

An Analysis of The Innovation and Development of Policy Financial Institution, Japan Policy Investment Bank, Based on Entropy Weight-Multiple Regression Model

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Abstract. Policy-based financial institutions play an important and special role in the financial system. They have the characteristics of independent institutions, paid funds, moderate profits and quasi-common financial products, which affect the economic development. Therefore, this paper uses the entropy weight-multiple regression analysis method, using SPSS software as the platform, selects the relevant indicators of the Japanese economy and the relevant data publicly disclosed by the Bank since 2004, and selects the indicators with strong correlation and influence weight, which has important reference significance for the innovation and development of policy-based financial institutions in China. The results show that the innovation and development of Japanese policy investment banks is adjusted according to the national economic structure and development stage, and the service content of policy financial institutions is determined according to the main areas of market failure and low efficiency of resource allocation, so as to play an effective role in regulating resource allocation and solving the problem of market failure. Drawing on the useful experience of Japan, in the practice of innovation and development of policy-based financial institutions in China, it is necessary to fully reflect the will of the government, cooperate with the public policy, and adhere to the long-termism. In the course of operation, it is necessary to pay attention to the risk management of asset structure, take into account social rationality and economic effectiveness, and achieve sustainable development by the purpose and method of non-profit and moderate commercialization.

Keywords: Policy-Based Financial Institutions; Japanese Policy Investment Bank; Innovation And Development

1 Introduction

In the process of economic development, a country believes that the ideal situation of social resource allocation is Pareto optimal. However, the development of a country also needs social fairness and a safe and stable environment, and the allocation of resources needs to take into account both social rationality and economic effectiveness. Various systems and methods adopted can ensure the efficiency of resource allocation while solving market failures. In Japan's economic development, policy-based financial institutions assist the government to effectively solve the problems of individual and common market failures and resource misallocation faced by the economy in different stages, while taking into account social fairness

and stability and ensuring the quality of economic development. This is because the innovation and development of policy-based financial institutions can keep pace with The Times in their service content. This is because the innovation and development of policy financial institutions can keep pace with The Times and help the high-quality development of Japan's national economy. Therefore, it is very important to study the innovation and development of Japan's representative policy financial institutions and policy investment banks.

Development Bank of Japan (DBJ) is a policy financial institution with a separate entity. The government takes the lead in strategic innovation and development. It takes paid financial instruments as its main products and services, and its main funding sources are not limited to regular financial allocation. In 2022, the strategic innovation development of the Policy Investment Bank of Japan will be "to meet the changing needs of society and customers, promote sustainable operation to achieve economic and social value, and contribute to the realization of sustainable social development."^①

Japan adopts government intervention to solve market failure and improve the efficiency of resource allocation, which is a model of market economy model reform. Among them, policy-based finance plays an important role in promoting the development of Japan's economy. Policy-based finance can fundamentally optimize a country's macro-financial regulation system, and can act as an economic regulation or management means through its unique financial activities according to the level of economic development, making up for some defects and deficiencies in the market economic mechanism. Through direct or indirect (inducing commercial finance) financial activities, it can improve, perfect and optimize a country's macroeconomic resource allocation and regulation system and function^[1]. Supplement some defects or deficiencies in the mechanism and function of commercial finance, and correct some deviations in the selection of commercial finance. Among them, the policy-based financial institutions that play the role of policy-based finance have become an important part of Japan's economic main body. Development banks and policy investment banks that specialize in long-term investment in infrastructure and pillar strategic industries are the pillars and main players of Japan's advanced economic and financial development strategy and government-led market economic system^[2]. Therefore, learning from the innovation and development experience of Japan's policy investment banks is of great benefit to China's policy financial institutions to promote the high-quality development of China's economy.

2 Driving factors of innovation-driven development

In the current period of Japan's economy, there is a corresponding relationship between the market failure and the difficult allocation of resources and the main service content of Japan's policy investment banks. In different stages of Japan's economic development, the performance of market failure and government failure is different, but the common source of the problem still focuses on "externalities, information asymmetry and public goods". The policy-based financial institutions that play the role of policy-based finance, namely "Japan Policy investment Bank", can effectively reduce the market failure and improve the efficiency of resource allocation, and

^① Japan Policy Investment Bank disclosed 2022 semi-annual report:https://www.dbj.jp/pdf/CSR_disclo/2022/02.pdf

take into account both social rationality and economic effectiveness, which is conducive to the national economic development.

2.1 To achieve the government's goal of social rationality

Social rationality means that the allocation of resources should be conducive to the development of the economy, to the realization of the coordination of the relationship between various interests, and to the maintenance of social fairness, security and stability. In different periods of Japanese economy, market failure is caused by information asymmetry and public goods. Commercial financial institutions in the market subject make a series of profit-seeking choices from the perspective of rational people, which leads to unbalanced development of regional economy and industrial structure. The existence of phenomena such as the emphasis on short-term profits and the limited implementation of environmental protection policies, and market failure is prominent^{[3][4][5]}. The government has taken a series of policy measures, but the excessive financial pressure, market structure and other problems lead to the low efficiency of the government's public policy, little effect on the market, can not solve the problem of market failure.

Based on the government's endorsement, Japanese policy investment banks give full play to the role of capital siphoning and induce capital to flow into specific fields. Compared with the unlimited supply of long-term low interest rate funds, the demand side is idle to improve its own strength, resulting in dependence. With independent decision-making ability, the joint-stock group of Japan's policy investment bank adopts professional services and effective evaluation to provide consultation, paid financing and other services, which can ensure the effectiveness and sustainability of resource allocation. In terms of investment business, Japan's policy investment banks focus on core areas such as infrastructure, industrial and social development, increase the proportion of structural financing and fund investment for long-term loan projects, provide low-interest long-term loans for projects that meet the requirements, and provide funds for supporting areas by means of mezzo-level financing and equity financing in order to better play the siphoning and inducing functions of policy investment. In addition, the Japanese policy investment Bank also provides a variety of consulting services to increase the source of income, reduce the financial burden, and at the same time can use professional knowledge to help economic development.

In short, policy-based financial institutions are the tools for the government to develop the economy, implement macro management and implement development strategies, and achieve the social rationality of the government's financial resource allocation.

2.2 Meet the objective of economic effectiveness of market subjects

Economic efficiency means that the allocation of resources should eventually achieve certain economic benefits, with less input and greater output. We should give full play to the decisive role of market players in the allocation of market resources. Policy-based financial institutions do not actively compete with market players, do not participate or rarely participate in the areas of effective resource allocation and positive external effects, and only participate in the timely correction of market failures^[1].

The Japanese policy investment Bank is a joint-stock system but closely related to the government. First of all, they have greater autonomy. Innovation and development are not based

solely on policy orientation, and they can balance the interests of multiple parties to improve business efficiency. Secondly, its business purpose is non-profit but its business products are quasi-public goods. Finally, the public policy-oriented, paid, low-interest and long-term capital outflow, capital inflow from the financing of market subjects, adjust the capital structure while increasing income, strengthen risk management, improve the efficiency of capital use. The combination of the three can realize the "open source and reduce expenditure" at the management level, and fully meet the capital and service needs of market subjects.

3 The innovative development of Japanese policy investment banks promotes the high-quality development of the Japanese economy

Based on the comparison of the main service fields of Japan's policy investment banks, this paper finds that there is a corresponding relationship between the two and there is a certain internal connection. At the same time, a large number of scholars' research shows that the policy-based financial institutions that play the role of policy finance are conducive to economic development, and the impact of Japanese policy investment banks on Japanese economic development, innovative development and service areas worth learning from the adjustment need to be further studied.

3.1 Data source

This paper constructs a comprehensive evaluation index system based on the quality of economic growth reflected by its stability, effectiveness, coordination, sharing, innovativeness and sustainability^[6]. This paper evaluates the quality of economic growth in 30 provinces (autonomous regions and municipalities) in China based on the process and outcome^[7]. The process of economic growth is divided into growth efficiency, structure and stability, and the results of economic growth are measured by the distribution of residents' welfare level, the cost of ecological environment and the basic situation of the overall quality of the national economy. Combined with the concentrated areas of "market failure" in the stage of Japanese economy, this paper constructs the measurement system of Japanese economic development level from the perspective of economic stability, economic structure adjustment, residents' living standards and social security level. This paper selects 18 relevant indicators (see Table 1 for details) to reasonably measure Japan's economic development level from 2004 to 2020 by using the entropy weight method.

The selected indicators in Table 2 are the financial indicators of Japan's policy investment banks from 2004 to 2020, including four categories: basic indicators, assets, liabilities and profitability. In terms of investment business, Japan's policy investment banks focus on core areas such as infrastructure, industry and social development, increase the proportion of structural financing and fund investment for long-term loan projects, provide low-interest long-term loans for projects that meet the requirements, and provide funds for supporting areas by means of mezzo-level financing and equity financing in order to better play the siphoning and inducing functions of policy investment. In addition, the Japanese policy investment Bank also provides a variety of consulting services to increase the source of income, reduce the financial burden, and at the same time can use professional knowledge to help economic development.

Table 1 Indicators and interpretation of indicators

	Classification of indicators	Indicator name	Indicator explanation	Efficacy
Level of economic development	Steady economic development	Public finance expenditure (EXP)		+
		Producer Price Index (PPI)	Producer price index	-
		Gross agricultural product (GVAP)		+
		Retail sales (PRV)		+
		Employment rate (LAB)		+
		Population (POP)		+
		Number of corporate bankruptcies (BKR)		-
		Number of new housing units (NH)		+
	Economic restructuring	Unemployment rate (UR)		-
		Inflation rate (IR)		-
		Public finance R&D expenditure (E-R&D)		+
	Residents' standard of living	Per capita disposable income (GDPPC)	Per capita disposable income of residents	+
		Consumer Price Index (CPI)		-
		Household savings (SAV)		-
		Household Loan Amount (LIA)		+
		Household Consumption Index (HCTI)	Real household consumption expenditure/Real household consumption expenditure for 2020	+
	Level of social Security	Pension per capita (PENPC)	Amount spent on pensions/number of pensioners	+
		Public Health spending (PHS)		+

Note: ① "+" (-)" in the column of "efficacy" means that the index is positive (negative) under the set measurement method, the larger (smaller) the better.

② Data source: related data of Japanese economy publicly disclosed by Bank of Japan, Ministry of Finance, Ministry of Internal Affairs and Communications, World Bank and other websites.

Table 2 Names and explanations of financial indicators of Japan's policy investment banks

	Classification of indicators	Indicator name	Indicator explanation
Policy Investment	Basic Indicators	Total revenue (SIZE)	Includes revenue from other services such as consulting and asset management

Bank of Japan		Total income TAX (TAX)	Most are extremely low or even negative
	Assets	Loans (LO))	Mainly based on venture capital generation
		Securities (SU)	Debt formed by state guaranteed bonds, fiscal investment and financing bonds and investment through mezzanining, equity financing and other ways
	Liabilities	Borrowing (BR)	Mainly from public finance (fiscal investment and financing funds, etc.)
		Bonds and corporate bonds (DB)	Corporate bonds
	Profitability	Net profit (NP)	
		Return on assets (ROA)	
		Return on equity (ROE)	

Data source: collated according to the disclosure annual report of Japan Policy Investment Bank.

3.2 Methods

In this paper, the entropy weight-multiple regression analysis method is used to measure the economic development level of Japan from 2004 to 2020. The core idea is to use the entropy weight method to assign weights to each index on the basis of the standardization of indicators. Then the multiple regression method is used to analyze the influence of Japan's policy development bank on Japan's economic development level and the main ways.

3.2.1 The entropy weight method is used to measure the level of economic development

In the first step, in order to eliminate the inconsistency of different indicators in terms of order of magnitude and dimension, the range method is used to standardize the indicator X_{ij} of economic development level:

$$Y_{ij} = \begin{cases} \frac{X_{ij} - \min(X_{ij})}{\max(X_{ij}) - \min(X_{ij})}, & X_{ij} \text{ Be a positive indicator} \\ \frac{\max(X_{ij}) - X_{ij}}{\max(X_{ij}) - \min(X_{ij})}, & X_{ij} \text{ Be a negative indicator} \end{cases} \quad (1)$$

Where i represents the year and j represents the index; X_{ij} and Y_{ij} represent the original and standardized economic development level index values respectively, and $\max(X_{ij})$ and $\min(X_{ij})$ represent the maximum and minimum values of X_{ij} respectively.

The second step is to calculate the information entropy E_j of each index Y_{ij} in the level of economic development:

$$E_j = \ln \frac{1}{n} \sum_{i=1}^n [(Y_{ij} / \sum_{i=1}^n Y_{ij}) \ln(Y_{ij} / \sum_{i=1}^n Y_{ij})] \quad (2)$$

The third step is to calculate the weight W_j of each indicator Y_{ij} in measuring the level of economic development:

$$W_j = (1 - E_j) / \sum_{j=1}^m (1 - E_j) \quad (3)$$

The fourth step is to construct the weighting matrix R for each indicator in the economic development level:

$$R = (r_{ij})_{a \times m} \quad (4)$$

$$\text{Of which } r_{ij} = W_j \times Y_{ij}, \quad (5)$$

3.2.2 The multiple regression method is used to analyze the impact of Japan's policy development bank on the level of economic development and the main ways

$$R_t = \beta_0 + \beta_1 SIZE_t + \beta_2 TAX_t + \beta_3 LO_t + \beta_4 SU_t + \beta_5 BR_t + \beta_6 DB_t + \beta_7 NP_t + \beta_8 ROA_t + \beta_9 ROE_t + \varepsilon_t \quad (6)$$

β_0 Is the intercept; $\beta_i (i = 1, 2, \dots, 9)$ Is the regression coefficient of the model, is the random disturbance index, obeying the independent and identically distributed, and represents other indexes that affect $\varepsilon_t R$ outside the model; t represents the value of the TTH time series, the data disclosed in the TTH year, where., $(t = 2004, 2005, \dots, 2020)$

3.3 Analysis of results

3.3.1 Entropy weight method

According to the entropy weight method, the weights of 18 indicators selected in Table 3 that affect the level of economic development in terms of stable economic development, structural adjustment, residents' living standard, social security level, economic structural adjustment and sustainable development are calculated. After the range standardization, the entropy weight method is used to obtain Table 4, the level of economic development, which increased steadily from 2004 to 2020.

Table 3 The weights of 18 indicators calculated by the entropy weight method

	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18
Weight	0.06918	0.04579	0.06125	0.06844	0.09776	0.00653	0.05319	0.07847	0.06199	0.00882	0.05242	0.08371	0.05340	0.02539	0.05237	0.04779	0.06550	0.06800

Table 4 Results of the entropy weight method to measure the level of economic development in Japan

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Level	0.03709	0.03104	0.03045	0.02547	0.02644	0.02103	0.02214	0.02999	0.03552	0.03542	0.03055	0.03694	0.04893	0.05665	0.06944	0.07644	0.08706

3.3.2 Multiple regression analysis

The backward regression method was used, as shown in the P-P plot of the standardized residual distribution in Figure 1. The overall distribution was diagonal, and the assumption of normality of the residual was established. After excluding the variables with collinearity, the model with the best fitting effect is obtained based on (6) the influencing factors of Japan's economic development level: $R = 0.041 + 0.06TAX - 0.018SIZE + 0.024DB$ (7) the index total income has a negative impact on the economic development level, while the total income tax, bonds and corporate bonds have a positive impact.

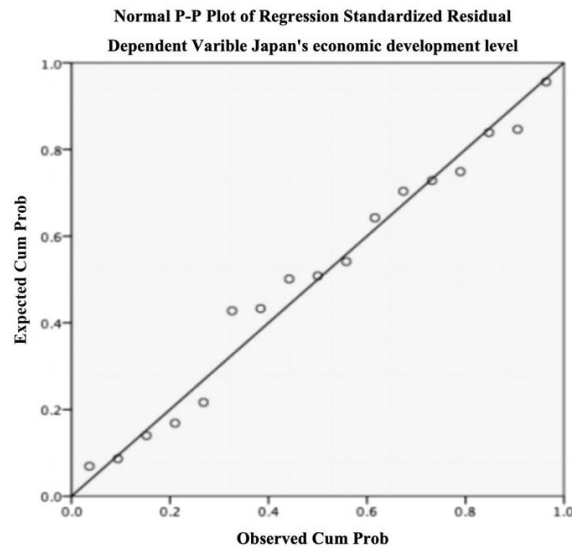


Figure. 1 P-P plot of the distribution of standardized residuals

4 Experience of innovation and development

The capital markets of both developed and developing countries are faced with the misallocation of financial resources caused by different market failures, which hinders economic development^[8]. China is in a period of exploring high-quality economic development in the new era. The experience of innovation and development of policy financial institutions, Japanese policy investment banks, is worth learning for China to solve the problem of market failure, improve the efficiency of public policy resource allocation, and promote high-quality economic development.

As a policy financial institution, Japanese policy investment banks start from the mission of practicing long-termism, reflecting public policies and promoting social development. They take non-profit and moderate commercial operation as the business goal and method, adhere to the consideration of social rationality and economic effectiveness in operation, combine the national economic structure strategy in different stages, based on the actual situation, Taking into account the demand objects of different periods, regions and industries, gradually adjust the mission innovation development and service fields.

4.1 Fully reflect the will of the government and cooperate with public policies

In this paper, the indicators that reflect the behavior of the state, such as public finance, health expenditure, total income tax and borrowing, are selected from the indicators of Japan's economic development level (Table 1) and the financial indicators of Japan's policy investment bank (Table 2). Through empirical analysis, the results of Model (7) show that the total income tax of Japan's policy investment bank has a positive impact on the level of economic development. The results of Model (7) show that the total income tax of Japan's policy investment banks has a positive impact on the level of economic development.

Japanese policy investment banks are closely related to the government. Their innovation and development and service fields fully reflect the will of the government and cooperate with public policies, while the government provides strong support for them, providing endorsement of government credit and preferential policies such as tax exemption^[9]. The objective and mode of non-profit-oriented operation reflect the non-profit public nature of policy finance. Through tax exemption, policy financial institutions in China should not take profit maximization as the goal and give full play to the function of assisting the government to improve the efficiency of resource allocation.

4.2 To provide moderately profitable financial services

The results of Model (7) show that bonds and corporate bonds have a positive impact on the level of economic development. The financing methods of Japanese policy investment banks include borrowing (mainly fiscal borrowing) and issuing bonds and corporate bonds (mainly state-guaranteed bonds). As shown in Figure 2, the proportion of Japanese policy investment banks' bonds and corporate bonds in total liabilities is relatively stable from 2004 to 2020. There is a slight increase. Return on equity represents the bank's capital use efficiency. Under the condition of maintaining low profit operation, the higher the capital use efficiency, the stronger the positive impact on economic development. The financing mode of Japanese policy investment banks is mainly market financing, which is paid by issuing bonds as the way of capital accumulation. At the same time, different from traditional finance and central bank investment, Japanese policy investment banks, which also emphasize social rationality, are characterized by paying for the financing of the capital demand side. Through paid financial instruments, they can "increase revenue and reduce expenditure", control the risk while increasing income, enhance the scrutiny of the demand side, and avoid or reduce the loss to the minimum. China's development financing institutions should not operate for the purpose of profit, but ensure moderate profitability, reasonable financing and investment, be responsible for their own profits, improve operating efficiency, and achieve sustainable development.

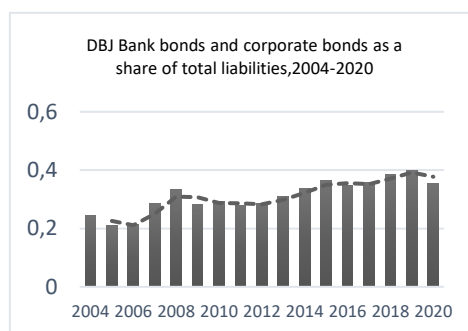


Figure. 2 Proportion of Japanese policy investment bank bonds and corporate bonds in total liabilities from 2004 to 2020

4.3 Rationalized asset structure

Policy-based investment business refers to the direct investment of funds or injection of funds by purchasing securities issued by the supported policy objects. The risk of assets formed through investment is relatively high. For policy-based financial institutions, the risk of their

asset structure comes from the following three perspectives: First, the capital investment is special, and most of them are weak areas with low or no return that commercial financial institutions are unwilling to get involved in, so the risk is inherent. The benefits of risk are future and long-term, but the losses are often immediate^[10]. Second, unsecured or special guaranteed loans. The credit objects of policy financial institutions are often to support the economic development of old, minority, border and poor areas, or to show specialized characteristics. Most of the loans are unsecured or special guaranteed loans (such as intellectual property guaranteed loans), with small default consequences, high risks and frequent losses. Thirdly, policy changes, the business objectives and scope of policy-based financial institutions are closely related to government policies, and they serve national industrial and regional development policies. Once the policy is adjusted, it will directly threaten the asset business of policy-based financial institutions.

In 2008, Japanese policy investment banks were transformed into shareholding system to strengthen market-oriented operation, make more prudent investment choices, attach importance to risk management, and further control the rapid growth of risk assets by adjusting asset structure. Model (7) shows that the growth of total income of Japanese policy investment banks has a negative impact on the level of economic development. As shown in Figure 3, prudent asset structure makes the asset adequacy ratio reach a high standard. However, the high adequacy ratio has a certain inhibitory effect on economic development. Therefore, China's policy-based financial institutions need to pay attention to the rationalization of asset structure and maintain it in an appropriate range.

At the same time, they can choose business diversification (such as increasing consulting business, asset management, etc.), organize collectivization to give full play to the advantages of professionalism and increase the source of income. As a comprehensive policy-based financial institution, Japanese policy investment banks can improve their operational efficiency through collectivization. The risk of asset structure is reasonably dispersed at the level of business and organizational structure.

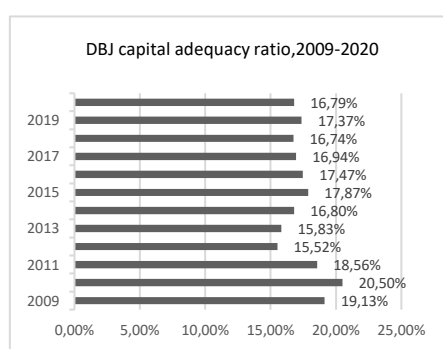


Figure 3 Capital adequacy ratios of Japanese policy investment banks from 2009 to 2020

Data source: collated according to the data disclosed in the annual reports of the Policy Investment Bank of Japan from 2004 to 2020

5 Conclusion

This paper studies the innovative development of policy financial institutions of Japan's Policy Investment Bank and finds that, in general, the positioning of development financing institutions is to adjust according to the national economic structure and development stage, and determine the service fields of development financing institutions in combination with the main areas of market failure and low resource allocation efficiency, so as to play an effective regulatory role in resource allocation and solve the problem of market failure. Learning from the beneficial experience of Japan, in the innovation and development of policy-based financial institutions in China, we need to adhere to long-termism, reflect public policies, and operate in a non-profit and moderately commercial purpose and way, while taking into account social rationality and economic effectiveness.

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