

Exploration of the Future Path for Empowering the Smart Elderly Care Industry Through the Development of Elderly Care Finance

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Abstract. As the population ages more quickly, the smart elderly care sector has emerged as a crucial avenue to address the issues surrounding elder care. However, obstacles to its growth include a lack of funding and a misalignment between supply and demand. Through risk management, payment guarantees, diversified financing, and other methods, pension finance is a crucial enabling tool that may support the modernization of the smart aged care sector. This study systematically analyzed the internal mechanism of elderly care finance empowering smart elderly care, including six dimensions: capital formation, payment guarantee, risk management, financial innovation, policy coordination and market cultivation, and proposed a collaborative path of "capital supply - demand activation - ecological coordination - institutional protection". Research suggests that by optimizing the investment in the three pillars of pensions, innovating the application of insurance funds, improving the payment system, building a fin-tech ecosystem and perfecting the regulatory framework, a deep coupling between pension finance and the smart elderly care industry can be achieved. Ultimately, this will promote the industry's development towards intelligence, scale and inclusiveness, and help address the challenges of an aging society.

Keywords: Pension finance, smart elderly care industry, financial innovation, supply and demand balance.

1. Introduction

The global aging process is currently getting deeper. China has aging challenges such rapid development, aging before being prepared, and aging before becoming wealthy. China has a deeply aging culture, with 220 million people 65 and older by the end of 2024, making up 15.6% of the nation's total population, according to figures from the National Bureau of Statistics [1]. According to the prediction of the China Population and Development Research Center, during the period from 2025 to 2030, the elderly population aged 60 and above will continue to grow rapidly, with the scale increasing from 320 million to 390 million. The country is currently struggling to address the impact of population aging on future development.

The elderly are increasingly seeking elderly care services that meet their high-level demands, including high-quality scientific care, medical integration, and smart services. Traditional elderly care models are confronted with numerous challenges, including lack of flexibility, single services, and imbalance between supply and demand [2]. In order to address the issue of elder care, smart elderly care has emerged as a significant innovation. By 2023, the size of China's smart elderly care market was estimated by the Smart Health and Elderly Care Industry Alliance to be around 6 trillion yuan, which is still far below the true market demand [3]. At present, China smart elderly care industry has moved from the exploration stage to the growth stage, mainly presenting the following two development trends: First, it closely follows technological development and actively utilizes existing technologies such as artificial intelligence and the Internet of Things to promote further intelligence in elderly care. Second, shift from basic guarantee to focus on the practical application significance of smart products, and enhance the scene diversity and demand differentiation design of products [4]. However, due to the incomplete exploration of industrial development, the current smart elderly care industry is confronted with problems such as insufficient supply, improper connection of industrial chain links, digital divide and an imperfect coordination mechanism between the government and the

market. Moreover, the long-term financing predicament it has faced is caused by the structural mismatch of traditional investment due to its unique attributes of long cycle, heavy assets, and thin profits [5-7].

China Pension Finance Development Report provides a clear definition of pension finance. Three components make up pension finance, which is the total of all financial operations done to satisfy the pension needs of society's members: finance for pensions, senior care services, and the senior care sector [8]. As pension finance has evolved, the multi-pillar pension model has emerged as the global standard [9]. However, at present, there are relatively few financial products for elderly care, especially long-term ones. There are very few innovative and distinctive financial services that can satisfy the demands of the senior population. In the personal pension system, "hot account opening but cold contribution" is a common occurrence [10]. Due to its public nature, the elderly care service industry has long been heavily dependent on government guidance and financial subsidies [11]. Many problems faced by elderly care service providers, such as an incomplete training system and low social recognition, have led to a shortage of professional and technical personnel, resulting in uneven service quality. This has hampered the industry's ability to grow healthily and caused a blow to the senior care sector and the creation of associated financial products.

The aforementioned literature review indicates that there is a high degree of alignment between the development characteristics of smart senior care and the exploration and construction sector of pension finance. Therefore, this paper will base on the current development status, through methods such as literature research, policy analysis, and case analysis, sort out the predicaments in their development. In this context, by fully acknowledging the significant role of financial technology in the smart elderly care industry, a future path for elderly care finance to empower smart elderly care will be constructed, providing strong support for China's active response to population aging.

2. Examining the Intrinsic Link between Pension Finance and the Advancement of the Smart Elderly Care Industry

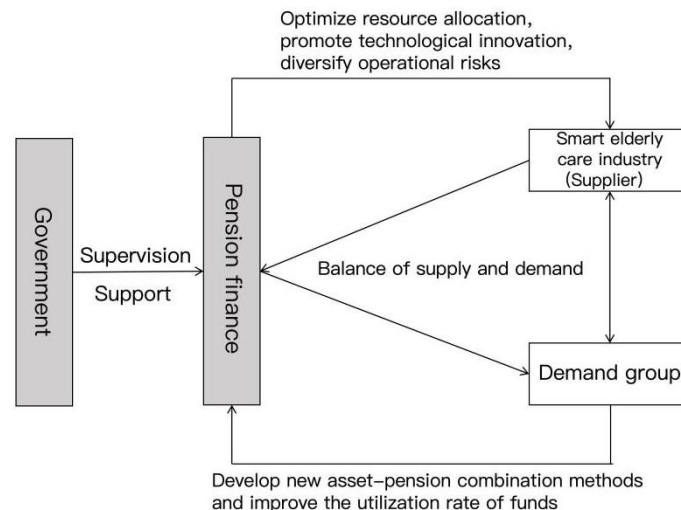


Figure 1. The internal connection between pension finance and the development of the smart pension industry (Picture credit: Original)

As shown in Figure 1, the bottleneck of consumption capacity for smart elderly care can be broken through wealth accumulation and payment guarantee. Pension finance provides an economic basis for the elderly to purchase smart pension products and services through long-term wealth accumulation according to the life cycle theory. Through various financial products, it helps residents to plan and accumulate funds from a young age, covering the wealth reserve needs at different stages of life, ensuring that with the growth of age, there is a continuous accumulation of funds to cope with pension expenses, meet the needs of residents and provide a purchasing power basis for smart pension consumption.

As shown in Figure 1, long-term capital supply is used to inject sustainable power into the smart elderly care industry. As the smart pension industry is characterized by large initial research and development investment, long return cycle and high risk, the development of the whole life cycle of the industry can be supported through diversified investment and financing methods, and insurance funds can be invested in the initial or growth stages of smart pension enterprises through private equity and venture capital.

As shown in Figure 1, the resistance to the promotion of smart elderly care is reduced through risk management and credit enhancement. Smart elderly care services implementation can be risky due to technical failures and payment defaults. According to risk management theory, elderly care finance can lower the market participation threshold through a risk dispersion mechanism. For instance, insurance companies can develop exclusive insurance products for the smart elderly care scenario, such as "Smart Device Failure Liability Insurance" to compensate for accidental injuries to the elderly caused by device failure, and "Home Service Liability Insurance" to cover disputes arising from operational errors by caregivers.

3. Main Issues and Challenges of Pension Finance Empowering the Smart Elderly Care Industry

3.1. Supply-side Structural Issues

China's pension system has been built around three key elements, which include the national old-age insurance system, the enterprise annuity system, and personal savings after years of research. The pension system is able to deal with the peak of aging with a strong support provided by a sustainable development cycle, which has been formed structurally. However, the three subsets of China's pension finance have not yet been coordinated and in close connection as a macro financial system [12].

The uneven structure of China's pension finance is mainly due to the fact that the first pillar's financial support level is approaching a critical point at the moment, while the second and third pillars are not being developed sufficiently. The China Pension Actuarial Report 2019-2050 predicts that China's participation rate will increase from 37.7% to 81.1%. If this trend continues, the fund balance will form a deficit in 2028 and be exhausted by 2035 [13]. However, the coverage rate of the second pillar after increasing the occupational annuity is only 15% of the total number of employees covered by the enterprise annuity in China [14]. Due to its short promotion time, the personal pension system is experiencing a trust crisis as the third pillar, few financial products and inadequate system design. From this point of view, the complementary role of the second and third pillars has not been fully played, and the fund protection is still "one-sided".

For elderly care service finance, the designers' pursuit of "short-term high returns" for the products is inconsistent with the risk-averse characteristics of the elderly group, resulting in a mismatch between supply and demand in the design of financial products.

From the perspective of elderly care industry finance, there are currently significant characteristics such as uneven capital allocation, uneven regional development, and strong reliance on government subsidies, which have suppressed the development of the industry.

The characteristics of large initial investment, long return cycle and high risk in the smart pension industry have exacerbated the imbalance of fund matching, making the credit support for asset-light and innovative smart pension enterprises "reluctant to lend", and more than 90% of the financial support comes from the government. Pension financial products are not highly distinguishable from ordinary financial products, thus having limited appeal to investors. For the truly suitable scenario of smart pension, such as loans for home aging transformation, exclusive and refined financial products to solve the subscription payment scheme of smart pension services are in insufficient supply. The accessibility of financial services for the elderly needs to be improved when dealing with the digital divide of the elderly [15].

3.2. Insufficient Driving Force on the Demand Side

The current smart elderly care sector is confronted with multiple challenges. Firstly, due to the varying income levels of the elderly, when faced with financial products with a single hierarchical classification, some elderly people have insufficient effective payment capacity and willingness, making it difficult for them to form effective demand for smart products and services with relatively high prices. Moreover, due to the high service threshold, low universality and obstacles to inclusiveness, consumers have low awareness and trust of such products and services, which further affects their adoption intention [1]. Secondly, the problems of low financial literacy and information asymmetry are also quite prominent. Most elderly people lack financial knowledge, which directly leads to obstacles in their understanding and application of financial tools. They face many difficulties in obtaining and using smart elderly care financial services. In addition, the coordination of the payment system is insufficient. *The Statistical Bulletin on the Development of Human Resources and Social Security of China in 2024* shows that at the end of 2024, the basic old-age insurance fund had accumulated 8,722.6 billion yuan in assets, while the fund's investment and operation volume was 2.34 trillion yuan. Funds are still available to support the development of the smart elderly care industry with considerable investment space. Individual pension accounts currently have an annual contribution limit of 12,000 yuan. The cost of high-end smart elderly care services cannot be covered by this amount, which hinders the development of smart elderly care.

4. Mechanism and Path Design for Empowering the Smart Elderly Care Industry with Elderly Care Finance

To fully leverage the enabling role of old-age finance in the smart old-age industry, it is essential to build a systematic path with multi-level, multi-agent collaboration and full chain coverage for future comprehensive development. This study integrates financial supply-side reform, payment system optimization, market ecology cultivation and policy guarantee mechanism. A closed-loop empowerment system was designed and formed.

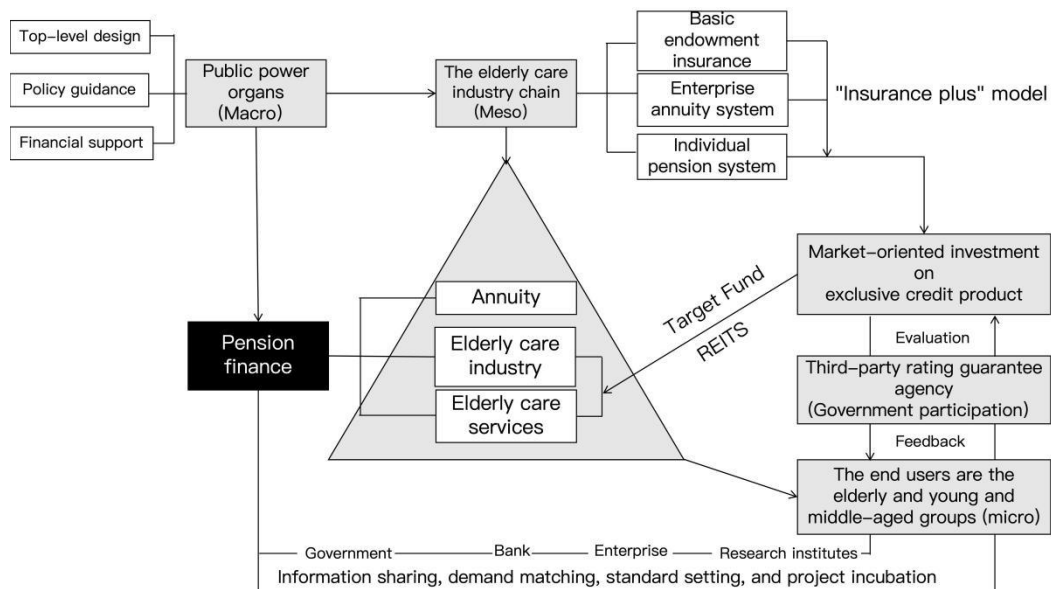


Figure 2. The path design of empowering smart industries with pension finance (Picture credit: Original)

As shown in Figure 2, policies, regulations and regulatory frameworks should be improved at the national level to ensure sustainable development by improving the legal norms of smart pension financial products, such as data privacy and device access standards, and establishing an inter-departmental collaborative supervision mechanism by the central bank. Innovation and risk control are a part of the activities of the Banking and Insurance Regulatory Commission and the Health

Commission. And further optimize the institutional environment through fiscal and tax incentives, such as additional deductions for research and development and equipment purchase subsidies.

As shown in Figure 2, within the industry, supply-side reform is deepened and channels for funds are broadened by optimizing the three-pillar pension system, expanding the investment scope of individual pension, setting up a special fund for smart pension, and promoting the allocation of pension technology equity for enterprise annuity. The pension target fund can be included as a qualified default investment option by learning from the Pension Protection Act (PPA) of the United States, employers can be exempted from liability to invest pension into the products in QDIA to help investors overcome wrong asset allocation decisions. The insurance funds will support the smart pension heavy asset project in the form of equity investment and debt plan, and establish a national smart pension industry development plan, enhance the design of financial empowerment at the highest level, and utilize social capital participation. At the same time, innovative financial instruments, the development of smart pension special credit, supply chain finance, REITs and other adaptive financing products to meet the capital needs of all links of the industrial chain.

China has been gradually developing the use of personal pension accounts to guide the targeted allocation of funds. For instance, the Bank of China has built the "Suyue Yiyang Smart Elderly Care Platform" in Suzhou. Through diversified forms such as sharing of technological systems, online display and payment, and exclusive rights redemption, it explores the creation of a "finance +" elderly care ecosystem closed loop - the funds in the account not only enjoy investment returns, and can direct deduction wisdom pension community rooms or equipment rental cost. This "fund locking + scenario binding" model not only ensures the long-term appreciation of pensions but also specifically activates the consumption demand for smart elderly care.

As shown in Figure 2, the smart pension payment system of the user side should be improved to activate the potential of the consumption side by promoting the social security system, such as long-term care insurance and personal medical insurance accounts, to cover eligible smart elderly care devices and services, and lower the threshold for the elderly to use them. Encouraging commercial insurance to innovate models such as "Smart Elderly Care consumption insurance" and "Service subscription installment" to alleviate payment pressure. The establishment of the Pension Investment Fund (GPIF) can be learnt from the Japanese government to manage the surplus funds of pensions mainly by entrusting external institutions to operate (80%) for fund management. The elderly can obtain annuity and additional medical fund support through the agent, and the trustee bank can integrate the property assets of the principal in advance to form a larger asset pool, which not only increases the investment income of the principal and agent, but also improves the use efficiency of funds.

As shown in Figure 2, a smart elderly care fin-tech ecosystem should be built to promote cross-border integration by establishing a "government-bank-enterprise-research" collaborative platform to promote data sharing, standard setting and technology transformation; Financial institutions and technology enterprises can cooperate to develop financial products suitable for the elderly, such as developing voice interaction financial management apps to support the elderly in managing their finances independently through voice assistants. Technologies such as block chain and AI can be applied to optimize risk control models and reduce information asymmetry; A smart elderly care industry alliance can be established and integrate supply chain resources to form a closed loop of "technology research and development - financial support - service implementation". Debra ca-faro companies in the United States adopt the unique "REIT s + operators" mode has a strong reference. Debra ca-faro through science and technology, assets, triple play service, developed the Ventas Smart Care platform, consolidated elderly care communities, such as independent living communities, assisted living communities, and professional care facilities, and continuing care retirement communities through the integration of Internet of Things devices and health data with technology companies, reducing labor costs by 25%, operating costs have been reduced by 18-22%. In 2023, Ventas launched the "Neogene Elderly Community Program ", investing 500 million US dollars in intelligent upgrades, adding an AI health monitoring system, and piloting robot-assisted care services.

5. Conclusion

The smart elderly care industry's development hinges on the importance of elderly care finance in light of rapid aging. On the one hand, enhancing the fund management level of the first and second pillars can ensure the steady increase of pensions and provide a solid economic foundation for old age. On the other hand, promoting and managing the account products of the third pillar well can help stimulate individuals' enthusiasm for participating in pension planning and broaden the sources of pension funds. The trend of integrated development of elderly care finance and smart elderly care has been closely observed by Chinese financial and insurance institutions, and have been actively exploring and practicing to play the role of advisors for financial institutions in the smart elderly care industry. Further enrichment of the financial product system for elderly care is encouraged, taking into account the risk preferences, income levels, and needs of various groups of elderly people. Taking Ping An Insurance of China as an example, it takes "comprehensive finance + medical care for the elderly" as its core development strategy. With the deep integration of information technology and medical care services, it creates a smart pension model and forms a closed-loop service circle of "insurance + service", which not only improves its own business competitiveness, but also provides a useful reference for the development of the industry.

In terms of policy, it is suggested to strengthen the supervision of elderly care financial products, standardize the product design, sales and investment operation links, protect the rights and interests of consumers, and prevent financial fraud and illegal fundraising from occurring in the elderly care field. The pension financial payment system requires further enhancement, and the upper limit of contributions should be moderately increased. Enterprise annuity, occupational annuity, and individual pension accounts should be appropriately integrated to expand the scope of fund utilization and strengthen pension payment capacity. It is essential to conduct a variety of financial literacy programs aimed at improving the elderly population's understanding of financial matters. It is necessary to optimize the financing environment for the smart elderly care industry, which includes enhanced credit support for this sector. Collaboration between financial institutions and technology companies is encouraged to develop a smart elderly care financial service platform that utilizes advanced technologies like big data, artificial intelligence, and blockchain. To enhance the overall quality and efficiency of smart elderly care services, the evaluation system for services needs to be refined and an effective information-sharing mechanism established to eliminate information silos.

With the continuous promotion of policies, the active innovation of financial institutions and the constant empowerment of technology, the elderly care finance and industry will usher in a new situation of deeply coupled development. Through the linkage mechanism of "financial tool innovation to leverage capital - payment mechanism to activate demand - ecological collaboration to enhance efficiency - policy protection to prevent risks", the smart elderly care industry will accelerate its progress towards intelligence, scale and inclusiveness, providing substantial support for China's active response to population aging and advancing the sustainability of the social economy.

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