Government’s Role in Meeting the Long-Term Care Needs in Developing Aging China: A Public-Private Partnership Pathway

Taixi Xiao
Yuhao Li
Yifan Yang

Abstract: China is encountering essential socio-demographic changes with respect to population aging and family structure transition. A case in point is long-term healthcare, especially to those less developed areas in Western and Central China. The increasing old population will assuredly place greater demands on the system of long-term care in China, but the magnitude of the problem has been the subject of some debate. Therefore, the main question is how to provide long-term care service in a smart way.

Public-private partnership (PPP) is extending promptly as an alternative innovation for the provision of services by government. Through PPP government is able to make long-term contract with qualified private partner to deliver a good or service. Although private firms have been involved in public service delivery for a long time, the introduction of PPP in early 1990s established a mode of public service delivery that redefined the role of public and private sectors.

This study is focusing on the practice of PPP in China. More specifically, the aims of the project are to:
1. Clarify what factors impact on people’s demand and decision strategy in long-term healthcare issues by conducting multi-variance analysis.
2. Compare the effectiveness of regional efforts to provide long-term healthcare insurance in three types of countries, and discuss the acceptable path for government to offer long-term healthcare program.
3. Determine why PPP could be a practical way for delivering Long-term Care Insurance in China’s government by applying Game Theory model and the possible challenges and opportunities PPP in long-term healthcare has on the mission of “Chinese old people are provided with a treasure sense of security, belonging, and worthiness”.

Key Words: Long-term Care Insurance, Public-Private Partnership, Game Theory

1 First Author, from School of Public Policy, University of Maryland-College Park. Contact Email: txiao@umd.edu
2 Co-Author, from Barcelona Graduate School of Economics. Contact Email: skyindeer@gmail.com
3 Co-Author, associate professor from Southwest Jiao Tong University. Contact Email: yangswjtu@126.com
4 Public-private Partnership As A New Way to Deliver Healthcare Service, JLN Espigares and EH Torres, 2009
Introduction
China is encountering essential socio-demographic changes: on one hand, the total fertility rates have fallen sharply from 5.8 children per women in the early 1970s to around 1.5 children in 2012\(^5\), which is far below the replacement level of 2.1 children. On the other hand, the life expectancy at birth increased by more than 10 years in the same period of time\(^6\). As a result of these trends, Chinese society is currently aging and additionally shrinking in the young adults.

Since the implementing the "one-child" policy, the number of family member is decreasing and the new “4-2-1” family structure could not support informal care giving sustainably. In 1973 the average number of a typical Chinese family member is 4.81, while in figure in 2009 goes down to 2.82. A smaller family means that women, who usually stayed at home and looked after the family member, now have to go and search for a job to lighten the family financial burden, while leaving the old alone at home. These trends implies that the traditional pattern of home-based long term care can barely continue.

Another critical issue China now face is so called “go old before being rich”. Comparing other population aging countries, Chinese may find they are much poorer than their developed counterparts. In 2000, the GDP per capita of China is 4238 US dollar, while that figure of Japan and US is 47132 and 42325 dollar respectively. Table 1 gives a more detailed information about this situation.

Table 1 here

Along with the development of economy, there is a massive need for a better health care service in China. While the cost for such service becomes more and more expensive. Although partially financed by the social security, such cost is paid by individual. Table 2 shows more detail.

Table 2 here

Despite a strong need for a more powerful social security, such system in China is now under heavily construction and need to be improved. The current social security system although covered majority of eligible citizen, can not provide adequate support when it is needed. Due to the low benefit level, this system can not include any long term care project, which means the social security in China is not able to handle the problem of dramatically population aging.

Since the gradual societal transformation in the 21st century which reflected in aspects including demographic composition, family function, and social structure, government should rethink seriously as to how to introduce an appropriate institutional foundation to meet the diverse needs of Chinese senior citizens in a sustainable way. A case in point is long-term health care. The increasing old population will assuredly place greater demands on the system of long-term care in China.

\(^5\) China's National Population and Family Planning Commission
\(^6\) UNICEF, statistic base
Facing the increasing old-age patients with chronic diseases and the expanding demand for nursing care, the long-term care insurance in China needs more attention. Two powerful instruments - market and policy - would impact on the aging industry by introducing competition mechanism and government support. Boosting the LTC insurance is a considerable way to fill the gap buried in the problem of care giving of the older generation. In the mean time, the establishment and development of long term care insurance is a beneficial complement to the under-going health care system of China.

Recently, China Insurance Regulatory Commission (CIRC) has issued a notice regarding the implementation of “Health Care System Reform Plan during the Period of Twelfth Five-Year Plan”, emphasizing that the government will pay greater attention to the development of business insurance companies. During the Period of Twelfth Five-Year Plan, the government plans to enhance the policies for the industry of business health insurance in the following ways:

• Issue preferential tax policy to encourage the participation of business health insurance.
• Initiate the development of various types of insurance products, such as long-term care insurance, special/major medical insurance, among others, at the business insurance industry.
• Encourage the appointment of qualified business insurance companies on various medical care services through government purchasing processes.
• Improve the insurance level on special/major medical care by allowing the purchase of special/medical insurance using basic medical care funds.

The development of long-term care insurance is now on the government’s agenda. This facilitates the prospering of long-term care service. A friendly environment for the business insurance companies will further stimulate its booming.

Empirical Analysis of Long-Term Care Insurance Demand of residences in Chengdu

The demand of LTC insurance is divided into two concepts: Active demand and latent demand. The active demand in LTC insurance is defined as customers who equipped both with the desire to consume and the capability to afford. While for those who only meet one of the condition we call them latent consumers. In order to know the demand of LTC insurance products in developing aging area of China, we implement a filed investigation with the help from Southwest Jiaotong University in Chengdu.

Chengdu served as the largest city in Western China is famous for its livable environment for aging population. The old-age population ratio (60 and over) is about 17.62% in 2010 reaching the top three oldest cities in China. Since 2007, Chengdu has been conducting the piloting comprehensive reform for coordinated and balanced urban-rural development which aimed to narrow the gap between rural and urban areas in developing western China. Also, another character of Chengdu is the outflow of labor force. Although labeled as a population nest of China, many young people from Sichuan province still decide to go to China’s Eastern Coast to seek for jobs leaving their families behind. On the other hand, Chengdu has its relatively good health resources compared to other Chinese cities.
Factors Definition

**Demographic factor**
Population aging is a key determinant on LTC insurance considering the global aging tide affecting both advanced economics and developing regions. Aging process brings changes to traditional society: expanded amount of old-age population, distorted population structure, i.e. the emerging of “4-2-1” and “Empty Nest” families, and reduced family function. Those changes actually, in turns, activate the demand of LTC of older generations.

**Health factor**
With the development of technology, the mobility is decreasing obviously and the life expectancy is growing globally. Under the conditions of this century, the health and economic costs of chronic diseases have created an impending disaster. The LTC insurance not only acts as a compensation to patients, but also incentives the developing of care giving industry.

**Economic factor**
The LTC is an expensive product. For those who living in developing country, the first problem is how to make LTC affordable? Another thing to consider is the Matthew Effect generated from enlarging wealth gap. Once commercial LTC insurance pay the bill for the wealth, those poor people cannot survive any more. Therefore, economic factor acts as an important power as to whether LTC insurance could pullulate progressively.

**Value factor**
Value system of Chinese people is learned unconsciously simply by growing up in a particular community or family. In Confucianism, it is inevitable to raising children for old age. However, the modern Chinese family structure cannot afford the expensive burden for old age. Moreover, the institutional rigidity and path dependency from planned economy period make many Chinese people pay little attention to their medical care and health condition, therefore, people have weak sense of investing on their health security.

**Substitute effect of other security program**
Social security scheme has its substitute effect on LTC insurance. Some people think pension and medical insurance provided by national social insurance system could cover their potential caring expenditure, and choose to save additional money for other purposes. Other alternatives such like critical illness insurance are also substitute products of LTC insurance.

**Data description**
The Chengdu Elderly Survey on Long-term Care Service was a cross-sectional data collection effort in 2009 that is nationally representative of the population aged 50 and older. The data were collected by researchers at the School of Public Administration, Southwest Jiao Tong University. The total number of respondents in this survey is 1,039. A multistage sampling design that divided Chengdu city into four regions was used.
Method
Using a logistic model, I am going to estimate the impact of the explanatory variables chosen on the probability of taking out a long-term care insurance. For an individual $i$, the likelihood $P_i$, that he or she insures against LTC depends on an explanatory variable vector, $Z_i$. We therefore see that:

$$P_i=\text{proba}[\text{Ass}_i=1]=F(Z_i,\beta)$$

$\text{Ass}_i$ is a binary variable that takes the value 1 if the individual chooses to take LTC insurance and 0 if not. The vector $\beta$ reflects the positive or negative marginal effect of changes in $Z_i$ on the likelihood $P_i$. $F(.)$ designates the link function associated with our logistical modeling. The estimated coefficient vector $\beta$ is obtained by the maximum likelihood method.

Findings from the Statistical Analysis
The simple model estimated by the weighting method gives us a first series of results. From the result we could see that four factors are significant at 99% or 95% level. With a high significant level, the model has fairly explain power. And the model has a good fit with a high Nagelkeke R Square value (0.834).

Firstly, elderly people insure themselves more than young people. Analysis of Table 4 shows that the probability of taking out a policy increases with age. As regards age, Nayaradou (2009) observed a difference between our study and that of Cosa-Font and Rovira-Forns (2008). The latter authors note a greater reported preference for LTC insurance by younger people than by older people. Same result in my study. Furthermore, age is often taken as a LTC insurance contract price indicator: the higher the age the higher the contract price. The fact that in our study subscription rates increase with age seems to suggest that price is not a fundamental variable in the decision to subscribe. It seems rather that the approaching risk (as age advances) encourages people to take out insurance. Also, our results tend to agree with Meier's (1998) theoretical predictions. Meier's model shows that young people and middle-aged people are less likely to insure themselves than older people.

Secondly, wealthier people are willing to buy LTC insurance than poorer people.

Thirdly, living arrangement is also a significant factor affected people’s behavior. Especially for those old-age people live with multi-generation. The beta-value is negative with a p-value smaller than 0.05. This could be explained by the social norm in China due to the traditional view of “raising children for old age”. Those traditional families tend to provide care giving by their family members, therefore, they have a relatively low preference to buy LTC insurance with an additional expense.

Lastly, for the last point considering LTC experience, the negative beta-value claims that people with LTC experience whether from their family members or friends are
willing to buy LTC insurance to better alleviate their pressures. It shows the importance of teaching the citizens to know about LTC and LTC insurance.

The bottom line of this empirical study is that the LTC in Chengdu, or we can say in a larger scope, do not develop well. Partly because its high price and relatively new to people, however, as have shown, even among high income and very professional group, such desire to buy TLC insurance is not strong. Therefore, we believe the main problem is a lack of structural arrangement. In the next sections, we will put more attention on how other developed countries do to deal with the TLC insurance. First, we will introduce three different ways to develop TLC insurance, and then compare their merits and shortages. Through such comparisons we try to find a proper way to implement TLC in developing aging areas of China.

Cross-national Comparison: Japan, Korea, Singapore and United States
This section will explore three different approaches taken by governments to address LTC demand of their citizens.

- Universal LTC Insurance program in Japan and Korea
- LTC program in the U.S. that mainly depends on the private partners to finance services
- The Public-Private Partnership conducted in Singapore

Type I: Japan and Korea
Japan, with a current population of 126.719 million, is famous for its high proportion of elderly population in the world. In 2010 about 23% were aged 65 and over, compared with over 20% in Germany and only about 11% in Korea. And this trend will grow rapidly during the next two decades: The proportion of the elderly population aged 65 and over in those three countries are projected up to 35% in the year 2050.

Focusing on Asian countries, Japan and Korea are embedded in a traditional norm of filial piety that perpetuates care giving by family members. For 2006, approximately 9.8% of Japan’s population over the age of 65 received LTC at home and 3% received care in an institution. While 2.1% of Korea’s elderly population received care from family members and 1.1% of this population received professional services in 2009.

In response to the increasing demand for the availability and access to elderly care, Japan implemented LTC insurance in the year 2000. It has been setup as the social insurance mode with public ownership and partial subsidy. It has somewhat mitigated the pressure brought by the old-age crisis in Japan. While Korea implemented a universal, comprehensive LTC insurance program in the year 2008. It is expected that the introduction of the public LTC scheme will result in an increase of care facilities in Korea. For instance, the number of home-based LTC service increased by about 63% and number of residences providing LTC assistance increased by about 19% within two years from the introduction of the public LTC system in Japan. Compared to LTC system in Japan, the management of Korea’s LTC insurance scheme is more centralized. And it characterizes for uniform contributions and benefits that are founded on its single-payer health insurance system.

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8 Country Report Korea, OECD 2011
The LTC insurance has been mainly implemented in municipalities and special administrative regions in Japan. The target population is all citizens aged 40 and above (65 and above – Type I Insurant, 40-64 – Type II Insurant, and others). Insurant pays 50% of the insurance contribution (33% - Type I, 17% - Type II). Another 50% is from all levels of the government (25% - Central government, 12.5% - counties, 12.5% - municipalities). The contribution from Type I insurant is determined based on income taxation and subtracted from pension automatically. Type II insurant pays the amount calculated based on national averages and his/her specific medical care item(s). Public-private partnership (PPP) has been employed in the system as the funding resource, which reduces financial burden for each insurant to some extent. However, the adopted method of financing is known as Pay-As-You-Go (PAYG), which essentially can hardly deal with the financial pressure.

Korea provides LTC benefits to those aged 65 and over and to individuals with geriatric diseases regardless of age. The program is funded by a combination of contributions paid by the insured, government subsidies and co-payments paid by the beneficiaries. This public financing model was built on the existing vehicle established for funding other Korean welfare program like pension, unemployment insurance. Using the same financing model allows the Korean government to leverage its existing National Health Insurance Corporation (NHIC) system and provides operational efficiencies. The LTC insurance contribution is paid by the working-age population and its based on a fixed percentage of health insurance contribution. In 2011, the health insurance contribution was set at 5.33% of wages, 6.56$ of which went towards LTC; the two contribution are collected together. Overall, the financing includes a government subsidy of 20%, a co-payment of 15% (home health) or 20% (institutional care), and a contribution of 60-65%.

Japanese long-term care insurance consists of two types: in-home and in-facility. To acquire insurance service, the insurant first needs to qualify certain requirements through the qualification committee of the system. The second step, each insurant’s status needs to be determined. Only individuals in “need-long-term-care” status or “need-support” status get the service. The service is classified into 6 levels, i.e. support and care level 1—5. Individuals have to obtain judgment on their needs in long-term care and/or support before they receive any service. For long-term care insurance, the degree of incapacity is mainly determined based on subjective assessment, which has been widely challenged. The insurance pay is delivered mainly in the form of goods and partially in the form of cash. This to some extent discourages individuals from insuring. Class specific insurance charges are presented in Table 5. Under the circumstances of utilizing insurance, 90% of the total expenditure on in-home care service and in-facility care service has been covered (note that when using facility, per diem needs to be paid).

Table 5 here

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10 D.Nleder and A. Leung, Long-term Care at a Crossroads: Delivery of Adequate Protection to the Wilder Public
11 Ibid, fn2
13 D.Nleder and A. Leung, Long-term Care at a Crossroads: Delivery of Adequate Protection to the Wilder Public
An appointed committee including doctors and nurses will determine the eligibility and level of each LTC insurers who claims for the services. The local NHIC agents will review their documents of a standard questionnaire and assessment materials. The assessment criteria include ADLs, age and disabilities/health conditions. An applicant can achieve a maximum score of 100 on the questionnaire; a score of 55 and over qualifies the applicant for LTC benefits.

Long-term care insurance in Japan and Korea has helped decrease the pressure from the aging population and thereby enhances families’/government’s financial status. The mode of in-home care has saved resources from the nursing houses. At the same time, evidences show that “hospitalization” has been contained effectively. During recent years, the prospering nursing industry highlighted both in booming economy of Japan and Korea, which overall speaks positively for the development of long-term care insurance.

Type II: United States
Long-term care insurance in U.S. has started as of 1980s. To ease the financial burden on public program such like Medicare and Medicaid, alternatives have been considered in order to increase public-private partnerships (PPP) and to enhance private LTC insurance in the U.S. However, there has been little success with efforts. Basically, the LTC insurance is mainly provided by business insurance companies. Their insurance products include:

1. Services at nursing facilities: professional care – 24-hour watch; intermediate care – regular daily services; basic care – providing basic assistances in daily life.

2. Services at communities: including home health care, adult day care, assisted living, and en-of-life care, etc.

Eligibility for LTC in the U.S is restricted unless one carries a private LTC policy. Its requirements for Medicaid are based on income and personal assets and vary by state. Medicare was created to provide healthcare coverage to individuals who are aged 65 and over. Providing less restricted and broad LTC coverage has been one of the primary LTC reform considerations in the U.S. LTC program alternatives have been designed to overcome some of the existing restrictions, such as means-testing. The Community Living Assistance Services and Supports (CLASS) program is a recent example of the alternatives that were determined actuarially unworkable and halted in its implementation.

In the U.S., as mentioned, a majority of the funding for LTC is provided by Medicare and Medicaid. Close to 40% Medicare while less than 10% is financed by private LTC insurance. Much of the remainder (29%) embraces out-of-pocket costs paid by those receiving care or by their families. The proportion of out-of-pockets costs for LTC in the U.S. is larger than in most other countries around the world. The main payment type of long-term care insurance is cash. The payment in the form of goods becomes more typical as “managed care” grows in U.S. The premium rate is highly related to the payment. Longer benefit period and shorter elimination/deductible period (see the
following paragraph) lead to a higher premium rate. The insurant can select the maximum daily benefit ($40 – $250) and benefit period (typically 2 – 5 years).

Every person has specific needs and the long-term care insurance policies can be created to suit those needs. The insurant can renew his/her insurance contract. Based on the contract, the renewal-enabled period is limited to a certain range based on his/her age. There are options such as inflation protection and nonforfeiture benefits (i.e. receive some benefit value for the money you have paid into the policy if you drop your coverage) in the policy to protect the insurant. Many policies have specified elimination period/deductible period in them, during which the insured is eligible for benefits but for which no long-term care insurance benefits will be paid by the insurance companies. The insurant will be compensated if he/she still needs care services after the elimination/deductible period. The premium rate is usually lower for the policies with longer elimination/deductible period.

The ways of selling long term care insurance is various from individual, group to attachment of life insurance. The long term care insurance is also divided as individual insurance and group insurance. Within the group insurance, there are non-employer supported and employer supported. For those who choose employer supported plan, the US government will provide some tax relief. These tax relief is a stimulation to both employers and employees as well as care industry.

The financial resources of long term care is primarily from individual and government. The average growth rate of long term care premiums in U.S is approx 6%, making consumers hesitate to buy such insurance. In 2004, insurance industry sold 699 million long term care insurance, while in 2000, this figure is 981 billion. Half of the insurance companies whose volume of sales exceed 10 million have quited from the this market. A shrinking market is the biggest threaten to the industry.

Thus, a more far-reaching solution may be needed. A recent example of that effort would be the CLASS Act that was passed as part of 2010 Health Reform. The CLASS Act would have created a voluntary government LTC insurance program, designed to assist in maintaining independence by providing cash benefits for those with functional disabilities to purchase non-medical services. Enrollment in the program would have been automatic for employees of participating employers, but with the ability to opt out. In Oct. 2011, however, the U.S. Secretary of Health and Human Services declared the CLASS program to be actuarially unworkable and work on the program’s implementation ceased.

**Type III: Singapore**

With 5.1 million citizens, Singapore is a small but unique country in Southeast Asian. The old-age population ratio is relatively low today; however, the aging process is predicted with a triple rate than other Asian countries. The mission of the Singapore government towards healthcare is to make good, affordable basic healthcare available to Singaporeans with a minimum of public subsidy, while promoting individual responsibility towards healthy living and medical expenses. The element of co-payments from patients is a central feature of Singapore’s approach to cost

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14 Most information directly comes from D.Nleder and A. Leung, Long-term Care at a Crossroads: Delivery of Adequate Protection to the Wilder Public
15 Ministry of Health, Singapore, [http://www.moh.gov.sg/content/moh_web/home/out_healthcare_system.html](http://www.moh.gov.sg/content/moh_web/home/out_healthcare_system.html)
management. Overall, healthcare in Singapore is financed through a combination of a compulsory medical savings account (Medisave), a low-cost catastrophic illness insurance, and a state-funded endowment fund.

The government in Singapore has embarked on a 3-E approach (Elderfund, Eldershield, and Eldersave) to help its citizens finance their future LTC expenses:

- Elderfund was set up in 2000 and serves as a means-tested safety net for elderly from households with lower incomes that pays for LTC expenses provided by selected voluntary welfare organizations. It is an endowment fund with a target capital of 2.4 billion USD. Oly interest generated from the fund is used to finance respective subsidies.

- Eldershield is an obligatory insurance scheme, which was set up in 2002 to protect against the cost of LTC expenses and which is run by the Singapore Ministry of Health (MoH). The government provides the framework for the scheme but the private insurance industry assumes the role of risk taker and administrator. When the scheme started in 2002, a tender went out to all Singapore insurers, and two companies were finally chosen for the period 2002-2007. A third Singapore insurer was added for the 2007-2012 after another tender, and a new tender is expected later in 2012. The scheme provides a fixed monthly cash benefits to help pay for out-of-pocket care expenses.

- Eldersave was set up in 2010 to encourage the younger generation to set aside funds for future LTC needs.

And we will focus on the second Eldershield scheme for more detailed information.

Eldershield was designed and is monitored by the Singapore government, but it is currently offered and administered by three private life insurance companies. All three insurers offer the same premiums and benefits under the ElderShield scheme. Premium increases are only possible subject to approval by the MoH. Benefits are initially approved by the insurance companies; however, claimants can appeal to the ElderShield Arbitration Panel that is set up by the MoH and whose decisions are final and binding.

Eldershield is an obligatory insurance program, that is to say, all Singapore citizens and permanent residents who have a Medisave account are automatically invited into the scheme when they become 40 years old. It is possible to opt out of the scheme if a corresponding opt-out form is submitted to the respective insurer. Re-entry into the scheme is only possible subject to a health declaration and good state of health. Premiums depend on gender and age at entry and are payable annually until 65. The premiums are not guaranteed, but increases have to be approved by the MoH after receiving an actuarial report from a consulting actuary appointed by the MoH and are capped at 20% over a five-year period. The payment of the premiums can be made from the medical savings account.

The Singapore government is still hunted by challenges from its LTC insurance program. It has been reported that the opt-out rate of the Eldershield scheme has decreased from 38% in 2002 when the scheme was introduced to 14% in 2006. There were about 810,000 in-force basic Eldershield policies in 2010, which implies that about half of Singapore citizens and permanent residents aged 40 and above are

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covered by the scheme. Reasons quoted for the dissatisfaction with the basic Eldershield scheme are low monthly benefits, strict criteria for claims and short benefit durations17.

Managing the future care expenses of those who opted out of the Eldershield scheme at a young age can be a political and economic challenge. The Singapore government might also be faced with pressure to allow re-entry at age 65 and above in the future. There were about 190,000 supplemental policies in force in 2010, and only about 14% of Singapore citizens and permanent residents in the 40-65 age range had purchased additional LTC protection that enhances their basic coverage. The Eldershield scheme is not a social insurance scheme, and higher income earners pay the same premiums as lower income earners. The burden of purchasing the LTC protection is hence significantly more severe for lower income earners. This might induce anti-selection of healthy people who hope for government subsidies should the need for care arise in their future lifetime and who prefer to opt out of the scheme.

So far we have reviewed three different ways to develop LTC insurance. Those countries all have their own systematic schemes to build LTC protection for citizens. However, a critical question follows immediately, which one will suit China best, especially for those less advanced areas? Culturally, the Chinese share a similar belief to that of Japan and Korean. Should China adopt such a government-oriented strategy or follow what Americans do: to let the market run? Or build a system that involves both government and private firms? In the following section, we will refer a model used in the political economy to try to find a proper way for China.

**The Choice of Ways**

To our knowledge, there is few literature that gives a solid and convincing suggestion regard this issue. However, we find a model once used in Biology and Game Theory and recently in Political Economy named Predator-Prey model can be applied to our issue. In this section, we will follow Zhang’s (2012) Predator-Prey model to figure out a right way.

If we treat potential clients of LTC insurance as prey while the premium of TLC insurance as predator, we may build a Predator-Prey model. The basic Predator-Prey model has this endogenous relationship with a cycle of flows: an increase in the prey population leads to more predation, more predation will then low the density of prey, subsequently a lower density of prey reduces the frequency of predation, and eventually a lower level of predation induces to an increase in the prey population. It is frequently used to describe the dynamics of biological systems in which two species interact, one a predator and one its prey. These interactions will create a cycle of flow as aforementioned. In general, The model is a part of evolutionary game theory.

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With a standard setting of a Predator-Prey model, LTC insurance premium is defined as “predator” and potential buyers as “prey”. An exception to the basic model, we assume government plays as “intelligent designer”, i.e. Government can adjust parameters to keep the economy stable. On the basis of these assumptions, a Predator-Prey model is developed,

\[ \dot{X} = gX \left(1 - \frac{X}{K}\right) - \frac{X}{S + X} Y, \]
\[ \dot{Y} = \frac{X}{S + X} Y - \gamma Y. \]

where:
- \( X \) is the number of the potential buyers, and it has a logistic growth rate. This rate depends on how well government “invest” to the LTC industry.
- \( Y \) is the premium of LTC insurance
- \( XY \): interaction term, which indicates the encounter rate of a random prey with a random predator.
- \( \mu \) is the coefficient of predation rate, it will largely decide whether a prey is caught and a predation is executed.
- \( \delta \) is the amount of resources gained when the predator executes the predation. It also measure the efficiency of an institute, a higher \( \delta \) means more efficient.
- \( \gamma \) measures how competitive within the LTC market, more competitive less premium will be charged. It also measure how much government-provided social security plan can replace private LTC insurance.
- \( S \) measures the saturation rate. A saturation effect indicates that predators might be satiated with food intake or does not have enough time to handle too much prey.
- \( K \) is the maximum just-maintainable density of prey. Beyond \( K \), the prey population will be over-crowded.

The non-zero rest points of these equations (i.e. Points that makes \( \frac{dx}{dt} = 0 \) and \( \frac{dy}{dt} = 0 \)) are \( Y = \frac{gK - gX}{k} \times \frac{S + X}{\mu} \) and \( X = \frac{\gamma S}{\delta - \gamma} \). Therefore, these equations simultaneously include both stabilizing and destabilizing forces. The \( \frac{dx}{dt} = 0 \) locus begins with positive slop and then ends up with a negative slop. While the \( \frac{dy}{dt} = 0 \) locus is a vertical.
The slope of this prey locus is the partial derivative of $Y$ with respect to $X$:

$$\frac{dY}{dX} = \frac{g(K-S)}{k\mu} - 2gX$$

with $X^* = \frac{K-S}{2k\mu}$. Any $\frac{dy}{dt} = 0$ locus locates left side of $X^*$ leads to a stable situation where $X$ and $Y$ converges to a steady state. However, any $\frac{dy}{dt} = 0$ locus on the right hand side of $X^*$ leads to an unstable situation where eventually they will go extinction.

This model has a critical implication. Since we assume government is intelligent designer and can modify the parameters, we can try to explain these parameters.

(1) This model suggests a mix of market and government-oriented LTC strategy is more desirable than a purely market strategy. The parameters $\gamma$ and $\delta$ will largely determine the position of the vertical predator locus. The movement of this locus has to be incremental rather than radical, because it is limited by the carrying capacity $K$. Even if there is immediate mass privatization, the market cannot be suddenly inflated so as to accommodate a large number of market capacity. Graphically, if the government manually moves the predator locus to the right of $K$, it incurs a policy failure.

(2) The market liberation and economic growth will enhance the ability of consumption, which as a result, increase the carrying capacity $K$. As carrying capacity expands, $X^*$ will move towards right as shown in the following figure:
This will lead an unstable situation to a stable one, which implies some level of liberation of LTC insurance is necessary.

Therefore, we believe that a mix structure of government-oriented and private-provided LTC insurance is a best way for China to adopt.

**Policy Implication**

The concept of Public-Private Partnership is based on Governance Theory, Public Choice Theory, and cooperation theory. To activate the cooperation and interaction of government, society, and market, the PPP theory introduces competition mechanism into public service area. In this way, the capital, technology and management experience from private sectors will fully support the service delivery achieving the public interest maximum. After all, PPP could be regarded as a new way for both government and its citizens to manage public life together.

No matter consider the aging speed or the economic situation, however, the LTC insurance in China will route to social insurance model in the future. Therefore, we think it is necessary for the government to include the LTC insurance into our current social security system legislatively under the principle of ‘limited benefit, wider coverage, pool account plus individual account. The interactively development of both social insurance and commercial insurance will meet different levels of needs from the public.

1. System design

To build a mixed structural of LTC program, the most important thing for government is to design such structural properly. We suggest in the following three parts:

(1) Financing

A proper finance model is a key element to a success of long term care project. It includes how to collect premium and through which mechanism. We believe that a triple provided finance method suits best in China: the government-oriented long
term project should be paid by the government, employers and employees. Since for employers, it is a way to keep employees’ loyalty as well as to improve enterprises’ social appearance. The government itself should be source of long term care project, however, the proportion is critical. Currently, it is widely believe that the government should invest more resources to the social security program.

(2) Operation

We also believe that follow a structural that mixed PAYG and funded is a more efficient way to deal with the running issue. It is useful to take Japan as an example when running such LTC funds, however, consider such population aging problem China now face, it might be not so wise to only opt PAY.

(3) Benefit

Under the contest of mixed structural, the government-oriented LTC project should not be too big, therefore the respective benefit should be limited to very basic. It is also very considerable to provide more medical service than to give money directly.

2. Financial support

Government continues its preferential tax policies towards commercial insurances and nursing homes as part of financial supports in the public-private partnership. It will give tax breaks to individuals and businesses that purchase long-term commercial nursing insurance. Preferential tax policies can also encourage nursing homes to enter the market of long-term cares. Another critical task for the government at this stage is to provide fiscal subsidizes to infirm and impoverished seniors. They need long-term care, but they can not afford social insurance, not to mention commercial insurances. Government should provide free or subsidized long-term care and low-level welfare subsides. Government should strike a balance between efficiency and equality in the development of long-term care insurance.

3. Governance and Regulation

In the path of Public-Private Partnership, both commercial model and social insurance model should be supervised effectively by the government. Firstly, the government should regulate the eligibility of LTC insurance from the supply side. As a positive response to the new LTC insurance policy supported by the government, the LTC institutions in market will increase rapidly. At the same time, the government should produce strict and reasonable standard for service suppliers to get an access license. Secondly, the government should assess the eligibility for the elderly to get their benefits and services in different levels. The three types of countries we discussed above are all conducted strict series of standard to verify and examine claims from insurers. The government should clarify levels of needs of old-age people based on ADLs and physician certificates. Thirdly, government coordination allows clients, service and insurance institutions to buy long-term care insurance under a transparent, fair, open, convenient environment and to benefit all parties in the development of TLC industry.
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Appendix

Table 1 Disposable Income of US, Japan and China

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Disposable Income of US (US dollar)</th>
<th>Disposable Income of Japan (1 billion Yen)</th>
<th>Disposable Income of China (RMB)</th>
</tr>
</thead>
</table>

### Table 2 health care expenses from 2003 to 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total expenses paid by individual (100 million RMB)</td>
<td>3678.7</td>
<td>4071.4</td>
<td>4521.0</td>
<td>4853.56</td>
<td>5098.66</td>
<td>5875.86</td>
</tr>
<tr>
<td>Average expenses paid by individual (RMB)</td>
<td>509.5</td>
<td>583.92</td>
<td>662.30</td>
<td>748.84</td>
<td>875.96</td>
<td>1094.52</td>
</tr>
<tr>
<td>Total expenses paid by government (100 million RMB)</td>
<td>1116.94</td>
<td>1293.58</td>
<td>1552.53</td>
<td>1778.86</td>
<td>2581.58</td>
<td>3593.94</td>
</tr>
</tbody>
</table>

### Table 3 statistical presentation

<table>
<thead>
<tr>
<th>Number</th>
<th>Sex</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>%</td>
<td>54.4</td>
<td>45.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Martial Status</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>Unmarried</td>
</tr>
</tbody>
</table>

| 60.0 | 26.1 | 7.2 | 6.7 | 2.8 | 8.9 | 22.2 | 25.6 | 30.6 | 10.0 |

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Monthly Income after tax(RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Company Employee</td>
</tr>
</tbody>
</table>

| 8.9 | 36.7 | 15.6 | 11.1 | 9.4 | 5.0 | 13.3 | 20.0 | 28.3 | 28.3 |

<table>
<thead>
<tr>
<th>Monthly Income after tax(RMB)</th>
<th>Living Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>8001-10000</td>
<td>1w-1.5w</td>
</tr>
</tbody>
</table>

| 8.9 | 36.7 | 15.6 | 11.1 | 9.4 | 5.0 | 13.3 | 20.0 | 28.3 | 28.3 |
### Health Status

<table>
<thead>
<tr>
<th>Health Status</th>
<th>Is there any patient with LTC in family?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>Yes</td>
</tr>
<tr>
<td>Self-care with some problem</td>
<td>Yes</td>
</tr>
<tr>
<td>Partly self-care</td>
<td>Yes</td>
</tr>
<tr>
<td>Cannot self-care</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| 69.4 | 23.3 | 6.1 | 1.1 | 63.3 | 36.7 |

### Table 4 Variables in the Equation

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>B</th>
<th>Wald</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V1 Sex(1)</td>
<td>-1.161</td>
<td>1.335</td>
<td>.248</td>
</tr>
<tr>
<td></td>
<td>V2 Age</td>
<td>1.843</td>
<td>8.089</td>
<td>.004**</td>
</tr>
<tr>
<td></td>
<td>V3 Marital status</td>
<td></td>
<td>5.467</td>
<td>.141</td>
</tr>
<tr>
<td></td>
<td>unmarried</td>
<td>1.265</td>
<td>.571</td>
<td>.450</td>
</tr>
<tr>
<td></td>
<td>divorced</td>
<td>-6.340</td>
<td>4.242</td>
<td>.039**</td>
</tr>
<tr>
<td></td>
<td>widowed</td>
<td>0.238</td>
<td>0.006</td>
<td>.936</td>
</tr>
<tr>
<td></td>
<td>V4 Education</td>
<td>0.245</td>
<td>0.245</td>
<td>.621</td>
</tr>
<tr>
<td></td>
<td>V5 Occupation</td>
<td></td>
<td>3.495</td>
<td>.745</td>
</tr>
<tr>
<td></td>
<td>Company employee</td>
<td>-2.027</td>
<td>0.889</td>
<td>.346</td>
</tr>
<tr>
<td></td>
<td>Public Servant</td>
<td>0.300</td>
<td>0.016</td>
<td>.900</td>
</tr>
<tr>
<td></td>
<td>Doctor and Nurse</td>
<td>-3.506</td>
<td>1.102</td>
<td>.294</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>-1.814</td>
<td>0.358</td>
<td>.550</td>
</tr>
<tr>
<td></td>
<td>Soldier</td>
<td>-2.906</td>
<td>0.906</td>
<td>.341</td>
</tr>
<tr>
<td></td>
<td>Self-employed</td>
<td>-3.595</td>
<td>1.815</td>
<td>.178</td>
</tr>
<tr>
<td></td>
<td>V6 Income after tax</td>
<td>3.674</td>
<td>9.455</td>
<td>.002**</td>
</tr>
<tr>
<td></td>
<td>V7 Living arrangement</td>
<td></td>
<td>8.806</td>
<td>.097*</td>
</tr>
<tr>
<td></td>
<td>With spouse and child adult</td>
<td>-1.275</td>
<td>0.833</td>
<td>.362</td>
</tr>
<tr>
<td></td>
<td>With multi-generation</td>
<td>-3.747</td>
<td>3.930</td>
<td>.047**</td>
</tr>
<tr>
<td></td>
<td>Alone</td>
<td>-0.471</td>
<td>0.059</td>
<td>.809</td>
</tr>
<tr>
<td></td>
<td>With friends</td>
<td>-3.660</td>
<td>1.812</td>
<td>.168</td>
</tr>
<tr>
<td></td>
<td>With siblings</td>
<td>-0.982</td>
<td>0.170</td>
<td>.681</td>
</tr>
<tr>
<td></td>
<td>V8 Health Status</td>
<td></td>
<td>5.087</td>
<td>.166</td>
</tr>
<tr>
<td></td>
<td>Self-care with some problems</td>
<td>0.415</td>
<td>0.057</td>
<td>.812</td>
</tr>
<tr>
<td></td>
<td>Partly self-care</td>
<td>-6.540</td>
<td>4.475</td>
<td>.034**</td>
</tr>
<tr>
<td></td>
<td>Cannot afford</td>
<td>9.085</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>V9 Experience</td>
<td>-5.697</td>
<td>9.484</td>
<td>.002**</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-10.162</td>
<td>7.372</td>
<td>.007**</td>
</tr>
</tbody>
</table>

### Table 5 The Insurance Charges for Different Service Class

<table>
<thead>
<tr>
<th>Class</th>
<th>Need Support</th>
<th>Care Level 1</th>
<th>Care Level 2</th>
<th>Care Level 3</th>
<th>Care Level 4</th>
<th>Care Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance</td>
<td>About 60,000</td>
<td>About 170,000</td>
<td>About 200,000</td>
<td>About 260,000</td>
<td>About 310,000</td>
<td>About 350,000</td>
</tr>
<tr>
<td>Charge per</td>
<td>Yen</td>
<td>Yen</td>
<td>Yen</td>
<td>Yen</td>
<td>Yen</td>
<td>Yen</td>
</tr>
<tr>
<td>Month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6 Symptoms by grade in the Korean public LTC insurance program\(^{18}\)

<table>
<thead>
<tr>
<th>Grade score</th>
<th>Grade I (Severest)</th>
<th>Grade II (Severe)</th>
<th>Grade III (Moderate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95+</td>
<td>The patient remains lying down all day long and cannot move independently.</td>
<td>The patient uses wheelchairs but cannot keep sitting posture.</td>
<td>The patient needs partial help from other people in daily activities such like eating, toileting, and dressing.</td>
</tr>
<tr>
<td>75-95</td>
<td>The patient needs total help from other persons in daily activities such like eating, toileting, and dressing.</td>
<td>The patient needs total help from other persons in daily activities such as eating, toileting, and dressing.</td>
<td>The patient in many cases spends most of time lying on the bed.</td>
</tr>
<tr>
<td>55-75</td>
<td>The patient can go out only with the help of other persons.</td>
<td>The patient needs partial help for 3-5 items of ADL in brushing teeth, washing face, etc.</td>
<td></td>
</tr>
</tbody>
</table>

Results of examination

<table>
<thead>
<tr>
<th>Grade I (Severest)</th>
<th>Grade II (Severe)</th>
<th>Grade III (Moderate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient needs total help in more than 6 items of ADL including the changing of body position, eating or sitting down.</td>
<td>The patient needs help in more than 5 items of ADL such as eating, sitting down, washing face or brushing teeth.</td>
<td>The patient needs partial help for 3-5 items of ADL in brushing teeth, washing face, etc.</td>
</tr>
</tbody>
</table>

\(^{18}\) Ibid, fn 2.