The Evolutionary Game Analysis and Research of the Government and the Aged Care Institutions in the Marketization of the off-site Pension

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Abstract. The aging society in China is a serious phenomenon. How to establish an effective and professional pension system/industry is an important method to solve the burden of heavy pensions in the aging society. The rise of new models of old-age support in different places has aroused widespread concern. The purpose of this paper is to explore the solution to the phenomenon of inhibiting the development of off-site pension market after the game of interests between the government and the pension institutions under this model will cause serious loss of users, shortage of funds, and social dishonesty. Using evolutionary game mathematics model to explore the impact of government regulations on the marketization of pension institutions, and to introduce the influencing factors of strategic choices of government and pension institutions and the degree of influence on the marketization of off-site pension development. At last propose innovations in terms of systems, mechanisms, and models, which promote the healthy development of off-site pensions.

Introduction

According to the latest National Bureau of Statistics survey, as of the end of 2017, China’s population over the age of 60 has grown to 230 million people. China is the only country in the world with an old population over 200 million. At the end of the year, the number of basic pension insurance for urban employees in the country was 400.99 million, and there were 32,000 social service agencies providing accommodation, including 29,000 service institutions for the aged. There are also 7.495 million social service beds, including 7.142 million old-service beds. From the point of view of measuring the ageing social burden index—the old-age dependency ratio, it will accelerate its growth year by year and will rise to 16.9% by 2020. Even though the ratio of old-age dependency in current families is increasing, the proportion is not high in nature. The government’s old-age subsidy is generally raised, but the subsidy amount is still low. The number of old-age service organizations is extremely unequal to market demand, and the number of children working in different places is increasing. With an increase in hidden safety risks, China’s pension situation is still severe.

Off-site old-age pension refers to the old-age pension model that the old who leave their current place of residence and go to an old-age pension institution in another administrative district. As the pension institutions are both public and private or government subsidies, this article will proceed from the point of the marketization of off-site pension market and explore how the government should regulate the marketization of pension institutions and propose innovative solutions.

The Dilemma of the Marketization of the off-site Pension under Profit Gambling

Based on China's modern socialist policies with Chinese characteristics and the nature of public service in the pension market itself, the marketization of major pension institutions must be hampered by the government. What makes Off-site pension market different from the general pension market is it is characterized by a positive emerging market, of which market users are more distinctly positioned and require more personalized services. In this situation, the stronger the
government regulation is, the more pension institutions need to complete the pension goals set by the
government, and the market-based income of the pension institutions will be reduced. The
pursuit of a game between the two sides that maximizes the interests of both parties will create
many problems.

The Psychological Drop of the Pension Institution is Big and the Loss is Serious

The development of pension institutions in China has matured, but it is still at an exploratory stage
for the off-site pension model. The change of living habits of the elderly living in different places,
the conflict of cultural ideas, the loneliness of old friends and the differences in language
communication will all bring great psychological sensation to them. The services of the old-age
care institutions are not in place, security measures are not perfect, professional service personnel
are lacking, and entertainment and leisure methods are unreasonable, which easily lead to the loss
of users due to mistrust of the elderly. At this time, the pension institutions will face various
challenges: how to appease the old people's emotions, and how to provide more quality services to
attract users.

Value-added Services for old-age Care Institutions have a Heavy Economic Burden and Low Retention

In order to attract more users, pension institutions often provide value-added services, such as full
medical protection services for disabled seniors. However, high-quality services often come with a
high-intensity economic burden. If value-added services have low feedback effectiveness, pension
institutions can only make ends meet. According to statistics, the idle rate of high-end beds in
retirement institutions is currently 50% to 60%.

Inadequate Government Policy in the Development Bottleneck

In 2018, Chinese government has subsidized the old-age pension subsidy across the country to ease
the regional differences. However, judging from the current situation, when the elderly have been
treated in a hospital at an emergency, they need to be paid by their children first and then
reimbursed to the local reimbursement. Turnover between the old people is time-consuming and
labor-intensive. And each time the maximum amount of medical claims for reimbursement is 5,000
yuan. To ease the family's economic burden, the patient family uses multiple hospital admissions.
The medical insurance and potential risks during each visit to the hospital can also cause problems
for the patient's family. It is also difficult for today's pension institutions to work seamlessly,
resulting in more social cost loss. In addition, if the government's policy subsidy to the local
pension institutions is not in place or is low, it will also affect the entry of social capital. Take the
Xiaotian elderly care service base in Xiaogan City, Hubei Province as an example. The old-age
pension base that was scheduled to be put into use in February 18 will suffer investors. The sudden
withdrawal of funds made the use of plans have been postponed indefinitely.

Evolutionary Game Model Analysis

Build a Game Matrix

The evolutionary games in this model are government groups and pension institutions. The
government will designate certain old-age care tasks for the pension institutions, and the pension
institutions should first fulfill their duty of retirement care after receiving government-subsidized
investments. However, the pension institutions under the trend of marketization still need to
increase more income to seek further development. Both sides of the game will pursue the
maximization of their own interests. Both parties are rational economic people.

For the government, the government has two strategies{ Strong regulation, weak regulation}and
the pension institutions also have two strategies {due to duty, not due diligence}.

When the government regulations are strong and companies perform their duties, the government’s
social benefits increase by \(N_1\), and supervision costs (including subsidies)\(N_2\) are paid. Compliance
income of pension institutions (including some market income) $M_1$, compliance operation cost $M_2$, government reward subsidy $M_3$.

When the government regulations are strong and the companies do not perform their duties, the government pays the regulatory cost $N_2$, and gains overall benefits (including fines and social reputation) $N_3$. The pension institution’s compliance income $M_5$ ($M_5 < M_1$), loss cost and fine $M_4$, additional extra marketing income $M_6$.

When the government regulations are weak and companies perform their duties, the government can save costs $N_4$. Legitimate income from pension institutions Legitimate income $M_1$, compliance operating costs $M_2$.

When the government regulations are weak and companies do not perform their duties, the government has to respond negatively to the pension problem and cause losses $N_5$. Pension institutions earn $M_5$ and increase additional marketized income $M_6$.

The game matrix is shown in the figure 1. below.

**Figure 1. The game matrix.**

### Model Derivation Solution

The evolutionary game needs to calculate the “positive” and “negative” strategies of both parties and the average expected return of the group, and then establish the evolutionary dynamic equation. In the long-term dynamic game, the low-yield will gradually imitate the high-yield behavior and gradually tend to be consistent with the benefits. The balance point.

Expected revenue of the government:

\[
\begin{align*}
E_x &= x(N_1 - N_2) + (1-x)N_4 \\
E_y &= x(N_3 - N_2) - (1-x)N_5 \\
E_z &= y(E_x) - (1-y)E_x
\end{align*}
\]

Expected income of pension institutions:

\[
\begin{align*}
E_y &= y(M_1 - M_2 + M_3) + (1-y)(M_1 - M_2) \\
E_y &= y(M_5 - M_6 + M_4) + (1-y)(M_5 + M_6) \\
E_z &= x(E_y) - (1-x)E_y
\end{align*}
\]

Government’s dynamic equation

\[
x' = x \left[ E_y - E_x \right] = x(1-x)[E_y - E_x] = x(1-x)[(M_3 + M_4)y - (M_2 + M_5 + M_6 - M_1)]
\]

Pension mechanism dynamic equation:

\[
y' = y \left[ E_x - E_y \right] = y(1-y)[E_x - E_y] = y(1-y)[(N_4 + N_5) - (N_3 + N_4 + N_5 - N_1)x]
\]

There are two equilibrium points for the dynamic equation (7), $x = 1$ and $x = 0$.

When $y = \frac{M_2 + M_5 + M_6 - M_1}{M_3 + M_4}$, the value point is always zero, and it is in an equilibrium state. The pension institutions and the government both perform due diligence and strong regulatory management. When $y = \frac{M_2 + M_5 + M_6 - M_1}{M_3 + M_4}$, the value of $x$ is 0 at this time, that is, when the pension institution does not perform its duties, the government will tend to strong regulation. When $y = \frac{M_2 + M_5 + M_6 - M_1}{M_3 + M_4}$, the value of $x$ at this time is 1, that is, when the pension institution performs due
diligence, the government will tend to weak regulation.

There are two equilibrium points for the dynamic equation (8), y = 1 and y = 0

When \( x = \frac{M_2 + M_5 + M_6 - M_1}{N_3 + N_4 + N_5 - N_1} \), the value point is always in an equilibrium state, and the pension institutions and the government both perform due diligence and strong regulatory management. When \( x > \frac{N_4 + N_5}{N_3 + N_4 + N_5 - N_1} \), the value of y at this time is 0, that is, the government is not strong and the pension institution will not perform due diligence. When \( x < \frac{N_4 + N_5}{N_3 + N_4 + N_5 - N_1} \), the value of y at this time is 1, that is, when the government is under strong control, the pension institution tends to perform due diligence.

The dynamic path of the two parties’ selection strategy is shown in the figure 2:

![Figure 2. The dynamic path.](image)

**Result Analysis**

Through the game analysis above, except for the influence of each other's choice strategy in the dynamic game between the government and pension institution, the tactical choices of pension institutions are also mainly related to the proportion of income from regular operations and extra market-based income. If the amount of government subsidy and compliance income are less than the fines for pension institutions and market-based income, pension institutions will tend to choose not to perform due diligence and seek out more social capital and market-based gains.

The choice of the government is related to the increase of social benefits and the ratio of subsidies or management costs to pension institutions. If the government chooses to intervene too much in the operation of pension institutions, then it must require the use of pension institutions to solve the problem of pension is less than the government's other pension support policies. Otherwise, the government tends to choose a weak regulation strategy.

**Management Inspiration and Solutions**

According to the previous case studies and modeling analysis, there is a dynamic balance between pension institutions and the government in the process of marketization of pension institutions. The strategic choices of pension institutions are related to the proportion of government subsidies, while the government is subsidizing social benefits and management cost. So we get the following innovative management strategies for the above characteristics.

The first is institutional innovation. When the pension institutions' short operating hours are insufficient, the government needs to strengthen control, improve the institutional structure, and promote institutional-community linkages. The elderly (especially those with disability) should be transferred to institutional pensions in a timely manner. When the pension institutions operate more maturely, they will create social composite subjects and establish multiple governance.

The second is mechanism innovation. The pension institutions need to communicate with the elderly and the government accurately, improve the coordination mechanism of interest, and minimize unnecessary losses. Pension institutions need to improve the funding source protection system based on their own development. The government can establish credit assessments for institutions and establish scientifically distributed funding mechanisms.

The third is model innovation. The government needs to establish an economic compensation model and improve economic compensation for organizations that have been performing due diligence. Pension institutions also need to improve the psychological compensation model for the
elderly, fundamentally stabilize old people living in different places, and attract more elderly people with better economic conditions to come to live and consume more value-added services and increase their own additional market income.

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