Feasibility and Program Design of Maintenance Insurance for Common Parts in Residential Communities

Sijia Tian*, Shurui Ding and Taotao Jin

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China.

* Corresponding Author Email: 1608423164@qq.com

Abstract. Residential special maintenance funds for residential common parts, common facilities and equipment warranty expires after the maintenance and renewal, transformation. However, in the process of repairing the common parts of the district, the problems of misrepresentation, fraudulent claim and excessive repair of maintenance funds are prominent. In this paper, based on the maintenance data of Xuanwu District and Gulou District in Nanjing City from 2020 to 2022, we carry out the feasibility and program design of maintenance insurance for the common parts of residential neighborhoods. The results show that the existing maintenance funds can cover the expected premiums, verifying the feasibility of common parts maintenance insurance and designing an insurance program to help solve many problems in the process of community common parts maintenance.

Keywords: Residential special maintenance funds; common parts maintenance insurance; insurance design.

1. Introduction

Residential special maintenance funds are specifically for residential common parts, common facilities and equipment warranty expires after the maintenance and renewal, transformation of funds, so called "housing pension", mainly to ensure that the community common parts of the normal maintenance, improve the quality of living and the service life of the equipment.

With the increase in the number of years of use, residential special maintenance funds often appear some problems: First, maintenance in the misrepresentation, fraudulent claims and excessive maintenance; Second, maintenance funds exhausted after the renewal of the fundraising difficulties. Relying on the regulator to strengthen supervision and improve the procedural process cannot be very effective in solving the information asymmetry, and has not fundamentally solved the problem of information asymmetry and free-riding [1].

Therefore, this study attempts to theoretically analyze the feasibility of solving the information asymmetry and free-riding problem by using the maintenance data of Xuanwu and Gulou districts in Nanjing from 2020 to 2022 to design a preliminary insurance scheme. Through the introduction of commercial insurance to reduce the phenomena of misrepresentation, fraudulent claims and excessive maintenance, improve the safety, security and efficiency of the use of funds, and resolve the contradictions surrounding the maintenance funds, thereby ultimately promoting social harmony and stability [2] [3].

2. Theoretical foundations

2.1. Principles of Insurance Pricing

(1) Principle of Equalization of Income and Expenditure

Let the number of participants be N, the premium per unit be P, the frequency of insurance accidents be R, the amount of compensation be L, the principle of equivalence of income and expenditure can be expressed as follows:

$$NP=RL \rightarrow P=RL/N \quad (1)$$

(2) The principle of loss compensation

Insurance premiums are used to compensate for the policyholder's losses, and cannot make additional profits, after satisfying the insurer's own compensation, and its own operating costs, and at the same time, also need to make profits from it.

2.2. The method of determining the insurance premium rate

The insurance premium rate is generally composed of two parts, one is the natural rate based on the probability of risk occurrence, and the other is the additional rate based on the operating costs and reasonable profit of the insurance company.

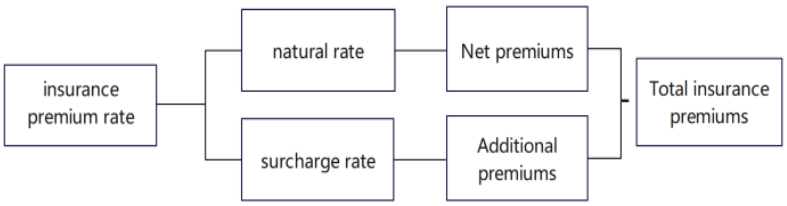


Fig 1. Insurance Rate and Premium Composition.

2.3. Analysis of the theoretical basis of commercial residential maintenance insurance

Commercial insurance can provide effective solutions to many problems.

Firstly, maintenance companies may utilize their information advantage in maintenance expertise to defraud maintenance funds by misrepresenting the amount of work and the cost. In the case of purchasing commercial insurance, the insurance company is responsible for the maintenance of the damaged common parts, while the owners only need to pay the premium regularly, shifting the risk of information asymmetry to the insurance company.

Secondly, it is very difficult to renew the maintenance funds after they are used up in many neighborhoods, and the relevant departments that manage the funds on behalf of the owners do not have the intrinsic motivation to promote the value-added of the maintenance funds. The insurance company has specialized financial management ability, at the same time, after the scale can reduce the marginal cost of maintenance [4] [5].

3. Theoretical foundations

From Table 1, the total amount of maintenance money shared equally by the owners of dwellings without shared elevators in 2020, 2021, and 2022 is RMB 100.54, RMB 119.87, and RMB 128.61, respectively, with an average value of RMB 116.34.

Table 1. Maintenance Data Analysis.

Maintenance type	2020			2021			2022		
	Total maintenance	Average value	Parcel	Total maintenance	Average value	Parcel	Total maintenance	Average value	Parcel
Elevator	14062591.36	647.99	19.99	17987014.32	592.75	25.57	28257879.66	724.43	40.17
Waterproofing	23064293.05	739.24	29.09	35434679.14	748.61	44.69	47726229.22	916.93	60.19
Control	3803644.26	569.92	4.80	6022028.77	805.95	7.59	8411029.64	1017.67	10.61
Water pipes	475160.89	610.75	0.60	869790.49	441.74	1.10	1885815.43	494.06	2.38
External wall	4046845.64	1254.45	5.10	4226179.71	1208.52	5.33	4648763.34	961.68	5.86
Fire-fighting	37416115.38	1275.82	47.19	28264611.96	1514.55	35.65	22808466.74	1365.61	28.77

Other		10914763.33	1091.04	13.77	20226610.48	1188.89	25.51	16498435.89	829.86	20.81
Total	No elevator	79720822.55	5541.22	100.54	95043900.55	5908.26	119.87	101978740.26	5585.81	128.61
	Elevator	93783413.91	6189.20	120.53	113030914.87	6501.01	145.44	130236619.92	6310.24	168.79

The total amount of maintenance shared equally by the owners of residences with shared elevators in 2020, 2021, and 2022 is RMB 120.53, RMB 145.44, and RMB 168.79, respectively, with an average value of RMB 144.92. Therefore, the factor of the presence or absence of an elevator in a residence influences the number of repairs shared equally by residential owners each year.

This study is based on the insurance pricing principle. First, the premium for common parts maintenance insurance for residences with elevators is calculated, and the average of the three-year equal share of the maintenance amount by all householders is recorded as the pure premium. Assumptions about the additional premium: first, additional premium = operating cost + reasonable profit; second, operating cost = net premium × 5%; third, reasonable profit = premium × 8%.

As an example, for homeowners with elevators, Y, Y', X, and R, represent historical maintenance costs, insurance company maintenance costs, total premiums, and interest on maintenance funds, respectively.

$$\text{Reasonable Profit} = \text{Operating Income (simplified as Premium X)} \times 8\% \tag{2}$$

$$\text{Administrative costs} = \text{insurance company's maintenance costs } Y' \times 5\% \tag{3}$$

$$\text{Total Insurance Premium X} = \text{Net Premium} + \text{Additional Premiums} \tag{4}$$

$$\text{Total premium X} = \text{insurer's maintenance cost Y'} + \text{administrative cost} + \text{reasonable profit} \tag{5}$$

$$\text{Simplified}: X = Y' + 0.05Y' + 0.08X \tag{6}$$

The following discussion is organized into two scenarios:

(1) The original repair cost covers the total premium:

$$\text{Annual maintenance expenditures before purchasing insurance } Y \geqslant \text{premium } X$$

$$\text{Set } Y = X, \text{ then } Y = Y + 0.05Y' + 0.08Y \tag{7}$$

$$Y' = 0.88Y$$

It is calculated that when the premium is set at RMB165.21 per household per year, insurance companies are willing to provide common parts maintenance insurance for dwellings with elevators. When the premium is set at RMB132.63/year per household, the insurance company is willing to provide common parts maintenance insurance for dwellings without elevators.

In the case of commercial insurance, the insurance company is responsible for maintenance, and when the scale effect is formed to reduce the maintenance fee by 12%, the premium can be equalized with the original maintenance cost. In reality, the maintenance funds wasted due to information asymmetry and other reasons are much larger than this value, so the actual net premium per household should be lower than expected, and the program is feasible.

Use of the value-added portion of maintenance funds as premiums:

$$\text{Interest on maintenance funds } R \geqslant \text{premium } X \Rightarrow R \geqslant X \tag{8}$$

The law stipulates that residential special maintenance funds can be taken as fixed deposits and the purchase of treasury bonds in two ways to preserve and increase the value of the funds. According to the relevant data of the Nanjing Municipal Bureau of Housing Security and Real Estate, the stock of residential special maintenance funds in the main urban areas of Nanjing reaches 15.572 billion yuan, and assuming that an annual return of 3% is adopted as its reasonable interest rate. Replace Y

with the average value of total maintenance amount in Xuanwu and Gulou districts of Nanjing in 2020-2022.The calculation is as follows:

$$\begin{gathered} R = (155.72 \times 3\%) \div 3 = \text{RMB}1.5572\,(\text{million}) \\ Y = (0.937841391 + 1.1303091487 + 1.323661992) \div 3 \approx RMB1.13\,(\text{billion}) \\ X = Y' + 0.05Y' + 0.08X \qquad R = X \geqslant 1.14Y' \to 1.5572 \geqslant 1.14Y \\ \text{yielding } Y' \leqslant \text{RMB}1.37 \text{ million} \end{gathered} \tag{9}$$

Due to the scale effect, Y'≤Y=RMB1.13 million must be established. Therefore, Y≤RMB1.37 million also holds. Derivation: Xuanwu and Gulou districts in Nanjing, for example, the value-added portion of their residential special maintenance funds is sufficient to cover the premium; in addition, the value-added portion of the maintenance funds in Nanjing as a whole is sufficient to cover the city's housing maintenance expenses, and for districts with an insufficient balance of maintenance funds, they can be guaranteed maintenance through the coordination of government funds.

4. Maintenance insurance design for common parts

4.1. From the perspective of owners

The original maintenance and property fees are used to insure the property, so the premiums come from two sources.

A part of the property owners to pay the property fee. The Measures for the Administration of Property Service Charges clearly state that the property service charges include the operation and maintenance fees of public facilities and equipment.

The other part is the residential special maintenance fund. Directly using the special maintenance funds to insure in the common parts maintenance insurance, directly by the fragmented owners to declare online, the insurance company is responsible for the follow-up package of maintenance and supervision work, improve efficiency.

From the form of insurance, the use of mandatory insurance can avoid the public psychology of free-riding and the original cumbersome voting decision-making process due to the characteristics of residential housing maintenance.

On the arrangement of compulsory insurance system regarding the maintenance of common parts, the following aspects are mainly considered:

First, the policyholder incentive system. Link the rate arrangement of insurance with the maintenance status and quality of common parts, so the policyholders will seek better facilities and equipment, and enhance the user's self-maintenance awareness. Secondly, the right to claim insurance premiums is transferred with the transfer of housing ownership. Thirdly, the insurance system also has the function of preserving and increasing the value of assets. It is possible to agree on a capital preservation and appreciation clause with the insurance company and to utilize the capital management capability of the insurance company to solve the problem of capital sustainability.

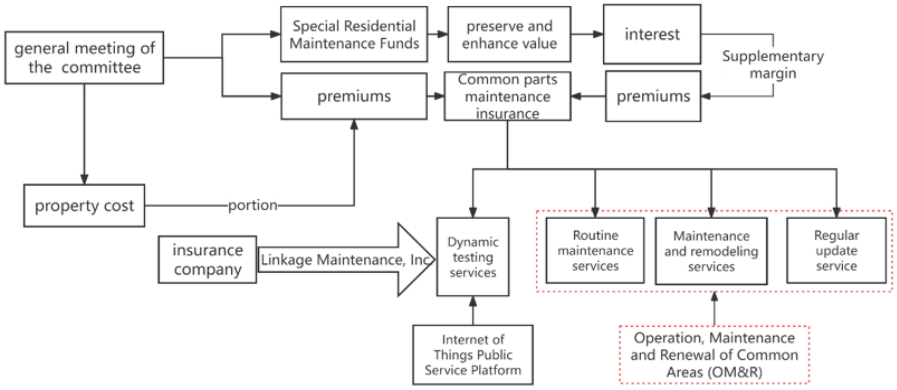


Fig 2. Insurance program design.

4.2. From the perspective of insurance companies

Insurance companies have sufficient funds, sound internal control mechanisms and strong risk management capabilities. In contrast, maintenance companies have specialized maintenance capabilities that insurance companies do not possess, and they have rich experience in different types of maintenance works, with a higher level of efficiency and each has its own strengths.

Therefore, in the field of common parts maintenance insurance, insurance companies and maintenance companies can join forces to create solutions for the risk of residential common parts. At the same time, the head of the property company, to create "technology + service + insurance" trinity of one-stop supply chain maintenance service platform. When owners have maintenance needs, the realization of insurance, repair, claims and other full-process online processing, can quickly respond to the needs of owners, improve user experience.

At the same time, with the real-time monitoring of the intelligent scheduling center, the quality of maintenance and follow-up service is linked to the performance of maintenance personnel to establish incentives compatible mechanism. The owner, as the original principal, will also pay close attention to monitoring the process and status of maintenance. This solves a number of problems such as long problem handling cycle, complicated procedures and shifting of responsibilities.

In this way, the supply chain maintenance platform built by the insurance company improves the efficiency of maintenance companies in receiving commissions and reduces their costs of bidding on their own. In addition, by integrating the maintenance works in each region, a scale effect is formed, which reduces the marginal cost of maintenance works and insurance costs.

5. Conclusion

Common parts maintenance insurance aims to solve the problems of information asymmetry and "free-riding" in the maintenance process, thereby reducing the phenomena of misrepresentation, fraudulent claims and over-maintenance in the use of maintenance funds in reality, and improving the efficiency of fund utilization. This study explores the feasibility of common parts maintenance insurance through both theoretical and empirical analysis, and designs a program.

On the theoretical level, based on the information asymmetry theory, principal-agent theory and insurance pricing principle, this study argues that there is no guarantee for the quality of the maintenance works of the residents' common parts and inefficient use of the maintenance funds under the traditional mode according to the principal-agent relationship in the process of common parts maintenance, and utilizes the theory of insurance to prove the advantages of purchasing common parts maintenance insurance.

On the empirical level, this study analyzes the maintenance data of Xuanwu and Gulou districts in Nanjing from 2020 to 2022, and the results show that: the purchase of insurance for the annual maintenance expenditures of the residential special maintenance fund can make the two insurance parties reach a cooperation, and the insurance company is willing to provide common parts maintenance insurance for residences with elevators when the premium is set at 165.21 yuan/year for each residence; and the insurance company is willing to provide insurance for common parts maintenance for residences with elevators when the premium is set at 132.63 yuan/year for each residence. When the premium is set at RMB 132.63 per year per household, the insurance company is willing to provide common parts maintenance insurance for residences without elevators. The value-added portion of the residential special maintenance fund can also further enhance the feasibility of the common parts maintenance insurance, which provides a practical solution for the vision of "secure living" in Nanjing.

References

[1] Xu Shengyu. Reasons for the high price of maintenance of common parts in residential areas -an analysis based on the perspective of information economics [J]. Construction and Budget,2020(06):32-35.

[2] Wu Yan. The shortcomings and suggestions in the management and use of housing special maintenance funds[J]. Modern property (last issue),2015,14(04):96-97.

[3] Zhang Zhiyu. Analysis and research on problems in the management and use of housing special maintenance funds[J]. Finance and economics,2013(27):78-88.

[4] Kim S, Lee S, Ahn Y H. Evaluating Housing Maintenance Costs with Loss-Distribution Approach in South Korean Apartment Housing[J]. Journal of Management in Engineering, 2019, 35(2):45-53.

[5] Fulcher M, Edwards D J, Lai J H K, et al. Analysis and modelling of social housing repair and maintenance costs: A UK case study[J]. Journal of Building Engineering, 2022(52): 104-389.