Japan's Government Pension Investment Fund and ESG Investment: Policy Pathways to Carbon Neutrality

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Abstract: With climate change and carbon neutrality becoming focal issues, GPIF, as the world's largest pension fund, plays an important role in promoting sustainable finance in Japan. Although there are still obstacles to achieving Japan's carbon neutrality goal, the Government Pension Investment Fund (GPIF) has proposed solutions in sustainable finance. Its exploration and practice of ESG investment is achieved mainly through participation in engagement-enhanced passive investment, inclusion of ESG indices as passive benchmarks, improvement of ESG rating standards, and increased investment in ESG bonds. As a result, GPIF has not only achieved investment returns higher than the benchmark through ESG

investment, but also saw an annual improvement in the portfolio greenhouse gas emission. Drawing on GPIF's experience, this study provides a practical reference for the national social security fund of the People's Republic of China.

Keywords: GPIF, carbon neutrality, sustainable finance, ESG investment

I. Introduction: Overview of GPIF and Sustainable Finance Development

(1). Overview of GPIF

Japan has a long history of operating pension fund on a large scale. In 1961, the Japanese government established the "Pension Welfare Service Public Corp." directly managed by the Ministry of Health and Welfare to operate the pension fund on a large scale. Since then, this pension fund has become an important source of funding for Japan's national finance, and a driving force behind economic development.

The management agencies of GPIF have been continuously evolving. From 1961 to 2000, Japan's pension fund was managed by the " Pension Welfare Service Public Corp." which is directly administered by the Ministry of Health and Welfare. From 2000 to 2006, it was managed by the "Japan Pension Fund" directly led by the Minister of Health and Welfare. In 2006, the " Japan Pension

Fund" was dissolved and the Independent Administrative Institution was established, which is now known as the Government Pension Investment Fund (GPIF). GPIF is independent of the government, entrusted by the Minister of Health, Labor and Welfare to manage and invest in Japan's National Pension Fund and Employees' Pension Insurance. As of December 2021, GPIF has 196 trillion yen ($1.5 trillion) in assets under management, making it the world's largest pension fund. With its huge asset scale, the measures and reform directions of Japan's public pension fund in the investment process have a great influence on the Japanese market.

(2). Sustainable Finance Development in Japan

Sustainable finance refers to financial activities that incorporate environmental, social, and governance factors into the decision-making process. ESG investment refers to the investment strategy formulated by investors from the perspective of non-financial factors such as environment, society, and governance in the investment process. The world is currently facing severe sustainable development challenges. During the low-carbon transition, the lack of funds in various industries is widely regarded as one of the reasons that limits sustainable development. In order to achieve the world's carbon neutrality goals, ESG investment as a type of sustainable finance has gradually become a hot topic in the global investment field.

Initially, Japan was not a first-tier country at the forefront of climate change and carbon neutrality issues. The main ESG investments in the world were concentrated in Europe, the United States, and Canada. As shown in Table 1, in 2016, Japan's total sustainable

Region	2016	2018	2020	2016-2020 Growth ra
Europe	12,040	14,075	12,017	0%
United States	8,723	11,995	17,081	96%
Canada	1,086	1,699	2,423	123%
Japan	474	2,180	2,874	506%
Total(millions of dollars)	22,839	30,683	35,301	55%

investment assets accounted for only 2.07% of the world's total. After being promoted by the Japanese government and market, they grew rapidly to 8.14% in 2020, with a growth rate of 506% in just four years, making it the third largest sustainable finance market outside Europe and the United States.

Table 1: Total sustainable investment assets and their growth by country and region in 2016, 2018 and 2020

Source: Global Sustainable Investment Review 2020

This rapid development cannot be achieved without policy guidance from the Japanese government and regulatory authorities on sustainable finance. As a trillion-dollar asset manager, GPIF plays a critical role in promoting ESG-related information disclosure by

domestic Japanese companies in achieving carbon neutrality goals. Especially after signing the "Paris Agreement" in 2015, the layout of Japan's sustainable finance policy has become more focused on climate issues. The Japanese government has not established an independent administrative agency to integrate and supervise sustainable finance issues and ESG-related policies. Most of the policies related to sustainable finance come from major government departments such as the Ministry of Environment, Ministry of Economy, Trade and Industry, Ministry of Finance, and Cabinet Office. These policies provide guidance for the development of Japan's sustainable finance, causing more companies to pay attention to climate change-related issues and promote ESG-related information disclosure.

II. Obstacles to achieving carbon neutrality in Japan and the role of public pension funds

(1). Obstacles to achieving carbon neutrality in Japan

The obstacles to achieving carbon neutrality in Japan mainly come from two aspects.

On the one hand, Japan's energy structure needs to be optimized. The biggest resistance to achieving Japan's 2050 carbon neutrality target comes from the industrial sector. The industrial sector in Japan accounts for nearly half of the country's energy consumption,

which uses nearly 90% of fossil energy in Japan's energy supply, making it the dominant sector. Some high-energy-consuming companies have high carbon emissions in their production activities, which still fall short of global decarbonization standards. These companies have low endogenous motivations for decarbonization transformation, and they also lack the power to use decarbonized energy and technological innovation. This undoubtedly poses significant obstacles to Japan's efforts to achieve carbon neutrality.

On the other hand, Japanese companies have a low willingness to transform towards decarbonization. The key reason for the low endogenous motivation for enterprise decarbonization reform stems from economic factors. The transformation process will undoubtedly face a significant increase in costs in the short term, which will bring huge operational risks to well-circulated enterprises and create a large gap in capital. This is highly matched with the application scenarios of sustainable finance. Through ESG indexes, climate bonds and other green financial instruments, enterprises are compelled from the capital side to carry out decarbonization transformations. Encouraging enterprises to disclose non-financial information and providing relevant financing channels such as issuing green bonds to ensure uninterrupted business operations. The development of sustainable finance has increased the autonomous willingness of companies to carry out

decarbonization transformations, which greatly promotes the realization of the government's carbon neutrality targets.

(2). The role ofGPIF in achieving carbon neutrality

GPIF was originally an important source of funding for financial investment and financing. Its leadership in developing sustainable finance has had a considerable impact on the domestic market in Japan, and has played a significant role in achieving carbon neutrality targets.

Initially, low-carbon energy companies to solve Japan's energy mix problems need to be invested in. To replace traditional fossil energy sources such as coal and oil with renewable energy sources such as solar and wind is one of the main ways for enterprises to achieve energy conservation and emission reduction. Investing in renewable energy companies promotes the development of clean energy in Japan, advances the optimization and integration of the energy mix, and will contribute to the achievement of carbon neutrality.

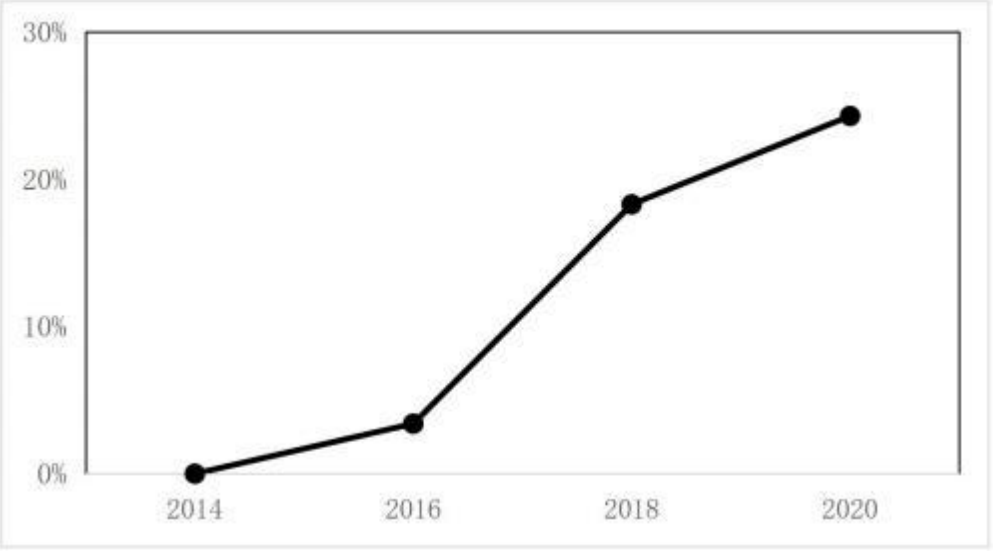
Secondly, financial support for companies to make environmental technology changes should be increased. Low endogenous motivation for enterprise decarbonization transformation is partly due to difficulties in environmental protection technology innovation, but more is owing to economic pressure that makes it impossible to innovate existing technologies. However, investment by GPIF can make up for the funding gap in reform and help enterprises update

decarbonization technology, reduce energy consumption, and help the government achieve carbon neutrality targets.

Thirdly, the ESG index was introduced to urge companies to improve their ESG performance. The asset size applied to the domestic market in GPIF's portfolio has reached JPY 93,829.9 billion, with a share of 90% in passive investments. Adding ESG indices to passive investments can be viewed as an incentive mechanism. In order to improve their ESG ratings, invested companies need to improve their ESG strategies in their production and operation activities. ESG index providers will include carbon emissions standards in the rating process, standing from the perspective of sustainable development. This will become a driving force for high-carbon-emitting enterprises to undergo low-carbon transformations.

These actions have brought tremendous driving forces to Japan's efforts to achieve carbon neutrality and other sustainable development goals by 2050. From 2014 to 2016 alone, Japan's sustainable investment scale grew rapidly from JPY 840 billion to JPY 57,056 billion, a nearly 67-fold increase, as shown in Figure 1. Such rapid growth is undoubtedly driven by both market and government factors.

Figure 1: Growth of the share of sustainable investment assets in total managed assets in Japan



Source: Global Sustainable Investment Review 2020

III. Implementation path of ESG investment by Japan's public pension fund

(1) Exploration and Practice of ESG Investments in Equity

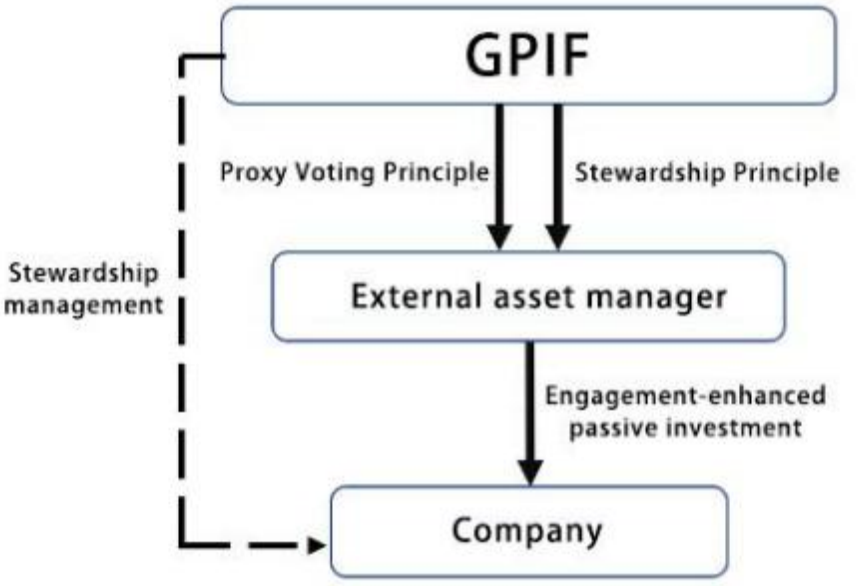
1. Fulfilling Stewardship Management through Engagement-Enhanced Passive Investment

GPIF primarily fulfills its stewardship management as an asset manager in improving the domestic market and enhancing long-term corporate value through "engagement-enhanced passive investment". Unlike active investment, passive investment mostly involves long-term holding of assets, and investors need to exercise voting rights

on strategic decisions at shareholders' meetings of invested companies during the holding period. On one hand, GPIF can participate in the governance process of invested companies through passive investment and guide them to adopt ESG considerations from a long-term perspective. Among the ESG themes involved, environmental and climate change issues are currently the key focus for GPIF. On the other hand, as a shareholder, GPIF can require companies to proactively disclose non-financial information related to ESG, which not only enhances enterprise value in the long-term, but also promotes supervision and promotion of low-carbon reforms in enterprises.

GPIF entrusts its external asset management companies to exercise voting rights based on two regulatory documents, the "Stewardship Principles" and the "Proxy Voting Principles." As guidelines, the above principles require asset management companies to identify key ESG themes and set goals they believe should be achieved, and actively negotiate with invested companies. ESG issues should be fully considered when exercising voting rights, and votes should be raised with the goal of enhancing the medium- and long-term value of the investee company.

Figure 2: Engagement-enhanced passive investment process between GPIF, external asset management companies, and invested companies



Source: Official website of GPIF

2. Introducing ESG indices as benchmarks for passive investments

After signing up for UNPRI in 2015, GPIF began to consider incorporating ESG into the investment operation of public pension funds and adopted ESG indices as benchmarks for equity investments in 2017. Incorporating ESG considerations in enterprise business processes will undoubtedly increase operating costs, and in the short term, companies are likely to face some degree of cost increase and profit decline during the transition period. Therefore, from the perspective of financial performance, the endogenous motivation for companies to undertake ESG-related activities is not

substantial. In the face of this situation, GPIF's priority measure was to include ESG indices in its equity products investment, while modifying its investment principles, emphasizing the inclusion of ESG considerations in stewardship activity. GPIF believes that in the long-term perspective, introducing ESG indices can not only improve the risk and return of investment portfolios but also boost the Japan's stock market through secondary effects of ESG ratings.

Under the above requirements, GPIF gradually selected eight ESG indices for passive investment since 2017. Each index has different characteristics in terms of component stock size, weight, and association with the parent index. Some indices aim to restore the real situation of the stock market, strive to reduce tracking errors, and allocate weights based on the performance of ESG activities of different enterprises in the parent index. In the process of adopting ESG indices every year, it is evident that GPIF's initial choices tended to lay out ESG considerations comprehensively across all three elements, and subsequent additions focused more on considering the carbon emissions of companies and their climate transformation strategies. The specific features of the eight indices and the asset allocation situation selected by GPIF are shown in Table 2.

Table 2: GPIF's eight ESG index asset situation

Serial number	Exponential name	Types of equity	Number of shares	Number of assets (100 billion)	Proport total ass (Up to 2
1	FTSE Blossom Japan Index	domestic	229	983.0	0.50%
2	FTSE Blossom Japan Sector Relative Index	domestic	493	800.0	0.41%
3	MSCI Japan ESG Select Leaders Index	domestic	222	2099.0	1.07%
4	MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	foreign	2111	1618.7	0.82%
5	MSCI Japan Empowering Women Index (“WIN”)	domestic	352	1245.7	0.63%
6	Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	foreign	2149	419.5	0.21%

7	S&P/JPX Carbon Efficient Index	domestic	1855	1567.8	0.80%
8	S&P Global LargeMidCap Carbon Efficient Index	foreign	2428	3390.6	1.72%

Source: Official website of GPIF

3. Gradually Improving ESG Rating Standards and Index Coverage

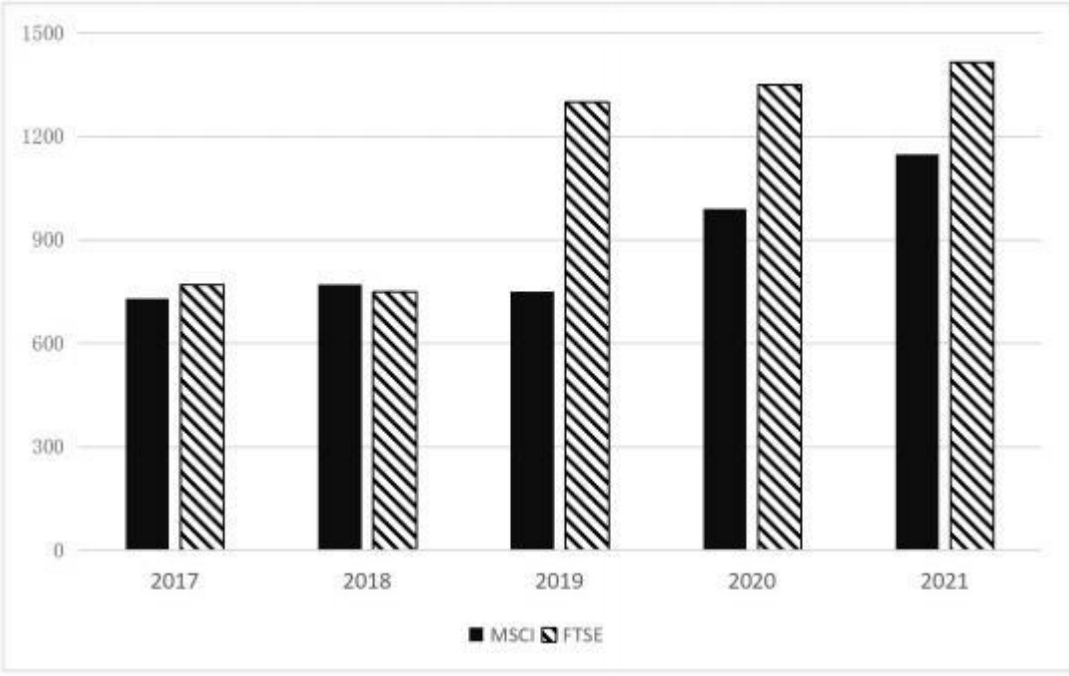
For passive investments, the index selection directly affects future returns. Based on this, GPIF focuses mainly on the following two aspects regarding ESG index selection.

On the one hand, GPIF should actively communicate with rating agencies and index providers to improve ESG index rating standards. GPIF requires rating agencies and index providers to assess the ESG activities of each enterprise based on public information and disclose evaluation methods and results, and to continuously improve ESG rating methods.

On the other hand, the index should use an "active screening" method to screen component stocks and gradually expand the ESG rating scope. To expand the scope of passive investment in ESG indices, GPIF introduced the "Index Publication System" in 2019 to collect the latest ESG-related index information to optimize their

asset allocation. In recent years, Japanese enterprises have actively communicated with rating agencies and index providers to improve ESG ratings to be included in index coverage. From 2017 to 2021, the number of Japanese enterprises that consulted with FTSE and MSCI rose from 1,310 to 2,563.

Figure 3: Growth of Japanese firms consulting with index providers



Source: Official website of GPIF

(2) ESG Exploration and Practice of Fixed-Income Investments

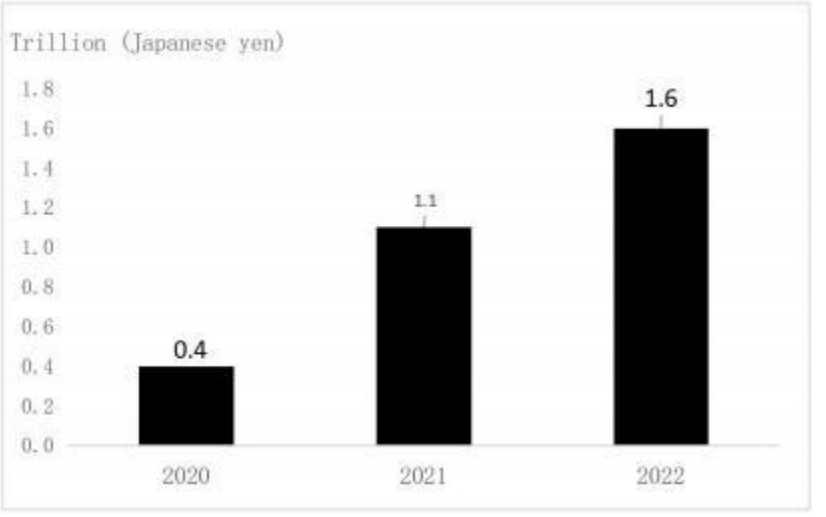
The GPIF considers ESG factors in its fixed-income investment management, mostly through investments in green bonds, social bonds, and sustainable bonds. Green bonds are used to raise funds

for projects that benefit the climate and environment; social responsibility bonds are used to raise funds for projects that benefit society; and sustainable development bonds are a combination of green and social bonds that aim to raise funds for projects that benefit both society and the environment. GPIF entrusts their assets to third-party managers for passive investment. In order to fulfill their commitment to sustainable finance, GPIF requires these asset managers to integrate ESG throughout the investment process. (According to the definition provided by UNPRI, ESG integration involves "clearly and systematically incorporating ESG factors into investment analysis and investment strategies.")

Since PIF and the World Bank Group published a joint research paper in 2018, efforts have been made to incorporate ESG factors into fixed-income investments. After that, the International Bank for Reconstruction and Development (IBRD) and the International Finance Corporation (IFC), members of the World Bank Group, drafted a new proposal in the same year to provide external asset managers of GPIF with opportunities to invest in green, socially responsible, and sustainable development bonds. This means that external asset management companies managing passive investments for GPIF can invest in green, social, and sustainable development bonds, as well as other securities issued by multilateral development banks and government financial institutions, to obtain excess returns over the benchmark.

GPIF's ESG-related bond investments are currently increasing rapidly year by year. As of March 2022, the scale of these ESG-related bond investments has grown to about 1.6 trillion yen (see Figure 5), an increase of nearly 45% compared to the previous year.

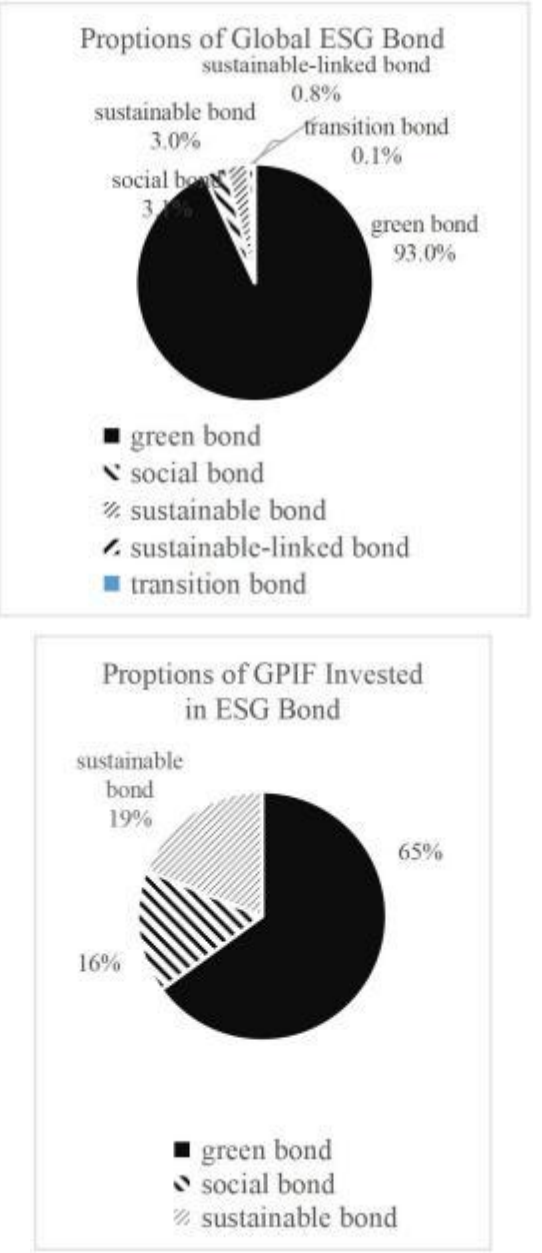
Figure 5: Japanese ESG bond investment trends



Source: Official website of GPIF

Among them, green bonds account for 65% of the total investment, followed by sustainable bonds (19%) and social bonds (16%) (Figure 6). The Climate Bonds Initiative (CBI) subdivides global ESG bonds. The following figure shows the proportion of green, social, and sustainable bonds in all ESG bonds. From the comparison, it can be clearly seen that the proportion of green bonds invested by GPIF is significantly smaller than the market share of all green bonds, while the proportion of sustainable bonds and social bonds is significantly higher. This means that GPIF has adjusted its bond selection to emphasize investment diversification to reduce risks, which is in line with its consistent investment style.

Figure 6: Global ESG bonds and the proportion of GPIF investment in ESG bonds



Source: Official website of GPIF

IV. Analysis of the Effectiveness of GPIF's ESG Investments

(1) Investment Returns of ESG Indices

Since 2017, GPIF has started to adopt ESG indices in passive investments. Although ESG investment has the characteristics of better performance with longer horizons, short-term return analysis still has reference value. From the data published from 2017 to 2021, eight ESG indices have performed well overall in the five years, and most of the indices achieved excess returns higher than the benchmark index and the market average level (TOPIX/MSCI ACWI) in most years. From April 2017 to March 2022, eight ESG indices were used successively. Since the expected return pursued by GPIF is related to the benchmark, inflation rate (national wage increase rate), this article compares and analyzes the return of ESG indices with the benchmark index (TOPIX/MSCI ACWI) based on the average return of the aforementioned eight ESG indices over a five-year period.

Table 3: Return on Eight ESG Indices from 2017 to 2021

Exponential name	Self	Parent index	TOPIX MSCIACWI	Excess return (To parent index)	Exces retur (To benchm
FTSE Blossom Japan Index	14.83%	15.13%	15.87%	-0.30%	-1.04%
MSCI Japan ESG Select Leaders Index	13.74%	14.94%	15.87%	-1.20%	-2.13%
MSCI Japan Empowering Women Index (“WIN”)	15.29%	14.94%	15.87%	0.35%	-0.58%
S&P/JPX Carbon Efficient Index	/	/	/	/	/
S&P Global LargeMidCap Carbon Efficient Index	/	/	/	/	/
MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	/	/	/	/	/
Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	/	/	/	/	/
FTSE Blossom Japan Sector Relative Index	/	/	/	/	/
FTSE Blossom Japan Index	3.90%	5.05%	4.90%	-1.15%	-1.00%
MSCI Japan ESG Select Leaders Index	5.17%	5.14%	4.90%	0.03%	0.27%
MSCI Japan Empowering Women Index (“WIN”)	5.55%	5.15%	4.90%	0.40%	0.65%
S&P/JPX Carbon Efficient Index	5.19%	4.90%	4.90%	0.29%	0.29%
S&P Global LargeMidCap Carbon	9.16%	9.11%	8.95%	0.05%	0.21%

	Efficient Index					
	MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	/	/	/	/	
	Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	/	/	/	/	
	FTSE Blossom Japan Sector Relative Index	/	/	/	/	
	FTSE Blossom Japan Index	-6.96%	-9.18%	-9.50%	2.22%	2.
	MSCI Japan ESG Select Leaders Index	-3.39%	-9.28%	-9.50%	5.89%	6.
	MSCI Japan Empowering Women Index (“WIN”)	-4.78%	-9.09%	-9.50%	4.31%	4.
	S&P/JPX Carbon Efficient Index	-9.20%	-9.50%	-9.50%	0.30%	0.
19	S&P Global LargeMidCap Carbon Efficient Index	-12.81%	-13.11%	-13.40%	0.30%	0.
	MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	/	/	/	/	
	Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	/	/	/	/	
	FTSE Blossom Japan Sector Relative Index	/	/	/	/	
	FTSE Blossom Japan Index	43.93%	43.81%	42.13%	0.12%	1.
20	MSCI Japan ESG Select Leaders Index	38.90%	43.43%	42.13%	-4.53%	-3.
	MSCI Japan Empowering Women	37.49%	43.43%	42.13%	-5.94%	-4.

Index (“WIN”)					
S&P/JPX Carbon Efficient Index	41.95%	42.13%	42.13%	0.18%	0.18
S&P Global LargeMidCap Carbon Efficient Index	58.22%	59.95%	60.21%	-1.73%	-1.99%
MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	59.34%	60.10%	60.21%	-0.76%	-0.87%
Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	58.38%	60.25%	60.21%	-1.87%	-1.83%
FTSE Blossom Japan Sector Relative Index	/	/	/	/	/
FTSE Blossom Japan Index	5.72%	2.08%	1.99%	3.64%	3.73%
MSCI Japan ESG Select Leaders Index	3.64%	2.32%	1.99%	1.32%	1.65%
MSCI Japan Empowering Women Index (“WIN”)	0.87%	2.32%	1.99%	-1.45%	-1.12%
S&P/JPX Carbon Efficient Index	2.02%	1.99%	1.99%	0.03%	0.03%
S&P Global LargeMidCap Carbon Efficient Index	20.13%	19.12%	19.38%	1.01%	0.75%
MSCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	19.72%	19.40%	19.38%	0.32%	0.34%
Morningstar® Developed Markets Ex-Japan Gender Diversity Index(GenDi)	22.13%	22.20%	19.38%	-0.07%	2.75%
FTSE Blossom Japan Sector Relative Index	4.53%	2.08%	1.99%	2.45%	2.54%

Source: Official website of GPIF

The annualized converted returns of the ESG indices over the five-year period show that the eight ESG indices have significantly outperformed their parent indices and the market average (see Table 4). This may lie in the risk aversion characteristics of ESG. Furthermore, considering ESG factors in business operations may have a positive effect on cost control through technological innovation, the use of clean energy, and other reforms. This also indicates that adding ESG indices to investment portfolios can achieve higher returns.

Table 4: Comparison of Five-Year Returns between Eight ESG Indices and Benchmark Indices from 2017 to 2021

	Benchmark	Parent index	TOPIX MSCIACWI	Excess return (To parent index)	Ex r (benc
FTSE Blossom Japan Index	9.00%	8.03%		0.96%	1.
SCI Japan ESG Select Leaders Index	8.03%	8.03%		-0.01%	0.
SCI Japan Empowering Women Index ("WIN")	8.86%	8.03%	7.62%	0.83%	1.
S&P/JPX Carbon Efficient Index	8.80%	7.85%		0.95%	1.
S&P Global LargeMidCap Carbon Efficient Index	7.75%	7.62%		0.13%	0.
SCI ACWI ESG Universal Index (ex Japan and ex China A-shares)	14.58%	14.53%	14.55%	0.05%	0.

ningstar® Developed Markets Ex- n Gender Diversity Index(GenDi)	15.04%	14.45%	0.59%	0.48
E Blossom Japan Sector Relative Index	15.51%	15.40%	0.10%	0.95

Source: Official website of GPIF

GPIF originally designed to guarantee pension payments for retirees, has a longer investment horizon and puts more emphasis on stable returns rather than high risk returns. In the case of ESG investment, its characteristic is that the longer the investment period, the better the risk-adjusted investment performance, which can be seen by comparing the Sharpe ratio of the ESG index with the benchmark index. Figure 9 shows the relationship between ESG rating and Sharpe ratio of the domestic ESG index invested by GPIF. The Sharpe ratio of the index with higher ESG rating is significantly higher, which means better risk-adjusted performance. This clearly matches the operational objectives of GPIF.

Figure 9 Sharpe ratio of ESG index compared with TOPIX

Source: Official website of GPIF

(2) Carbon emissions of the GPIF portfolio

One of the most important reasons why the GPIF added ESG investments to its portfolio was to respond to the Japanese government's carbon neutrality goal. Although both the effectiveness of ESG investment and its impact on carbon neutrality should be studied from a long-term perspective, the analysis of greenhouse gas emissions of investment enterprises in the short term still has certain observation and reference significance. Therefore, the carbon emission of the GPIF portfolio is investigated from the two perspectives of carbon intensity and carbon footprint.

1. Carbon intensity of the GPIF portfolio

The investigation on the carbon intensity of GPIF portfolio mainly focuses on the division of investment regions and asset types. The GPIF divides all assets into four sectors: domestic equities, foreign equities, domestic bonds, and foreign bonds. The relevant bond sector, no matter domestic bonds or foreign bonds, only discusses the corporate bonds it invests in, and excludes the government and government-linked bonds that are not meaningful for investigation. The GPIF classifies investment companies by sector, and uses greenhouse gas emissions per million yen of sales as a statistical indicator based on their weighting in the portfolio. As of March 2022, the carbon intensity of the four plates is shown in Table 5. It can be clearly seen from the statistical data that the three industries with the highest carbon intensity are energy industry, public utility industry and material industry. Such a composition is not difficult to understand, the energy industry includes enterprises such as coal and oil, the public utility industry mainly includes the use of clean energy power companies, and materials industry mainly includes heavy industries such as chemical and steel manufacturing.

Table 5 Top six greenhouse gas emission industries of GPIF investee enterprises per million yen (unit: tons of carbon dioxide equivalent)

Industry name	Domestic stock	Foreign stock	Domestic bond	Foreign bond
Energy	27.48	51.58	26.80	47.30
Utilities	20.67	27.28	12.60	27.36

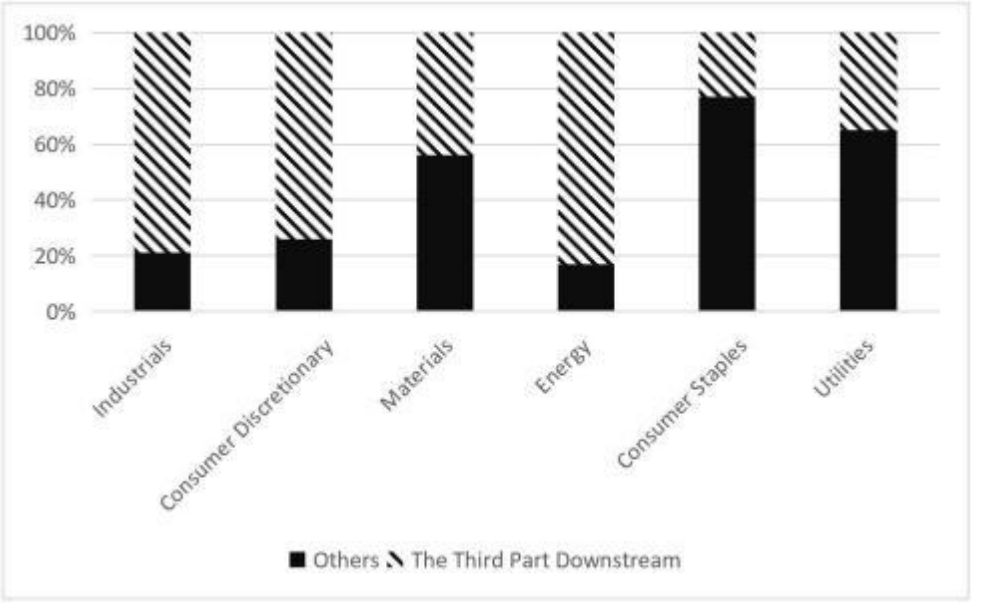
Materials	14.86	30.23	14.69	27.1
Industrials	13.15	13.51	7.21	11.6
Consumer Discretionary	8.61	7.06	11.26	9.24
Consumer Staples	4.81	5.84	3.76	8.0

Data source: Official website of GPIF

The statistical scope includes three main parts: the first part is the direct carbon emissions generated by enterprises in the production and manufacturing process; the second part is the indirect carbon emissions generated by enterprises in the manufacturing process due to the purchase of electricity; the third part includes the upstream and downstream parts. The indirect carbon emissions generated by other economic activities (such as production of raw materials, transportation of goods, travel of employees, etc.) during production and manufacturing are classified as the upstream and the indirect carbon emissions generated by sales and use of products and services are classified as the downstream. Through data analysis, it can be seen that indirect carbon emissions generated by product sales and use account for the largest share of the total carbon emissions of enterprises. The reasons may lie in two aspects. On the one hand, enterprises partly use clean energy in the production process and have a mature treatment system for waste discharge. On the other hand, a large amount of indirect carbon emissions will be generated in various scenarios during the use of products and services, such as automobile fuel consumption and electric power use of electronic equipment. Although not under enterprises' control, it also affects the total carbon emissions of enterprises. Therefore,

the GPIF not only pays attention to the carbon emission generated in the production process of enterprises, but also pays attention to the carbon emission management in the whole life cycle of products.

Figure 10 Greenhouse gas emissions in different product life cycles of various industries



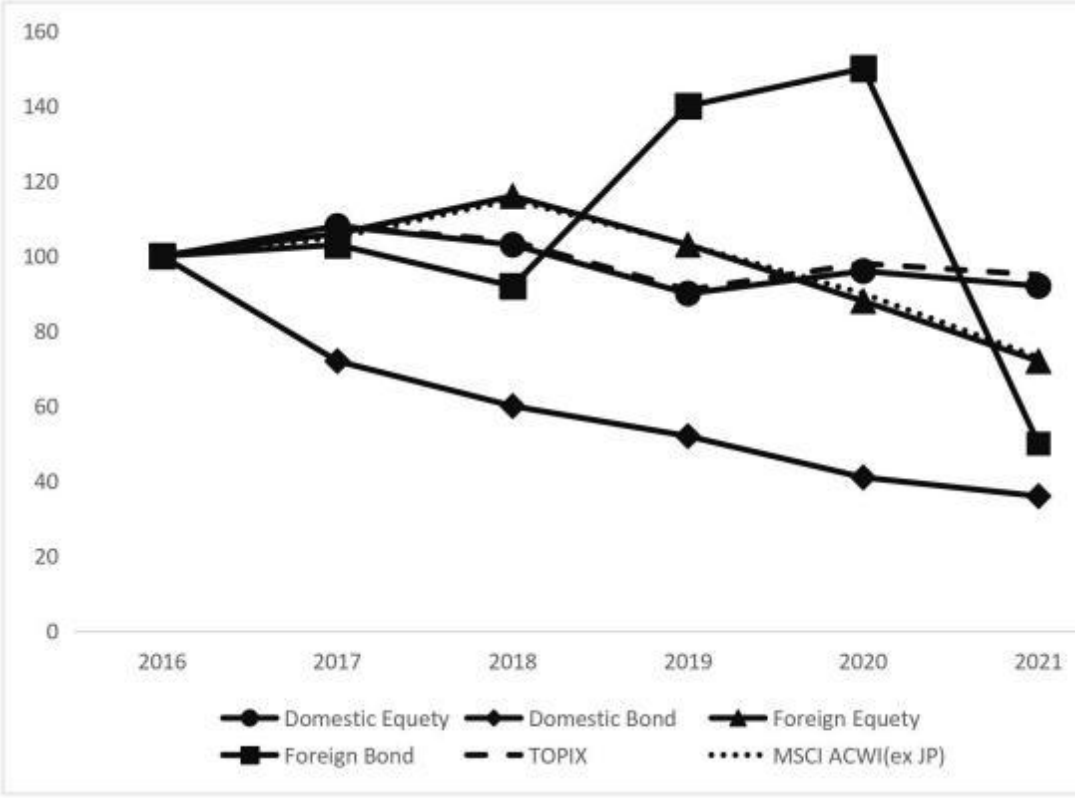
Source: Official website of GPIF

2. Carbon footprint of the GPIF portfolio

Carbon footprint refers to the total amount of greenhouse gas emissions produced by an enterprise in its business activities. The examination of carbon footprint is one of the important methods to measure the contribution of an enterprise to the goal of carbon neutrality. Using the 2016 carbon emissions as an initial value set at

100, the carbon footprint of the five years from 2016 to 2021 is shown in the figure below. As can be seen from the trend of the fold, there is a downward trend in carbon emissions for all four asset classes, with a significantly larger change in bond assets compared to equity assets, which may be due to the changes occurring in the industry types and scale of bond purchases. The main reason for the decrease in carbon emissions of domestic and foreign stock assets is the change in the shareholding scale of invested enterprises. As most of the investment methods are passive investment, the decrease in carbon emissions of the benchmark index TOPIX and MSCI ACWI is also one of the factors. Although the carbon footprint of the domestic plate is generally in line with the trend of TOPIX, it has obviously shown better performance than TOPIX in recent years. The main reason may be GPIF's use of the ESG index in passive investments in recent years. Changes in carbon emissions are unlikely to have the desired effect in the short term, but the GPIF's ESG management has been effective over the past five years of investment, which is a good sign for the Japanese government to achieve its goal of carbon neutrality in the long term.

Figure 11 Trends of greenhouse gas emissions from 2016 to 2021



Source: Official website of GPIF

V. Thinking and enlightenment

(1) Development of the strategic goal of carbon neutrality in China

The top-level design of sustainable investment in our country has been closely following the pace of The Times, the relevant system is becoming more perfect, and new policies have been introduced. After the start of the 14th Five-Year Plan, “the 14th Five-Year Plan for Economic and Social Development and the Long-Range Goals for 2035 of the People's Republic of China” once again emphasizes

the strategic position of green development in China's overall plan. It also sets a clear direction for achieving carbon peaking by 2035 and carbon neutrality by 2060. In September 2021, The State Council issued the "Opinions of the Communist Party of China Central Committee and the State Council on Fully and Accurately Implementing the New Development Philosophy and Doing a Good Job in Carbon Peak and Carbon Neutrality", which clearly pointed out that the "dual-carbon" goal is the inevitable choice to solve the resource problem and achieve sustainable development, and mapped out a roadmap for low-carbon transformation of various industries. In 2023, the Government Work Report points out that efforts should be made to strengthen ecological environmental protection and promote green and low-carbon development. In the face of the unexpected impact of the global epidemic on domestic and international economy in 2020-2022, improving the development of green finance and promoting the green transformation of industry will play an important role in economic recovery.

(2) Chinese pension fund investment difficulties

The balance of China's pension fund has been deteriorating since 2011, with the first deficit appearing in 2014, known as the pension gap. In the social background of population aging, it is not difficult to predict that the pension gap will increase, and utilizing pension fund investments to generate returns can alleviate the current crisis to some extent.

China's pension fund, the National Social Security Fund, is centrally transferred by The State Council to the National Council for Social Security Fund for unified management, and in 2015 began to explore the marketization of basic pension fund investment. However, as far as the current situation is concerned, the goal of maintaining and increasing the value of pension funds is still not optimistic. Under the background of the current economic downturn and high inflation rate, the implicit depreciation risk of pension funds is relatively large, and the market-oriented and diversified demand of pension funds investment is extremely urgent.

Adding ESG factor to the process of pension investment operation can increase the insurance in the process of the pluralistic reform of Chinese pension marketization. In order to make up for the pension gap, learning from the experience of developed countries, increasing the proportion of pension allocation in other categories of assets is a necessary process for the gradual improvement and upgrading of the pension system. Compared with a single conservative investment style, it is bound to face greater investment risks. From the perspective of the innate characteristics of ESG factors, adding such consideration in asset allocation will undoubtedly dilute the moral hazard caused by business ethics of the invested enterprise to a certain extent.

In the process of achieving carbon peak and carbon neutrality in China, adding the information disclosure requirement of ESG in the investment operation of basic pension funds is a practice of financial boosting the double carbon goal. This is not only conducive to the realization of China's green and sustainable development goals, but also conforms to the global trend and has practical significance for the common goal of coordinating international and domestic climate issues.

(3) Use mature experience for reference, promote the investment of Chinese pension fund ESG

Our country has entered a new development stage, in the period from extensive development to high-quality development, increasingly serious climate problems and our country's "double carbon" goal all pose severe challenges to all walks of life to realize green transformation. Under the circumstance that the pressure of pension payment increases in a futile manner, maintaining only conservative asset management is not the best solution to the current problem. The diversification and internationalization of pension fund investment management will become a breakthrough to seek reform. Adding ESG factor into the process of asset management can avoid some of the unexpected risk in the process of diversification and market reform of Chinese pension fund. Based on this, the management experience of Japanese government pension fund is worth learning from.

First, add ESG indexes to passive investments. Adding ESG Index to the process of basic pension fund investment in our country can, on the one hand, pursue the higher return rate to offset the pension payment gap, and on the other hand, avoid moral hazard to a certain extent by increasing the requirements of ESG of invested enterprises.

Second, we should invest in green bonds, social bonds, and sustainable bonds. When entrusting external institutions for asset management, we should require them to take ESG into consideration and account in portfolio such as allocate a certain proportion of green bonds after screening. In recent years, the scale of green bonds in the international market has grown rapidly, accompanied by the deepening of standardization and specialization. Adding green bonds to the asset allocation of pension funds is not only to improve long-term returns, but also to promote the development of domestic green finance and the realization of the "double carbon" goal.

Third, improve the annual investment report related information disclosure work. In addition to the establishment of sound investment criteria and regulations, the operation of any fund is more important to the subsequent effective supervision. This part of the main work will be completed through information publicity. It is necessary for the National Council for Social Security Fund of The People's Republic of China to disclose the non-financial information

in the annual investment report, and enrich the content of the report from the perspectives ofthe year's working promotion and the future goals. The gradual improvement in the quality and reliability of information disclosure has, to some extent, reduced unforeseen ethical risks.

Project Funding:

1. Philosophy and Social Sciences Research Fund Project of Chengdu University of Technology: "Research on the Effect and Optimization Path of Support Policies under the Background of Agricultural Power" (Project No.: YJ2023-QH001）

2. Major Special Project of Philosophy and Social Science Fund of Sichuan Province: "Ecological Civilization Implications of Chinese path to modernization and Sichuan Practice Research" (Project No.: SCJJ24ZD25)

3.National Social Science Fund Project "Research on the Practice and Experience of Urban Governance in Tibet related Areas in Four Provinces Led by the CPC" (Project No.:23CDJ042)