings rose. When we look at the ratios of corporate bond holdings by city banks and regional financial institutions to their bond portfolios consisting of government bonds, local bonds, and corporate bonds, the ratio of city banks' holdings declined to 8.1 percent as of the end of March 2004 from 10.1 percent as of the end of March 1998, while the ratio of regional financial institutions' holdings rose to 9.3 percent from 5.1 percent. The source of the data is banking accounts of domestically licensed banks released by the Bank of Japan.

[13] Note that categorization of investors here are slightly different from that in Box 1. The first and second types are both risk-averse investors, but only the first type investors consider the skewness risk. The third type are similar to risk-neutral investors.

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