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The Time Bank Mutual Assistance Pension Model: An Empirical Study on the Mechanisms of Influence among Different Stakeholders

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ABSTRACT: *This study aims to explore the mechanisms of influence among different stakeholders in the operation of the Time Bank Mutual Assistance Pension Model. Based on stakeholder theory, data were collected through a descriptive cross-sectional study and self-administered structured questionnaires, and then analyzed using SPSS software. The results indicate that government pricing design rules, the level of regulation of the Time Bank model, and the extent of blockchain technology application play a significant role in influencing elderly individuals' willingness to participate in the Time Bank. The study finds that government pricing design rules impact the participation willingness of the elderly, with reasonable pricing rules enhancing their willingness, while the level of regulatory norms in the Time Bank model and the degree of blockchain technology adoption also significantly affect participation intentions. The contribution of this research lies in constructing a multi-factor interaction theoretical framework for the Time Bank, providing empirical support and theoretical innovation for the development mechanisms of pension models. Future research could deepen the understanding of the mechanisms influencing the willingness of elderly groups to participate in the Time Bank model by increasing the study subjects, expanding the data collection period, and considering additional influencing factors.*

***Key Words**: Participation Willingness, Stakeholder, Time Bank.*

1. Introduction

The purpose of this study is to explore the intrinsic driving mechanisms and interactions between the pricing standards for time currency set by government organizations, the blockchain technology used by community enterprises, and the participation willingness of elderly individuals. By investigating this multi-factorial mechanism, we aim to gain a more comprehensive understanding and optimize the social participation environment for the elderly, thereby fostering a harmonious situation that benefits multiple stakeholders. According to the World Population Prospects report released by the United Nations Population and Development Commission at its 51st session in 2019, the proportion of the global population aged 65 and above increased to 7.6% by 2010, and is expected to reach 16.2% by 2050. However, the current caregiving service model is relatively simplistic and unable to meet the diverse needs of the rapidly growing aging population. Consequently, the demand for caregiving services among the elderly and their families is expected to continue rising. China, as the country with the largest elderly population in the world (Wu et al., 2024), faces increasingly urgent issues related to an aging society. The differentiated needs of elderly individuals have become a major focal point of attention (Hou et al., 2022). However, initiatives aimed at supporting the elderly are often driven by one-time investments from national or lower-level government

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entities, which can pose significant challenges to the human and financial resources at the community level (Russell et al., 2022).

It is noteworthy that if a significant proportion of older adults still possess the ability to contribute to society, this phenomenon could offer constructive insights into addressing the challenges of population aging. Consequently, in the later stages of life, volunteer activities have increasingly become a focal point in the field of health promotion, with their role in enhancing health receiving broader recognition and attention (Filges et al., 2020). Volunteer services are beneficial in improving the health of older adults, preventing depression, and enhancing quality of life (Chan et al., 2021). In addition to fostering a spirit of mutual assistance, volunteer services also significantly strengthen the caregiving support capabilities within communities, thereby potentially reducing the dependency on professional caregivers (Lu et al., 2023). One potential innovative strategy is to incorporate time banks into the social care system (Lu et al., 2024). As a form of community economy, time bank is a way for people to come together and help each other(Seyfang G&Smith K,2002),facilitate exchanges using time currency (Glynos et al., 2023). Although time banks are a thriving form of community currency(Collom,2005),while some organizers of time banks have focused on introducing innovative strategies to more effectively address the diverse social service needs within communities, the actual outcomes have not met prior expectations. Public participation remains insufficient, and lower levels of engagement are subtly undermining the efficiency of service exchange mechanisms and the optimization of resource allocation (Leung et al., 2022). Therefore, researching the factors influencing older adults' participation in the "time bank" mutual aid model is a critical avenue for improving the efficiency of volunteer service exchange mechanisms and the redistribution of social resources.

It is worth noting that in many studies, different scholars have investigated the various factors influencing older adults' willingness to participate in mutual aid elderly care models, thereby offering suggestions to improve the "time bank" model of mutual aid care. For example, in studies on the willingness of older adults to participate in the "time bank" model, in the context of a shortage of volunteers within the elderly volunteer workforce, younger elderly groups have been used as the primary analytical subject to explore their participation motivations. The research has found that multiple variables, such as the nature of the activity, service locations, and time arrangements, have significant effects on either encouraging or inhibiting older adults' willingness to participate (Cao et al., 2018). Other scholars emphasize that personal motivation and values are the core driving forces behind participation in volunteer services. By tracing the behavioral patterns, driving forces, and value changes of younger elderly volunteers, suggestions have been made for the deepening of volunteer service initiatives and the optimization of time bank projects (Liu, 2021). This indicates that the factors influencing older adults' participation in the "time bank" mutual aid model can be categorized into external factors, such as the advantages and disadvantages of service projects, and internal factors, such as personal values. Research aimed at enhancing the willingness of different groups to participate in mutual aid elderly care models can address a variety of these influencing factors. Notably, some scholars have selected specific elderly populations from particular locations as research samples to comprehensively explore the impact pathways of various variables on the willingness of older adults to participate. Furthermore, they have pointed out that further investigation is needed to explore whether cognitive level and risk awareness act as mediating factors in this process (Hu, 2022).

Through reviewing the viewpoints presented by scholars on the factors influencing participation willingness in the "time bank" model, it can be observed that most existing studies primarily focus on participation motivation and external factors. However, during the operation of "time bank" related institutions, there has not yet been a uniform standard for the pricing and acceptance rules of "time currency." Additionally, the impact of risk regulation within the operational process on the participation willingness of the elderly population has not reached a consensus in the academic community.

Therefore, this study begins by examining the risk factors in the operation of the "time bank" mutual aid elderly care model. It explores whether the policies introduced or implemented by stakeholders in the area of risk regulation have a significant impact on the participation willingness of older adults. Using stakeholder theory, which posits that business management should take into account the interests of a broad range of stakeholders—such as shareholders, employees, customers, suppliers, communities, and governments—rather than focusing solely on shareholder interests, this research identifies three key stakeholders: government organizations, community enterprises, and elderly groups. The study investigates the mechanisms through which the relevant policies and measures of both government and community

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organizations affect the participation willingness of older adults. A survey is distributed within the community to understand the awareness of Chinese elderly individuals, living in an aging society, regarding the "time bank" mutual aid care model. Based on the data collected from the survey and employing SPSS techniques alongside Process statistical methods, the study analyzes the impact mechanisms of the regulatory standards of the "time bank" and the execution of related policies by stakeholders—government and community organizations—on the participation willingness of older adults.

This study offers several marginal contributions. First, in contrast to the aging perspectives prevalent in Western countries, where the elderly often embrace a more institutionalized care approach, the elderly population in China tends to favor a "root-return" philosophy, emphasizing family-based care. However, the "time bank" mutual aid elderly care model originated in Western countries, and the attitudes of elderly populations differ across regions. By using Chinese local communities as the research sample, this study is well-positioned to explore a mutual aid elderly care model more suited to China's context. Second, this research pioneers an investigation into the "time bank" mutual aid elderly care model within typical Chinese community settings, addressing the current gap in domestic literature, which primarily focuses on theoretical discussions. There is a lack of empirical studies exploring the relationship between the degree of regulation in time banks and the level of mutual trust. Third, existing research on mutual aid elderly care in China often relies on role or regional samples but lacks data from elderly populations within communities. By using survey data collected from local Chinese communities, this study fills the gap in community-based samples and provides real-world data on the factors influencing the participation of elderly individuals. Lastly, by integrating the regulatory aspects of the "time bank" mutual aid model with the actions of stakeholders, this study explores the relationship between the level of regulation and participation outcomes. This approach helps build trust in the model among participants, thereby facilitating the broader implementation of the "time bank" system in China. This, in turn, can enhance resource utilization and contribute to the development of an elderly-friendly society.

The remainder of this paper is organized as follows: Section 2 presents the relevant literature related to this study. Section 3 outlines the research hypotheses and questionnaire design based on the theoretical framework and relevant guidelines. Section 4 provides a detailed analysis of the questionnaire data and presents the results of the empirical research. Section 5 discusses the implications of the findings and highlights the limitations of the study.

2.Literature Review

In April 2002, the World Health Organization published the report Active Ageing: A Policy Framework, formally introducing the concept of "active ageing." From the theoretical perspective of active ageing, the time bank, as one of the specific manifestations of mutual aid retirement models, holds significant practical relevance (Chen, 2020). A time bank refers to a system in which participants deposit the time they spend caring for other elderly members of the community. When they encounter difficulties in their later years, they can withdraw their deposited time and receive corresponding care from others (Edgar, 1980). Time credits are earned for each hour of voluntary service given, and can be used to purchase services from other members in return(Seyfang G,2003). For example, one hour of decorating can be "deposited in the bank" and later exchanged for one hour of computer tuition or shopping assistance. Unlike market economies, a unique feature of this community-based economy is that all labor time is equally valued (Glynos et al., 2023), and all services are assessed equally (Kakar, 2020). This mutual aid retirement model can address the challenges posed by insufficient human and financial resources to meet the collective needs of an ageing population. However, the implementation of this model involves issues such as providing services of equal value and the time lag in service exchanges. Consequently, participants' willingness to engage in the project is influenced by the level of regulatory oversight regarding project risks.

Edgar S. Cahn, the originator and proponent of the "time bank" concept, emphasized the crucial role of government legislation and policy support in the development of time banks when introducing the specific concept of time banking (Cahn, 1999). In-depth studies have shown that time currency, issued based on national credit, serves as an innovative social mutual aid medium. Its potential lies in its ability to significantly enhance community cohesion and the willingness to help one another. However, the credit system for time currency remains underdeveloped, and there are ambiguities in its exchange standards and the evaluation of service value (Lu et al., 2017). Some scholars have pointed out that due to the relatively

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unique operational mechanism of the time bank mutual aid retirement model, the value of the services provided within the time bank differs from that of market-based services. As a result, establishing a reasonable pricing mechanism for "time currency" has become a challenge (Lu et al., 2021). As a form of community economy that circulates time currency, the government's establishment of clear and accurate pricing standards and acceptance rules for the project directly impacts participants' risk perception and trust levels. This, in turn, indirectly affects the willingness of elderly individuals and their families to participate in the time bank mutual aid retirement model. Therefore, by examining the time currency, this study analyzes the impact of pricing standards and acceptance rules on the participation willingness of elderly individuals, offering recommendations for improving the mutual aid retirement model.

Meanwhile, the application of Internet of Things technology can also play a significant role in mitigating regulatory risks within the "time bank" system.Although timebanking takes advantage of web technologies, the lack of flexibility in managing web-based timebanking transactions still remain as major challenges(Han K et al.,2015). As one of the most disruptive information technologies today, blockchain technology holds considerable potential for risk management in supply chains (Wang, 2023). Applying blockchain technology to the field of eldercare service time banks can demonstrate its technical advantages and innovative prospects, aiming to promote the development of community-based eldercare services with the support of blockchain (Xu &Liu, 2023). Furthermore, some scholars have systematically explored the feasibility of integrating "time banks" with blockchain technology from the perspective of social exchange theory, emphasizing the important theoretical significance and potential value of this combination at the national institutional level (Guo et al., 2021). Therefore, as the main operational body of "time bank" projects, community enterprises can use blockchain technology to reduce risks in regulatory oversight, thereby indirectly influencing the willingness of elderly individuals to participate. Further investigation into whether the impact of blockchain adoption on participation willingness is significant is crucial for enhancing the vitality of "time banks."

In summary, this study posits that examining the pricing standards of "time currency" set by government organizations and the application of blockchain technology by community enterprises can elucidate the mechanisms by which both factors influence elderly individuals, thereby enhancing their willingness to participate through risk regulation, and improving overall efficiency. In studies of the factors influencing elderly people's willingness to participate, some scholars, constrained by limited human and material resources, have opted to conduct research through literature reviews and analysis of online news reports. By exploring the localized models of "time bank" mutual care, these scholars aim to increase the participation of elderly individuals (Sui et al., 2019). Although this approach is supported by a substantial body of literature, it lacks empirical data and fails to accurately capture the true intentions of the elderly population. Additionally, other scholars have employed team-based community visits, in-depth interviews, and surveys targeting younger elderly individuals. They analyzed the data from these surveys, combining them with literature, to investigate six key factors—such as participation location, participant demographics, and service time—and proposed measures to enhance the participation willingness of younger elderly individuals (Cao & Wang, 2018). However, this approach did not integrate data analysis methods, leaving the relationships unverified and unsupported by robust data analysis. By combining surveys with SPSS analysis, a more comprehensive research perspective can be provided to understand the factors influencing elderly individuals' participation in mutual care models. Mixed-method research can offer practical and realistic insights into the research process (Tilzey et al., 2020). This integrated approach not only allows for a deeper understanding of the direct stakeholders—i.e., the elderly population—regarding their awareness and participation in the mutual care model, but also provides concrete data for studying the impact of time bank risk regulation on the elderly's willingness to participate. Furthermore, the results of the study can inform targeted recommendations to improve the participation and outcomes of elderly individuals. Therefore, this research, from a stakeholder perspective, proposes hypotheses and conducts surveys and data analysis to verify how the risk regulation practices of stakeholders influence the participation willingness of the primary stakeholders. The next chapter will discuss the hypothesized relationships between the three stakeholders and their mechanisms of influence.

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3.The Formulation of Research Questions and Hypotheses

3.1. Theoretical Model and Research Hypothesis

The theoretical foundation of this study is stakeholder theory. Stakeholders are generally described as "any group or individual who can affect or is affected by the achievement of an organization's objectives," encompassing various types of participants both inside and outside the organization (Freeman, 1951). Currently, there is no single, universally accepted definition of stakeholders, as the term itself is somewhat contentious (Phillips, 2011). However, most existing definitions suffer from a lack of operational clarity, often remaining at the level of academic abstraction, which limits the practical application of stakeholder theory. The introduction of Mitchell's typology significantly enhances its operability and has greatly advanced the practical use of stakeholder theory (Jia & Chen, 2002). Therefore, this study adopts Mitchell's stakeholder typology to define the stakeholders relevant to the research.

Mitchell's typology primarily defines stakeholders based on three dimensions: legitimacy, power, and urgency. After classifying these characteristics, stakeholders can be further divided into definitive stakeholders, expectant stakeholders, and latent stakeholders, depending on the number of characteristics they satisfy. As shown in Figure 1, the elderly group, as a direct stakeholder, holds legitimacy, power, and urgency with respect to the "Time Bank" mutual assistance elderly care model. Addressing the needs and demands of this group is beneficial in increasing their willingness to participate, thus facilitating the promotion of the "Time Bank" model, making them definitive stakeholders. Government departments, as policymakers and issuers of policies, can directly engage in the process of formulating policies related to the "Time Bank" mutual assistance elderly care model. Given the increasing aging population, their influence on resolving elderly care issues is of short-term urgency. They also satisfy legitimacy, power, and urgency, making them definitive stakeholders. Community enterprises can provide essential technical support for the operation of the "Time Bank" model, and their involvement can promote the development and dissemination of the mutual assistance elderly care model. They satisfy legitimacy and power, categorizing them as expectant stakeholders. At the same time, unlicensed individual service providers, small informal intermediary organizations, or self-organized informal mutual assistance groups, which lack official authorization and certification, do not meet the legitimacy requirement and thus are considered expectant stakeholders. External social organizations, which are concerned with elderly care but have not yet participated in cooperation, lack power as they have not been granted the corresponding authority. This study explores the impact mechanism of the "Time Bank" mutual assistance elderly care model from the perspectives of three stakeholder groups: government organizations, community enterprises, and the elderly population.

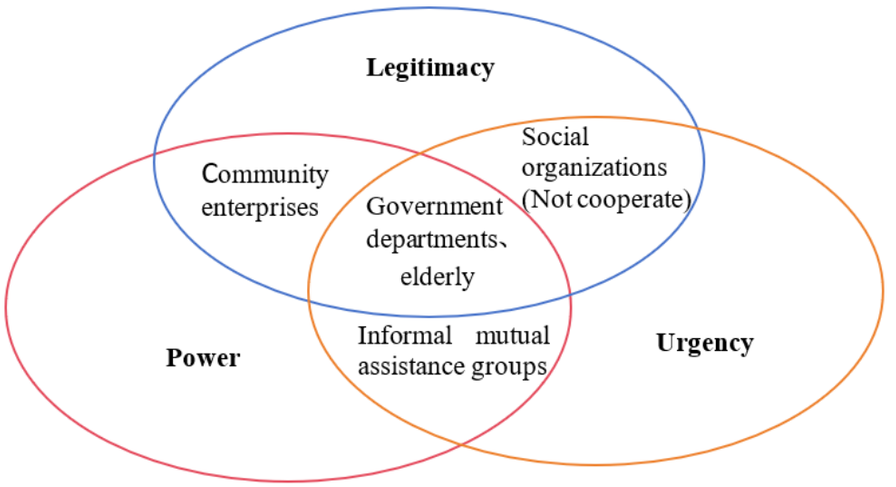


Figure 1. Classification of stakeholder groups in the time bank mutual support elderly care model.

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As definitive stakeholders, government organizations hold significant authority over policies that directly impact the elderly population. Moreover, the development of the Time Bank model is highly dependent on legislative and policy support from the government, which has been identified as a core driving force in the conceptualization of the model (Cahn, 1999). Furthermore, the "Time Bank" mutual assistance elderly care model, as a community-based economy that uses time currency for transactions, relies on the pricing and acceptance rules for time currency. These rules indirectly affect the smoothness, acceptability, and usability of currency circulation. Therefore, when government organizations establish clear and explicit pricing and acceptance rules for time currency, and accurately define the value of the services provided and received, it facilitates the participants' understanding of the "Time Bank" mutual assistance elderly care model. This, in turn, enhances their risk perception and trust, thereby increasing the elderly's willingness to participate. Based on this, the following hypothesis is proposed:

Hypothesis H_1: The pricing and design rules for the Time Bank established by the government have a significant positive impact on the elderly's willingness to participate in the Time Bank mutual assistance elderly care model.

Clear pricing and acceptance rules reduce the risks associated with time currency exchanges, enhance the trust of the participating groups, and indirectly promote the regulatory and normative development of the Time Bank mutual assistance elderly care model. In the practice of the mutual assistance elderly care model, relying solely on grassroots initiatives driven by civil organizations is insufficient; it is also necessary for government organizations to adopt a top-down approach to gradually improve the regulatory framework of the Time Bank model (Huang, 2014). By establishing pricing and acceptance rules, the government sets clear standards for the service value within the Time Bank mutual assistance elderly care model, thus avoiding the ambiguity and uncertainty of service valuation. This facilitates the quantification and evaluation of Time Bank services, thereby improving the operability and effectiveness of regulation. Moreover, these rules provide a specific regulatory basis for authorities, making it easier to detect and address violations. As a result, the regulatory oversight of the Time Bank mutual assistance elderly care model is strengthened, enhancing the model's normativity and safety. Furthermore, the increasing level of regulatory normativity raises the expectations of participants regarding the quality of services provided by the model, thereby boosting the elderly population's willingness to participate. Additionally, the improvement in regulatory normativity ensures a fair assessment and recognition of the value of services provided by the participants, offering motivational support for the elderly to engage in the mutual assistance elderly care model. Based on this, the following hypothesis is proposed:

Hypothesis H_2: The level of regulatory normativity in the Time Bank plays a partial mediating role in the process through which government pricing and design rules influence the elderly's willingness to participate in the Time Bank mutual assistance elderly care model.

Community enterprises, as prospective stakeholders, provide relevant technical support in the implementation of the Time Bank mutual assistance elderly care model. Firstly, blockchain technology, characterized by decentralization and immutability, ensures the authenticity and reliability of service records and transaction information during the exchange of time currency. This feature allows elderly participants to accurately understand the services they provide and receive, thereby enhancing their trust in government pricing rules. Secondly, the application of blockchain technology enables the fair exchange and use of service credits, promoting multi-party cooperation and mutual benefit, and fostering a positive mutual assistance community. This collaborative environment encourages stakeholders to focus on shared interests and development. Effective community interactions can offer valuable feedback and suggestions for refining pricing rules, thus further strengthening the incentivizing role of government-designed pricing rules and guiding elderly participants to actively engage in the Time Bank mutual assistance elderly care model. Moreover, the use of blockchain technology allows for the supervision and standardized management of the time currency exchange process, ensuring quality assurance during the exchange of elderly care services. High-quality services will, in turn, enhance the rationality and attractiveness of government pricing rules, increasing the satisfaction of the elderly population. Based on this, the following hypothesis is proposed:

Hypothesis H3: The level of application of community blockchain technology negatively moderates the impact of government pricing and design rules on the elderly's willingness to participate.

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4.Data Analysis

4.1. Research Design

The purpose of this study is to systematically present the basic characteristics of elderly individuals and their family members in Community A, Pothou District, Zhanjiang City, and to analyze demographic variables such as age and education level. A descriptive cross-sectional research design and self-administered structured questionnaire method were employed. During the data collection process, convenience sampling was used to invite elderly individuals and their family members from Community A in Pothou District, Zhanjiang City, to participate in completing the questionnaire. A total of 261 valid questionnaires were collected. The participants were all aged 60 and above, with the majority falling within the 60-79 age group. Most participants had an education level of high school or vocational secondary school or below. All surveys were conducted on a voluntary basis, with no coercion involved.

Descriptive cross-sectional research design, as an observational survey method, allows for the observation and data collection of a specific population or phenomenon at a particular point in time or over a short period. By adopting a descriptive cross-sectional design, data covering multiple characteristics, such as age, gender, and education level, can be rapidly collected, providing an overall understanding of the elderly population's participation in the time bank mutual assistance pension model. Compared to longitudinal studies or experimental research, descriptive cross-sectional research incurs lower costs in terms of human, material, and time resources, making it more conducive to conducting efficient survey-based research.

At the same time, this study employs a self-administered structured questionnaire to collect data. The questionnaire design underwent expert review to ensure content validity, and a small-scale pretest was conducted to assess feasibility and reliability. As a survey tool, the self-administered structured questionnaire consists of a series of pre-designed questions with a clear structure and sequence. In the process of collecting basic demographic data, the questionnaire-based survey enables the distribution of questionnaires to a large number of respondents simultaneously, thus saving on survey costs compared to one-on-one structured interviews. Additionally, all respondents are presented with the same set of questions and options, ensuring consistency and comparability in data collection. Furthermore, the pre-established structure and question types allow for easy coding and quantification of responses, facilitating data analysis efficiency, particularly when combined with the Likert scale method.

The data collection for this study is conducted in A Community of Potou District, one of the pilot sites for the Time Bank policy in Zhanjiang City. In 2022, the Potou District Civil Affairs Bureau, in collaboration with the Zhanjiang Ronghe Social Work Service Center, established the Potou District Comprehensive Elderly Care Service Demonstration Center. This initiative aimed to gradually develop new elderly care models to better meet the needs of elderly residents in the community. The center guides the operation of elderly care service stations in five communities, including A Community, and jointly launched the "Time Bank" elderly care service project. After two years of policy implementation, A Community has accumulated considerable practical experience in the operation of the Time Bank mutual assistance elderly care model. This situation provides an extremely favorable policy context and practical foundation for conducting empirical research on the factors influencing the willingness of the target group to participate in such initiatives.

4.2. Questionnaire Design and Measurement

Based on the previous chapter, the questionnaire in this study includes four main variables: the pricing design rules established by the government, the extent of blockchain technology application in the community, the level of regulation and oversight of the Time Bank, and the willingness of elderly individuals to participate. The measurement items for each variable are grounded in the aforementioned stakeholder theory and the established scales developed by scholars such as Zsidisin, G. A., among others. These items were further reviewed by two experts (Wang &Fan) and pre-tested to ensure their validity. Each research variable consists of five distinct items, and a 7-point Likert scale was used to capture subtle differences in attitudes.

4.3. Data Analysis Methods

Based on the literature review and the proposed hypotheses, this study develops its conceptual research framework, as shown in Figure 2.

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Hypothesis H1 employs SPSS regression analysis to examine and verify the direct relationship between the pricing rules for time banks established by the government and the willingness of elderly individuals to participate in the time bank-based mutual care model. SPSS regression analysis is primarily used to study the linear relationship between one dependent variable and one or more independent variables. For relatively simple research hypotheses, SPSS regression analysis provides clear and concise results, with output statistics such as correlation coefficients, t-values, and p-values that are easy to understand and interpret. Researchers can directly assess from these results whether a significant linear relationship exists between the variables, and if so, the direction and strength of this relationship. Compared to more complex models, simple linear regression is more advantageous for the preliminary exploration of direct relationships between variables, such as in the case of H1, and provides foundational data support for subsequent in-depth studies.

Hypothesis H2 uses the Process method to explore and verify the dynamic relationship, specifically the mediating role of the level of regulation and oversight of time banks in the relationship between government pricing rules and elderly individuals' willingness to participate in the time bank-based mutual care model. Process offers a straightforward interface and analytical steps, making it particularly suitable for testing hypotheses, like H2, that aim to validate the mediating effect of a variable. The mediation model can be directly found within the Process tool, which is simple, clear, and efficient for this type of analysis. Additionally, due to constraints in human resources and time, the sample size in this study is relatively small, and Process can still effectively test mediation effects with small sample sizes using appropriate statistical techniques (such as Bootstrap sampling). Compared to Structural Equation Modeling (SEM), Process provides more intuitive output, focusing directly on the key issue of the mediation effect, which facilitates a quicker grasp of core conclusions and better understanding of the results.

Hypothesis H3 employs hierarchical regression analysis in SPSS to examine and verify the existence of a moderating effect, specifically the negative moderating effect of the extent of blockchain technology application in communities on the relationship between government pricing rules and elderly individuals' willingness to participate in the time bank-based mutual care model. The basic principle of regression analysis for testing moderating effects is to incrementally introduce variables into the regression model and compare the goodness of fit and changes in variable coefficients across different steps to determine the existence of the moderating effect. This stepwise approach aligns with the process of building theoretical frameworks for research. When testing a hypothesis about a moderating effect, regression analysis helps researchers quickly assess whether there is preliminary support for the hypothesis based on the data. By observing the coefficient and significance of the interaction term, researchers can determine whether further exploration of this moderating effect is necessary or whether the theory should be adjusted. This exploratory functionality is particularly important for fields that have not yet developed mature research inquiries.

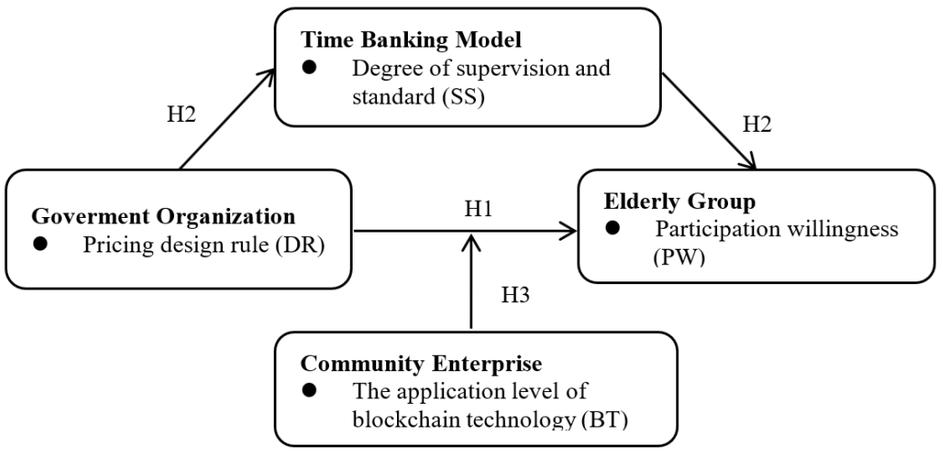


Figure 2. Conceptual research framework.

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5. Data Analysis and Results

5.1. Descriptive Analysis, Reliability and Relevance Analysis

The questionnaire includes five control variables: gender, age, education level, physical health status, and living conditions, as shown in the table below. The results of the cross-analysis between these different variables are presented and discussed separately.

As shown in Table 1, the results of the chi-square test between control variable 1 (participant gender) and questionnaire item C1 indicate a significant relationship ($p=0.008<0.01$), suggesting that gender differences influence the selection of options for item C1(I believe that the government has implemented more effective measures to promote the standardization of the time bank model).

Table 1. Cross-analysis of control variable 1 and item C1.

Title	Name	C1							Pearson's chi-squared	Kolmogorov-Smirnov Z
		1	2	3	4	5	6	7		
Gender	Male	6	5	4	38	37	23	7	17.495a	0.008
	Female	6	7	7	20	38	43	20		

As shown in Table 2, the results of the chi-square test between control variable 2 (participant age) and questionnaire item A4 indicate a significant correlation ($p=0.000<0.001$), suggesting that age differences lead to significant variations in the selection of options for item A4 (I believe that the government has taken into account the fairness of transactions when formulating relevant policies and regulations.).

Table 2. Cross-analysis of control variable 2 and item A4.

Title	Years	A4							Pearson's chi-squared	Kolmogorov-Smirnov Z
		1	2	3	4	5	6	7		
Age	60-69	0	5	3	10	19	16	17	44.871a	0.000
	70-79	2	10	4	23	39	30	18		
	80-89	2	2	5	5	12	13	12		
	Over	4	1	1	2	3	1	2		

As shown in Table 3, the results of the chi-square test between control variable 3 (participant education level) and questionnaire item B1 indicate a significant correlation ($p=0.000<0.001$), suggesting that differences in education level lead to significant variations in the selection of options for item B1 (I believe that community organizations have the capability to adopt the latest security technologies in the operation of the "time bank).

Table 3. Cross-analysis of control variable 3 and item B1.

Title	Name	B1							Pearson's chi-squared	Kolmogorov-Smirnov Z
		1	2	3	4	5	6	7		
Participant education level	Elementary school and below	8	9	2	12	8	9	8	46.305a	0.000
	Junior high school	1	5	7	22	18	28	4		
	High or secondary vocational school	0	7	7	21	25	18	2		
	College or university and above	2	1	5	7	13	8	4		

As shown in Table 4, the results of the chi-square test between control variable 4 (participant physical health status) and questionnaire item C4 indicate a significant correlation ($p=0.018<0.05$), suggesting that differences in physical health status lead to significant variations in the selection of options for item C4 (I believe that the level of regulation of the time bank model is appropriate and rational).

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Table 4. Cross-analysis of control variable 4 and item C4.

Title	Name	C4							Pearson's chi-squared	Kolmogorov-Smirnov Z
		1	2	3	4	5	6	7		
Participant physical health status	Very healthy	1	0	1	3	8	11	3	40.684a	0.018
	Comparatively healthy	5	0	5	10	25	31	4		
	General	4	1	1	11	23	37	11		
	Unhealthy	5	3	3	14	11	13	13		
	Very unhealthy	0	1	0	0	1	2	0		

As shown in Table 5, the results of the chi-square test between control variable 5 (participant living conditions) and questionnaire item D5 indicate a significant correlation ($p=0.000<0.001$), suggesting that differences in living conditions lead to significant variations in the selection of options for item D5 (I believe that participating in the time bank makes me feel valued).

Table 5. Cross-analysis of control variable 5 and item D5

Title	Name	D5							Pearson's chi-squared	Kolmogorov -Smirnov Z
		1	2	3	4	5	6	7		
Participant living conditions	Living alone	3	3	0	4	1	4	3	62.515a	0.000
	Living with spouse	2	6	2	10	18	38	47		
	Living with children	1	2	4	8	6	11	23		
	Living with other relatives	2	1	2	3	4	5	2		
	Elderly care institutions	1	0	0	0	8	7	13		
	Other	0	3	2	4	3	0	5		

The results of the reliability test are as follows: the government's pricing design rules (0.894), the degree of community blockchain technology application (0.911), the level of time bank regulatory standards (0.908), and the willingness of elderly individuals to participate in the time bank mutual assistance elderly care model (0.926). All variables exhibit a reliability greater than 0.7, indicating good internal consistency and reliability.

This study employs Pearson's correlation coefficient to analyze the associations among the research variables. The results show that: (1) the government's pricing design rules for time banks are significantly positively correlated with elderly individuals' willingness to participate ($r=0.856$, $p<0.001$); (2) the degree of community blockchain technology application is significantly positively correlated with elderly individuals' willingness to participate ($r=0.898$,$p<0.001$); (3) the level of time bank regulatory standards is significantly positively correlated with the government's pricing design rules ($r=0.865$, $p<0.001$); (4) the level of time bank regulatory standards is also highly significantly positively correlated with elderly individuals' willingness to participate ($r=0.913$,$p<0.001$). These results indicate a significant and strong association between the research variables.

5.2. The Pricing Design Rules Established by the Government Have a Positive Impact on the Willingness of the Elderly to Participate.

This study focuses on the direct impact of government pricing design rules on elderly individuals' willingness to participate. Both the independent variable (government pricing design rules) and the dependent variable (elderly individuals' willingness to participate) are continuous variables. Therefore, this study employs simple linear regression to examine the positive impact of the government's pricing design rules on elderly participation in the time bank mutual assistance elderly care model. The results of the simple linear regression test indicate that the correlation coefficient between government pricing design rules and

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elderly individuals' willingness to participate is 0.856, demonstrating a strong positive correlation between the two. Furthermore, the government's pricing design rules have a significant positive effect on elderly participation willingness (β=0.856, $p<0.001$), with an explanatory power of 73.3% in the positive direction (R^2=0.733). The final regression model is given by y=3.455+0.797x.

This finding not only validates the hypothesis H1 proposed in this study, highlighting the significant positive impact of government pricing design rules on elderly individuals' willingness to participate, but also provides strong empirical evidence for understanding the mechanisms linking policy intervention and social participation. Moreover, it aligns with the views expressed by scholar Edgar S. Cahn in the literature, who emphasizes that government policy support plays a key role in the development and promotion of the time bank mutual assistance elderly care model. Cahn argues that through the rational formulation of policy measures, such as the pricing design rules for "time currency," the government can create a favorable operational environment for the time bank model. This approach can precisely influence participants' cost-benefit expectations through various aspects, including value measurement, resource allocation, and incentive guidance, thereby directly affecting the willingness of the target group to participate. Therefore, the study provides data support for determining the role of government policy in promoting the time bank model. Consequently, this supports H1.

5.3. The Degree of Regulatory Standardization of the Time Bank Plays a Partial Mediating Role in the Relationship Between Pricing Design Rules and The Willingness of the Elderly to Participate

In order to systematically examine the mediating effect mechanism of the regulatory standards of the time bank as a mediator, this study employs the PROCESS method for mediation analysis. The path analysis results of the mediation model show that the model fit for the effect of government pricing design rules on the regulatory standards of the time bank is significant (R2=0.748, F=768.877, $p<0.001$). Additionally, a bias-corrected (BC) confidence interval was established through 5,000 bootstrap resamples, and the test results are shown in Table 2. As indicated in Table 2, the bootstrap 95% confidence interval for the mediating effect of government pricing design rules (independent variable) on elderly participation willingness (dependent variable) and regulatory standards of the time bank (mediator) does not include 0, suggesting that government pricing design rules (independent variable) can have a mediating effect on elderly participation willingness (dependent variable) through the regulatory standards of the time bank (mediator). The direct effect (0.283) and mediating effect (0.636) account for 30.8% and 69.1%, respectively, of the total effect (0.920). As the mediating effect does not fully account for the total effect, it is considered a partial mediation.

This finding not only confirms the research hypothesis H2 but also provides a deeper understanding of policy influence as a multi-dimensional, non-linear, and complex process, rather than a simple direct effect. Regulatory standards play a crucial (69.1%) mediating role in this process. Furthermore, it resonates with the view expressed by Huang in the literature, highlighting the significant role of government organizations in driving the development of a regulatory framework for the time bank model through a top-down approach. The government, as a leading force, is capable of formulating comprehensive regulations, standards, and oversight mechanisms at the macro level to ensure the establishment of an effective regulatory system during the operation of the time bank model. The degree of regulatory standards serves as a key dimension to measure the effectiveness of this driving force, indirectly influencing the willingness and actual participation of elderly individuals and other participant groups in the time bank-based mutual elderly care model. Therefore, this study provides a theoretical basis for government policy research within a favorable model environment. Hence, this supports hypothesis H2.

Table 6. A decomposition table of total effect, direct effect, and mediating effect.

	ES	Se	LLCI	ULCI	Effect size
Total effect	0.920	0.345	0.852	0.988	
Direct effect	0.283	0.514	0.182	0.385	30.8%
Indirect effect	0.636	0.494	0.535	0.729	69.1%

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5.4. The Extent of Blockchain Technology Application in Communities Moderates the Relationship Between the Pricing Design Rules Established by the Government and the Willingness of the Elderly to Participate

In order to systematically examine the moderating mechanism of community blockchain technology utilization on the relationship between government pricing design rules and elderly participation willingness, this study employs hierarchical regression analysis to test the moderating effects.

As shown in Table 3, in the first step, the government-established pricing design rules were included, yielding a correlation coefficient of 0.856 (β=0.856, $p<0.001$), indicating that government pricing design rules have a significant positive impact on elderly participation willingness. In the second step, both government pricing design rules and community blockchain technology utilization level were included. The results showed that both government pricing design rules (β=0.350, $p<0.001$) and community blockchain technology utilization level (β= 0.604, $p<0.001$) significantly predicted elderly participation willingness. In the third step, the interaction term between govemment pricing design rules and community blockchain technology utilization level was added. The results revealed that the utilization level of community blockchain technology negatively moderates the relationship between government pricing design rules and elderly participation willingness (β= -0.157, $p<0.001$). Specifically, the degree of blockchain technology utilization weakens the positive effect of government pricing design rules on elderly participation willingness. As the utilization of blockchain technology increases, the positive influence of government pricing design rules on elderly participation willingness diminishes.

Therefore, the statistical analysis in this study provides strong support for Hypothesis H3, revealing a significant negative moderating effect of community blockchain technology utilization on the relationship between government pricing design rules and elderly participation willingness. This finding also aligns with the feasibility of combining blockchain technology with time banking, as discussed by scholars such as Guo et al. in the literature. They argue that blockchain, with its technological characteristics such as decentralization, immutability, and traceability, can optimize the operation of time banks, enhance mutual trust among stakeholders, and ensure fairness in transactions and transparency of information. Consequently, this influences the relationship between government pricing design rules and elderly participation willingness, providing technical support and innovative pathways for moderating this relationship. This enables time banks to operate more efficiently and robustly in the digital age, better meeting the needs of elderly care. Thus, this study offers critical theoretical insights for social policy research in the digital era, supporting Hypothesis H3.

Table 7. Moderating role of blockchain application in community pricing and participation Willingnes

Variables	**Dependent variable: PW**		
	Model 1	**Model 2**	**Model 3**
	X	M	X*M
Independent variable (X: Pricing design rule)	0.856		
Moderator (M: The application level of blockchain technology)		0.604	
Interaction Term（X×M）：			-0.157
ΔR^2	0.733	0.110	0.012
ΔF	711.731	179.621	20.347
Δp	＜0.001	＜0.001	＜0.001
R^2（Final）	0.732	0.841	0.853
P （Final）	＜0.001	＜0.001	＜0.001

6. Discussion and Conclusions

6.1. Analysis of The Results of Hypothesis Testing

This study aims to explore the mechanisms influencing the willingness of elderly individuals to participate in the time bank-based mutual care model. Through a review of the literature and relevant theories, three distinct hypotheses are proposed. The results of the data analysis confirm the validity of all three hypotheses.

Firstly, the regression analysis conducted using SPSS supports the validity of Hypothesis H1. The findings highlight the critical role of government policy support in the development and promotion of the

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time bank mutual care model. This aligns with the perspective of scholar Edgar S. Cahn, who emphasized the essential role of government legislation and policy support in the growth of time banks, as discussed in the literature. The empirical analysis in this study clearly demonstrates the significant impact of relevant pricing design rules on the willingness of the target group to participate, providing strong evidence that government policies can indeed play a substantial role in promoting time banks through specific channels. By implementing well-designed policies, such as establishing appropriate pricing rules for "time currency," a favorable operational environment can be created, influencing participants' cost-benefit expectations, and ultimately affecting their willingness to participate.

Secondly, the results obtained from the process analysis support the validity of Hypothesis H2. This indicates that government pricing design rules not only have a direct effect on the willingness of elderly individuals to participate but also exert an indirect influence by affecting the degree of regulatory standardization within the model. This finding aligns with the theory proposed by scholar Huang in the literature, confirming the pivotal role of government-led, top-down efforts in establishing a regulatory framework for the time bank model. In practical operations of time banks, government-established pricing rules guide the flow and allocation of resources, while the development of a regulatory framework serves as a crucial bridge, effectively acting as an intermediary between government initiatives and elderly individuals' willingness to participate.

Finally, the results from the hierarchical regression analysis used to test the moderating effect support the validity of Hypothesis H3. This suggests that as the application of community blockchain technology increases, the positive influence of government pricing design rules on elderly individuals' willingness to participate diminishes. This finding echoes the viewpoint of scholars such as Guo and others, who discussed the feasibility of combining blockchain technology with time bank systems. As the application of community blockchain technology advances, the exchange of time bank services and the recognition of their value can be facilitated by precise technical algorithms. Elderly participants in decision-making processes are increasingly likely to rely on the trust and fairness mechanisms ensured by blockchain technology, rather than solely depending on government pricing incentives. This demonstrates the complex interaction between emerging technologies and government policies in the innovative development of time banks. The result aligns with current trends in research on the impact and transformation of traditional elderly care models by technological innovation.

6.2. Theoretical and Practical Significance of the Research

In order to construct a comprehensive theoretical framework that not only fills the gaps in existing literature but also provides comprehensive strategic recommendations for policymakers and practitioners, this study presents the following theoretical and practical implications.

6.2.1. Theoretical Significance

This study reveals the multi-faceted interactions among government policies, regulatory standards, and technological applications within the time bank model, offering a novel perspective for understanding how government policies, in an emerging technological context, can collaborate with regulatory standards to advance the development of elderly care models.

The mediating role of the time bank's regulatory standards acts as a bridge between macro-level government policies and micro-level individual participation behaviors, allowing abstract policy directives to penetrate the operational details of the time bank in the form of concrete regulatory norms. This deepens our understanding of policy transmission mechanisms. Moreover, it helps theoretical researchers more precisely analyze the pathways and evolving effects of policies within the complex social elderly care system, providing policymakers with richer theoretical foundations and practical references for subsequent policy adjustments and optimizations, thereby facilitating the efficient operation and development of time banks under the collaborative influence of policy guidance and regulatory norms.

The discovery of the moderating effect of community blockchain technology applications adds a new dimension to the theoretical research on the integration of technological innovation and elderly care models. Under traditional theoretical frameworks, government pricing was considered the key factor influencing participants' willingness. However, the moderating effect of blockchain technology demonstrates that the trust mechanisms and fairness systems enabled by technology can influence participants' decision-making

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criteria. This prompts researchers to reconsider the elements involved in constructing government policies in a technology-empowered context, offering a new theoretical entry point for the integration of science and technology with the elderly care industry.

6.2.2. Practical Significance

Firstly, it contributes to advancing the application and development of the time bank model. The findings of this study suggest that designing a reasonable pricing mechanism and regulatory system can effectively enhance participants' trust and willingness to engage with the model, thereby promoting social mutual assistance and resource sharing. First, through a well-structured pricing mechanism, differentiated prices can be established based on factors such as the difficulty and duration of various types of services, ensuring that the skills and efforts of service providers are accurately quantified and compensated, thereby facilitating precise alignment with elderly care services. Second, a reasonable pricing mechanism and regulatory framework provide an orderly and standardized structure for community residents' interactions, helping to foster and gradually spread a positive atmosphere of mutual assistance among residents. This, in turn, attracts more social forces to focus on the time bank, thus promoting the expansion of the time bank model for mutual elderly care.

Secondly, it supports the transformation and high-quality development of the elderly care service industry. The above findings indicate that blockchain technology, as an emerging scientific advancement, plays a crucial role in guiding the development of the elderly care service industry under government policy. First, the government can guide and support elderly care institutions in multiple ways through blockchain technology, promoting the creation of a unified and secure information management platform that integrates multi-source data such as elderly health records, service histories, and credit evaluations, thus facilitating the efficient circulation and sharing of data. Second, the government can incentivize elderly care institutions to collaborate across organizations based on the decentralized network architecture of blockchain, using blockchain technology to create an elderly care service ecosystem where different institutions can share resources, technologies, and practical experiences, thereby achieving complementary advantages. Third, as a technological achievement of the digital age, the moderating effect of blockchain technology will accelerate the digital transformation of the elderly care service industry, pushing the industry into a new stage of digital and intelligent transformation. This transformation will better adapt to the changing trends in the modern societal demand for elderly care.

6.3. Future Research Directions

In terms of the data collection timeframe, the current study only reflects the data at a specific point in time. Future research could involve long-term tracking to observe the dynamic changes in elderly people's willingness to participate as government policies are adjusted, regulatory frameworks are refined, and technological innovations continue to emerge over time. This would provide a deeper understanding of the developmental and evolutionary patterns of the time bank mutual elderly care model. For instance, as blockchain technology becomes more deeply integrated into the time bank system, elderly people's awareness and acceptance of it may gradually change. Such changes could, in turn, influence the direction of government pricing design rules. Long-term tracking studies could capture these dynamic shifts in a timely manner, providing evidence for the timely adjustment and optimization of elderly care service policies.

Regarding the selection of research subjects, this study primarily focuses on the individual willingness of elderly people to participate. Future research could broaden the scope by including multiple stakeholders involved in the time bank model, such as service providers, volunteer organizations, and community managers. It would be valuable to investigate the interactive relationships among these diverse actors and their combined impact on the operational effectiveness of the time bank mutual elderly care model, as well as on elderly people's willingness to participate. Such a multi-stakeholder perspective would help to construct a more comprehensive theoretical model. Through multi-stakeholder interaction research, a better understanding of the ecosystem characteristics of the time bank model can be achieved, providing a full range of strategic recommendations to enhance its overall operational efficiency and service quality.

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