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Retirement Strategy Study Based on Simulation Experiment

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Abstract
To minimize negative effects, it is necessary to well-consider workers' retirement intentions and decisions when government formulates and implements postponing statutory retirement age scheme having significant influences on interests of government and workers. In reality, formation of workers' retirement strategies is not based on perfect information and complete rationality, but affected by social relation network. This paper establishes a simulation experiment model to simulate reflections of workers being confronted with a delaying retirement scheme. The results after running a simple experiment show that a worker' retirement intention and decision may change after referring to link-persons' mainstream opinions no matter how decision-making ability he/she has.

Key words: Postponing statutory retirement age; Social network; Simulation experiment; Retirement intention and decision

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INTRODUCTION
Statutory retirement age[1] is an essential social economic parameter. Governments can make interventions in some other important social economic variables, say revenue and expenditure of the social pension insurance fund or employment capacity and structure of labor market, by adjusting it. In order to improve social administrative efficiency, it is considered necessary for government to select an appropriate time to extend statutory retirement age[2]. However, it's no doubt for workers that postponing retirement will bring about utility decrease owning to reduction of spare time. So, the attitude of workers, who are for or against delaying retirement scheme, will have a decisive impact on effects of this scheme. An example that the government of France extended the statutory retirement age from 60 to 62, which then causing social instability, indicates that it is the game pattern between a government and social public that decides social policies' effects[3]. Particularly, if a government unilaterally imposes to delay retirement, touching the core interests of workers, without accurate grasp of workers' opinion, the social crisis will be inevitable.

[1]In some state without explicit regulations on statutory retirement age, to regulate statutory age entitlement for enjoy social pension is a common approach.
[2]Delaying retirement scheme is regarded as having many positive effects for government, for example, can reduce the payment gap of current social pension fund; can decrease support rate and increase the demographic dividend; can utilize high skilled human resources more efficiently, and etc.
[3]The French government proposed the retirement system reform on July 13, 2010. the bill would raise the minimum retirement age from 60 to 62. once put forward that the bill is strongly opposed by opposition parties and trade unions in France. Demonstrations and strikes fell and rose, which result in great losses for French economy. The leader of socialist party threatened to recovery the minimum retirement age to 60 again once he won the presidential election.

In China, a research institute with government background put forward the conception of delaying statutory retirement age in 2008 due to consideration of cope with social pension payment pressure in the near future. When assessing effects of this idea, Chinese researchers are always trying to explore how replacement ratio of pension, post, and some other elements affect workers' retirement intentions and decisions through some statistical method. There is an apparent defect without considering impacts of social relation network on the retirement intention and decision of a worker. To solve this problem, this paper will build a model through simulation method based on the concept of social network so as to put forward a more scientific method to evaluate effects of postponing retirement scheme in China.

1. INFLUENCE FACTORS ON EFFECTS OF POSTPONING RETIREMENT SCHEME

Generally, the basis referred by government when formulating statutory retirement age policy subsume not only workers' natural physiological index but also several social administration indexes, such as the average life expectancy, rate of unemployment, ratio of social support, social pension payment gap, and etc. Whether workers support postponing retirement scheme or not, will decide its effects directly. According to some respective studies based on statistics samples extracted from Chinese workers by Chinese researchers, age, education background, income level and nature of job are main factors to affect workers' retirement intentions and decisions significantly (Sun & Wu, 2009). Obviously, impact of social network elements, such as the ideas of family members, friends, leaders at higher level, nature of working unit, and differences among workers, such as individual decision-making ability, intention stability, had not been taken into Liao's consideration. Therefore, it is necessary to seek a better way to fit closer to the reality of the process following which workers form their retirement intentions and make retirement decisions.

This paper researches effects of delaying retirement scheme from the perspective of social network[1]. The constructed model is made up of two types of nodes. One node represents workers, the nature of which include name, age, social identification marker[2], nature of post, replacement rate of basic pension, their opinions to the delaying retirement scheme, their capacities of making decisions, the stability of their decisions, and link-persons they contacting with (say relatives, classmates, workmates, friends and so on). The other node represents various communities which can be divided into working units and other communities which may have effects on workers' retirement intentions and decisions, such as enterprises in the same industry, superior departments, customer units and so on. There are also some edges representing information dissemination medias in this social network model. Whether it is community or individual, whether he/she plays the role of opinion leader, adherent or some others, all of impacts cannot be made without proper information dissemination medias. Different information dissemination media also affects workers' retirement intentions and decisions.

Standing for the view of social network, this paper will well-consider complexity of formation of workers' retirement intentions and decisions. Assumption as usual, if individual was a rational people completely; the main optimization goals of him/her when making decisions will be economic benefits in the case of information symmetry. But reality is information about delaying retirement is not entirely symmetrical, it is unsubstantial to establish mathematical optimization algorithm completely according to imperfect information. What's more, when we analyzed the social problems, a worker cannot be completely regarded as a rational person, because there are so many irrational factors, say emotional factors, affecting works' intentions and decisions. For example, someone would like to postpone retirement to avoid formation of the sense of emptiness owing to out of work; or someone would have too more important life planning, such as touring or taking care of great-grandchild, to take huge income difference before and after retirement into account and have to or be willing to retire directly no matter how retirement scheme changes; or in other cases, someone cannot analyze all of pros and cons and economic profit and loss of delaying retirement due to insufficient information, and then vary his/her ultimate retirement intention and decision because of the influence from link-persons' opinion. It's very clear that all of the above described cannot be accurately specified only by a simple model or a regression equation. This study tries to break through the difficulties through designs of simulation experiment.

2. DESIGNS OF SIMULATION EXPERIMENT

In experience, views of most of workers on delaying

[1]Scholars observing society from the perspective of social network propose that all of the decisions made at individual level should be considered at social network level. The theories of social network regards social structure as network structure, being made up of nodes and edges. Nodes represent individuals, groups or orgnizations; edges represent relations among these nodes. According to this theory, all of actions of one node will be influented by link-persons in the social relation network.

[2]Social identification markers refer to markers used to distinguish somebody in social relation network, for example, ID number or mobile phone number and etc.

retirement scheme may not be absolute extreme but a continuous change in attitude swing. Additionally, non-economic rationality and non-independent decision process are both important characteristics that should be described in a model of complex social network. In this paper, a dynamic model with communities is presented which takes into account the differences in community structures on the basis of Deffuant model, and a simple simulation experiment is to be run (Cheng, Xu, Peng, & Zhou, 2013).

2.1 Selection of Parameter (Cheng, et al., 2013; Liu, Hu, Luo, & Si, 2009)

There are three types of agents, that is, receptor agent of delaying retirement scheme, community agent that receptor involves in, and media agent.

Table 1
Parameter of Receptor Agent

Parameter	Parameter description and value
Name	Name (a) = a
Age	Age (a) = actual age (take the actual age of integer)
Gender	Gender = 0, female; gender = 1, male
Address	Address (a) = telephone number or mobile phone number
Post	Types of post: post = 1, senior executive; post = 2, middle managers; post = 3, production and sales staff; post=4, logistics service staff; post = 5, research staff; post = 6, administrative staff
Replacement rate	Pro forma replacement rate of pension: Replacement rate of pension values among [40%, 200%]
Opinion	Worker's decision intention: Continuously value among [0, 1], opposition for 0, support for 1.
Capability	Decision capability: Continuously value among [0, 1], the bigger, the stronger ability of decision; contrarily, the less, the weaker ability
Uncertainty	Uncertainty degree of worker's decision intention: To value among (0,0.2] or [0.8,1) in the initial intention represents someone is not easily affected by social network, called as determined ones; To value among (0.2, 0.8) represents contrarily someone is susceptible to influent from social network, called as opinion wiggler; To value 0 or 1 means someone has extreme opinion on delaying retirement scheme and will not be affected by social network, called as opinion leader.
Contact-list	Contact list: Contact-list (a) = (L_1, L_2, …, L_n), L_i represents link-persons of the researched person, (i = { 1, 2, …, n }). Properties of L_i include: Name (i)=I; Address (i) = telephone number or mobile phone number of i; Influence-Degree (i) ∈ [-1, 1]; contact distant (a, i) = min (x), x is the number of all contact from a to i on contact-list.

Table 2
Parameter of Community Agent

Parameter	Parameter description and value
Type	Types of working units: type = 1 is public sector; type = 2 is institution (type = 2.0 represents the institution supported by financial fund; type = 2.1 represents the institution may be or is going to be reconstructed as enterprise); type = 3 is public ownership enterprise (type = 3.1 represents enterprises administrated by State-owned Assets Supervision and Administration Commission; type = 3.2 represents financial enterprise administrated by China Banking Regulatory Commission, China Insurance Regulatory Commission, or China Securities Regulatory Commission; type = 3.3 represents the enterprises administrated by other departments under the State Council or managed by mass organizations); type = 4 is private economics (type = 4.1 represents leading enterprises; type = 4.2 is competitive enterprises); type = 5 is self-employed economics; type = 6 is NGO; type = 7 is virtual economics; type = 8 is other irregular organizations.
Address	Address (a) = office phone
Field	Business field: According to industry classification under statistics of national economy in China, to value natural number, such as 1, 2, 3, and etc.
Scale	Scale of community: To value positive integer in accordance with the number of the community
Ei	External impact of community (short for Ei): The capability of decision-makers of one community compelling another person of other community to change his/her opinion. Ei is proportional to compromise coefficient u,$u \in [0, 0.5]$
Ic	Internal cohesion of community (short for Ic): Speed of forming inner consensus. Ic is proportional to inner compromise coefficient v ($v \in [0, 0.5]$), inner connection probability, and inner active degree a ($a \in [0, 1]$) .

Table 3
Parameter of Media Agent

Parameter	Parameter description and value
Type	Types of medias: type = 0 represents direct expression; type = 1 represents MicroBlog; type = 2 represents Micro message; type = 3 represents Fetion; type = 4 represents BBS; type = 5 represents telephone or mobile phone; type = 7 represents other communication medias.
Trust	Authority of media: To value positive real number among [0, 10], The higher authority, the larger the value.
Influence	Influence sphere of media: To value positive real number among [0, 1]. The larger effect, the larger the value.

Table 4
Parameters in the Strategy Space of Postponing Statutory Retirement Age

Strategy	Description of strategy	Value of parameter
One step scheme	To postpone statutory retirement age "n" years at one time.	N = 1, 2, 3, 4, 5
Step by step scheme	To select the appropriate reform period "t", to defer statutory retirement age "i" years every "y" years until to achieve planned target "l".	t = 2015, 2016, …, 2050 y = 2, 3, …, 5 i = 1, 2, 3 l = 61, 62, ..., 65
Standard service-length scheme	Only up to standard service-length (e.g. "h" years), retirement process can be entered.	h = 40, 41, 42

2.2 Rule of Action

2.2.1 Rules of Opinion Leaders

a. The probability of I_{leader} tending to a delay scheme is P_1, $P_1 = P_2 \times g$ (degree), (degree is the influence of a delay scheme on utility of Ileader, to value among [-10,10]; g (degree) is an increasing function; P_2 is the probability that I_{leader} express his/her opinion in some community, P_2 = f (Ei, Ic), f (Ei, Ic) is an increasing function).

b. If opinion ∈ [0, 0.2], then add 1 to oppose- num.

c. If opinion ∈ [0.8, 1], then add 1 to support- num.

2.2.2 Rules of Opinion Followers and Opinion Wigglers

a. The probability of I_{others} tending to a delay scheme is P_1, $P_1 = P_2 \times g$ (degree) (degree is the influence of a delay scheme on utility of I_{others}, to value among [-10,10]; g (degree) is an increasing function; P_2 is the probability that I_{others} express his/her opinion in some community, P_2 = f (Ei, Ic)×h (comment-num), (f (Ei, Ic) is an increasing function; h (comment-num) is the propotion of persons who have open comments on the delaying retirement scheme. h (comment-num) is also an increasing function).

b. I_{others} search for the person "K" whose opinion has minimum difference with I_{others} according to the probability of $1\text{-}P_1$. If the difference of opinions between Iothers and K is less than "d" ("d" is a threshold), then Iothers will adjust his/her opinion as opinion'(i):

opinion'(i) = opinion (i) + f (k,i) (opinin (k)-opinion (i))

(f (k, i) is the function represents influence of K on I_{others}).

c. If opinion'(i) < 0.5, then add 1 to oppose-num; otherwise, add 1 to support-num.

3. A SIMPLE SIMULATION EXPERIMENT

Based on the above experimental model, a simple simulation experiment was run.

In the simulation experiment, set link-persons of every receptor agent obey a random distribution. The experiment ultimately indicates evolution process of receptor agents' retirement decision in a uniform random social network. In this experiment, given "t" years for receptor agent to make his/her final retirement decision after exchange of ideas with link-persons every year, the difference between final decision and initial idea on questionnaire will be analyzed in-depth. Only to consider effects derived from changes of replacement rate of pension, then we got a series of interest results.

The initial conditions automatically generated by computer is as follows: 800 nodes (N = 800) and 617 of them agree with delaying retirement scheme at the beginning, 500 edges (kmax=500), t=10.

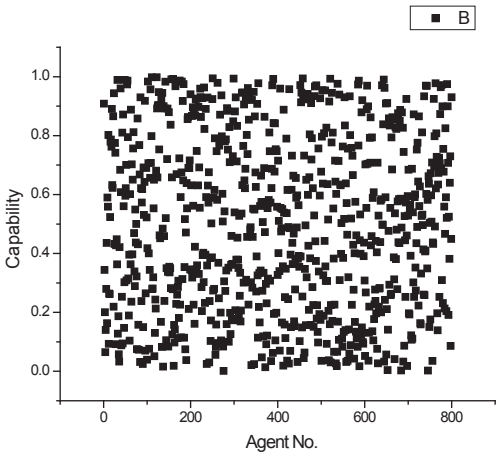

Figure 1
Decision Capability of Every Receptor

It can be clearly seen from Figure 1 that decision capability of every receptor agent obey uniform distribution in [0,1]. Additionally, 247 isolated nodes without link-persons generated in the stochastic network are found to stick to their original choices; and other nodes are non-isolated nodes with one link-person at least, or 5 link-persons at most. the network density is 0.15%.

Table 5
Changes of Non-Isolated Nodes' Decisions After t Years of Evolution

	0	1
Initial	123	430
End	171	382

Table 5 tells us that 48 non-isolated nodes change their minds from support of delaying retirement to opposition, which means the final decision of non-isolated nodes may be probably different from the initial choices. The percentage of changes is demonstrated in Table 6.

Table 6
Changes of Receptor Agent's Decision

Initial intention	Final decision	Proportion
1	0	0.219331
0	0	0.089219
1	1	0.579926
0	1	0.130112

It can be seen from Figure 2 that the proportion of mind-changes made by receptor agents with various levels of decision capability almost obey uniform distribution, which means the mind-changes are not be done only by those receptor agents with poor decisions capacity.

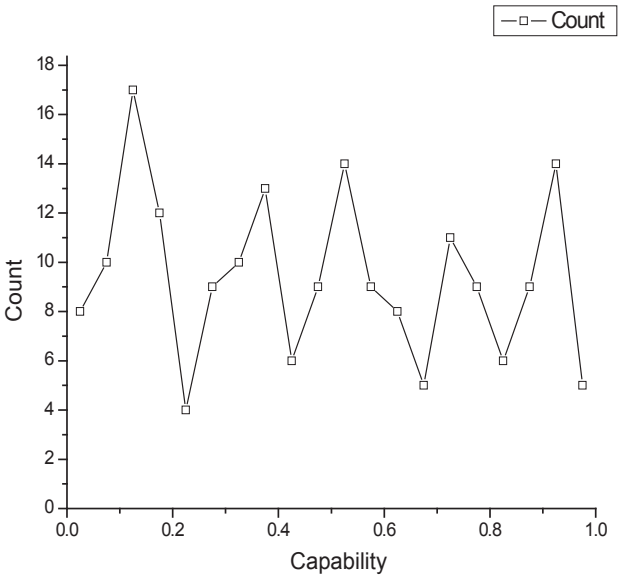

Figure 2
Distribution of Decision Capability of Mind-Change Receptor Agents

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