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COMPATIBILITY OF RATIONALITY AND IRRATIONALITY REFLECTED BY MIGRATION BEHAVIOR IN CHINA

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Abstract

With the rapid urbanization in China, many Chinese people are migrating from rural areas to large cities. This paper mainly explores the crowd mentality of these migrants based on the decision-making mechanism under the interaction of emotion, cognition and behavior. Moreover, the author probed deep into individual rationality and group rationality, and simulated the migration behavior with a matching model. The results show that the irrational choice under group mentality has largely evolved into a rational choice; the preference reversal is closely related to the brain area controlling emotions; the compatibility of rationality and irrationality in the prospect theory is valid.

Key words: *Emotion, Preference, Migration Behavior, Prospect Theory.*

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INTRODUCTION

Some animal experiments tend to regard the animals' behavior of gaining more reinforcers with smaller "costs" as a kind of rational behavior, and these experiments have subverted the traditional definition of irrationality (which comes from conditioned reflexes), and enlightened people's thinking about the compatibility of rationality and irrationality. Unlike animal instincts, people's behavioral choices are often dominated by emotions besides affecting by income, benefit, and other reinforcers. The correlation between bounded rational behaviors and emotions has been confirmed by brain imaging techniques (Sanfey, Rilling, Aronson et al., 2003). The expected utility based on rational decision-making can hardly explain human behavior in financial markets comprehensively and clearly, as the same is true for the selection behavior in the population migration process.

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There is a "plurality chasing" phenomenon in the selection of human migration behavior. Investors generally prefer to do businesses in cities where financial institutions are gathered.

Practitioners in the culture and film-television industries generally take the media industry gathering areas as their first choice for employment. A city dominated by a particular industry would attract more migration of this type, because people are more willing to choose a city that matches their skill structure (Helsley & Strange, 2014). The "plurality chasing" behavior in population migration is rational to a certain extent, because immigration has a greater promotion effect on the labor productivity of this industry than that on other industries, thereby obtaining higher returns. However, there are a lot of irrational factors in the migration decision-making process. For example, after people have stayed in one place for a long time and formed an inherent life culture, they would tend to settle in the status quo, and may not make migration decision even if the current income and status are relatively low. In addition, although a city's migration incentives might be very strong, if there is no herd effect (someone chooses to enter and others follow), it's still possible for the city to

maintain a balanced population mobility; in addition, in recent years, the proportion of rural migrants over 40 years-old in China who have returned from high-income areas to low-income areas increases year by year, which vaguely shows the reversal of preferences under emotional intervention, and the specific manifestation is the inconsistency between time preference and risk preference, namely the phenomenon of the compatibility of rationality and irrationality.

Based on cognitive psychology, this paper combines behavioral economics to analyze the phenomenon of population migration choice in China and the related psychological reaction process, and conducts in-depth discussions on "external stimulation of migration behavior" and "intrinsic preference inconsistency", it adopts experimental economic methods to explore the compatibility of rational and irrational migration choices under the intervention of people's internal emotions, and focuses on the following questions: does the influence of the reinforcer make the rational migration behavior transform to irrational behavior? If there is a compatibility between the rational choice and irrational choice of the individuals, how does it influence the group behavior?

We intend to carry out experimental simulations on the above questions, and design three matching mechanisms to simulate the population migration behavior in China. The structure of the paper is arranged as follows: the first part, question proposal; the second part, related literature review; the third part, migration behavior process; the fourth part, experimental simulation; the fifth part, conclusions.

LITERATURE REVIEW

Initially, experiments had found that animal behavior tends to obtain more reinforcers with less efforts, and the definition of reinforcer is quite rational, Meehl (1950), Timberlake & Allison (1974) and others have given different explanations according to their respective experiments. On the other hand, since the 1950s, some studies have combined economics and psychology to question the rational choice theory in mainstream economics. For example, Rachlin, Green, Kagel et al. (1976) proposed the optimization theory. In fact, when the above theories give explanations to the human choices, the transformation of rational and irrational choices is involved in all of them. For example, the individual behavior optimization theory points out that when a mouse can obtain an equal amount of reinforcer, it would choose the minimum bar-pressing times, which is an irrational behavior; according to the concept of different individual psychological characteristics in the cognitive psychology, when facing the stimulation of the same external reinforcer, individuals may produce completely different psychological reactions sometimes, and they may choose rational or irrational behaviors. In short, people's information processing and decision-making processes consist of two stages: edition and evaluation (Kahneman & Tversky, 1973). Simon (1982) used statistical methods to analyze the rationality in the cognitive process, the risk decision-making and the computational efficiency, and meanwhile initiated the discussion of irrationality theories, moreover, he has pointed out the existence of irrational choice under uncertain conditions, but has not systematically criticized the basic assumptions of the theory of expected utility. So, aiming at the basic assumptions of the theory of expected utility, Kahneman & Tversky (1979) identified the selection behavior through well-designed sociological and psychological experiments, and proposed an alternative model to replace the expected utility selection model, that is, the Prospect Theory. The prospect theory believes that the choice behavior under uncertain conditions is actually to try one's fortune based on reasoned reasoning and risk-taking; people forecast the risks and make choices, which is deviated from preference consistency and utility maximization. Since people often have the possibility to compare the results that may occur with the results obtained in the past, and thus underestimating the "determinacy" of the possible outcomes, rather than making decisions based entirely on the principle of utility maximization, according to this, the prospect theory draws an important conclusion: when the income is determined, the person's choice behavior is expressed as risk aversion; when the loss is determined, it is expressed as risk preference. These viewpoints revealed the isomorphism phenomenon of rational choice and irrational choice in reality in terms of selection results. Unlike most countries, China's population migration behavior is not only affected by its own rational or irrational situations, it is inevitably mixed with the government factors, such as the household registration system restricts the population mobility, the land policy restricts the city scale expansion, in such cases, the occurrence of the migration behavior is accompanied by a preference-

based bilateral choice (Hu, Wang, & Yin, 2017). "External factor stimulation" makes the preferences show the "rational" and "irrational" characteristics. If the occurrence of the migration behavior does not have "intrinsic preference consistency", then the Pareto efficiency of the matching markets (Chen & Sonmez, 2006) deserves in-depth discussion; before that, there are already constructive conclusions about the matching markets with heterogeneous preferences (Abdulkadiroglu, Pathak, & Roth, 2005, 2009; Roth & Peranson, 1999).

POPULATION MIGRATION PROCESS

At present, China's population movement faces two realities. On the one hand, large cities continue to develop industrial clusters in the form of various free trade zones, industrial parks, and new towns, and promote urbanization on a large scale; on the other hand, according to the negative external factors such as environmental pollution and traffic congestion, for industries of different types and different numbers, the degree of freedom for the labor access has been set, and meanwhile the farmers can have their own land. In simpler words, as people are choosing the cities, they are chosen by the cities as well, that's why we believe that the cities and the people is a two-sided matching market. The specific process of population migration is as follows:

The first step, a large number of laborers migrate to larger cities with higher production efficiency or to the developed cities in the east (i.e., the rational behavior), and some cities restrict the disorderly expansion of population scale.

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The k-th step, people who have not initially moved into permanent residences in the city migrate to other cities or choose to return to the countryside, and there are irrational behaviors under emotional intervention.

In step k, there are three matching situations when the population move to different cities.

Scenario 1: [Top Trading Cycles, TTC)] the population who have already met the priority rules are eligible for admission to the city, while others would search for other migration options. It exhibits a fusion of rationality and irrationality, then the situation is repeated constantly until the bilateral choices form a closed loop (cycle).

Scenario 2: [Deferred Acceptance, DA] After fierce competition, high-skilled talents are matched with big cities, and middle and low-skilled laborers who have been eliminated choose to migrate to middle or small cities, which is a rational behavior.

Scenario 3: [First Preference First, FPF] Cities with public product supply advantages would encourage the welfare speculative migration behavior, then the laborers who have risk preference would benefit in this process, while for other conservative laborers, they would suffer from welfare loss and show preference reversal.

SIMULATION EXPERIMENT OF POPULATION MIGRATION BEHAVIOR UNDER EMOTIONAL INTERVENTION

Experimental simulation settings

In the experiment, there are two questions in the migration behavior of the core simulation population: first, the population migration behavior implies the compatibility thought of rational and irrational choices; second, due to the rationality of the individuals, the irrational phenomena of social groups are generated. The experimental simulation adopts the 3×3×2 design (see Table 1) to evaluate the rational and irrational behaviors under the three mechanisms of TTC, DA, and FPF during the population movement process, and the corresponding social efficiencies. The simulation assumes that the alternative cities for people to migrate are limited, then the migration behavior is compared in random and set environments.

This experimental method incorporates Chen & Sonmez (2006) experimental ideas about school selection. But in our experiment, we simulated the relationships between 32 migrants and the cities.

Table 1. **Experiment comparison design**

Population movement scenarios	Payoff matrix	# Number of objects in each group	# Total number of objects
FPFd	Set	32	64
DAd	Set	32	64
TTCd	Set	32	64
FPFr	Random	32	64
DAr	Random	32	64
TTCr	Random	32	64

The 10 migrants currently in city A were numbered 1-10, the 8 migrants in city B were numbered 11-18, the 8 migrants in city C were numbered 19-26, the 3 migrants in city D were numbered 27-29, and the 3 migrants in city E were numbered 30-32. The industries the 32 migrants were engaged in were: *i=a, b, c, d, e, f, g*, respectively. Their residential utility in the cities was simulated by MATLAB software (see Table 2).

The results described in Table 3 applied the Prospect Theory proposed by Kahneman & Tversky (1979). At a significance level of 0.01, when people are facing the two options in migration situation I, 82% chose option B, while in the case of situation II, 83% chose option C. For the utility in situation I, through comprehensively comparison and analysis, the result is U(24)>0.33U(25)+0.66U(24), the reasons for the caused preference inconsistency or preference reversal may come from two aspects: on the one hand, it's because of people's living habits, they have high dependence on their original residence; on the other hand, the Chinese government's unique population restrictions and land policies change the expected migration income to some extent, resulting in emotional intervention, which further strengthens the compatibility of rational and irrational behaviors. In the case of migration situation II, although 0.34U(24)>0.33U(25), actually, the rational decision-making behavior still appeared, which shows the preference reversal in the process of population migration, and it does not conform to the theory of expected utility. Before the migration behavior occurs, the target income is determined, after moving to an unfamiliar environment, the income becomes uncertain, which would largely change people's migration preference.

Table 2. **Comparison of migration behavior utility**

Migrant number	Migration utility in a set environment					Migration utility in a random environment				
	A	B	C	D	E	A	B	C	D	E
1	***26***	32	18	4	10	***28***	16	20	26	32
2	***17***	14	11	6	3	***8***	15	2	5	16
3	***13***	14	8	15	3	***6***	22	13	3	8
4	***17***	15	19	5	9	***16***	22	10	15	8
5	***14***	11	13	4	12	***8***	7	7	2	2
6	***23***	13	19	18	23	***10***	14	17	19	24
7	***12***	13	2	4	9	***14***	11	13	15	17
8	***29***	22	6	23	16	***22***	12	14	2	8
9	***32***	22	27	18	14	***21***	15	8	9	12
10	***31***	23	3	8	22	***3***	4	6	12	14
11	22	***25***	26	6	8	13	***14***	23	2	3
12	12	***21***	1	7	8	11	***19***	12	31	21
13	22	***12***	4	7	13	13	***21***	1	5	12
14	2	***32***	21	17	4	12	***10***	21	22	17
15	21	***25***	13	16	17	12	***24***	22	13	9
16	9	***10***	1	8	12	21	***12***	15	9	3
17	21	***12***	18	23	10	5	***3***	23	12	6
18	16	***2***	11	21	3	12	***15***	4	1	16
19	1	21	***6***	6	6	6	14	***3***	6	8
20	15	20	***11***	9	2	21	26	***8***	6	22
21	21	14	***8***	8	12	12	17	***3***	8	9
22	12	3	***18***	12	11	8	6	***12***	9	14
23	12	13	***2***	4	9	14	11	***13***	15	17
24	12	22	***6***	12	16	10	12	***14***	2	18
25	17	22	***18***	18	10	1	2	***8***	13	12
26	10	11	***25***	8	22	12	4	***6***	18	15
27	14	23	14	***6***	8	8	5	5	***22***	3
28	12	21	1	***7***	33	11	19	12	***31***	21
29	22	12	4	***7***	25	13	21	1	***5***	12
30	2	32	21	17	***21***	12	10	21	22	***17***
31	9	2	13	16	***17***	12	23	16	10	***9***
32	9	21	1	12	***21***	12	12	15	17	***13***

Table 3. **Migration behavior preference inconsistency**

Migration behavior selection Situation I		Migration behavior selection Situation II	
Option A: Annual income RMB 250,000, probability 33%; annual income RMB 240,000, probability 66%. Option A selection rate: 18%	Option B: Annual income RMB 240,000, probability 100%. Option B selection rate: 82%	Option C: Annual income RMB 250,000, probability 33%; annual income RMB 0, probability 66%. Option C selection rate: 83%	Option D: Annual income RMB 240,000, probability 34%; annual income RMB 0, probability 67%. Option D selection rate: 17%

Result analysis of migration behavior

In order to compare the differences in migration behavior decision-making and the transfer mechanism after the change of emotional conditions, we use the average values to count the migration population strategy set and the game results, and repeat the steps for 1000 times, in such case, it generates 2*32*1000 operation links. *Y(m,n,l)* is ordered to be the *l*-th result of migrant *n* in stage *m*. The mixed form of the estimated average return value is expressed as follows:

$$\hat{\mu} = \frac{1}{64000}\sum_{m=1}^{2}\sum_{n=1}^{32}\sum_{l=1}^{1000} Y(m,n,l) .$$

The estimated variance of the return value is:

$$\sigma^2 = \frac{1}{64000}\sum_{m=1}^{2}\sum_{n=1}^{32}\sum_{l=1}^{1000} [Y(m,n,l) - \hat{\mu}]^2 .$$

To calculate the variance, 1000 mixed combinations are divided into two parts, 500 times in each part, that is:

$$\frac{1}{32000}\sum_{m=1}^{2}\sum_{n=1}^{32}\sum_{l=1}^{500} [Y(m,n,l) - \hat{\mu}] \times [Y(i,j,l+500) - \hat{\mu}] .$$

The approximate result of the variance is:

$$\mathrm{var}(\hat{\mu}) \approx \frac{\sigma^2}{32 \times 1000 \times 2} + \frac{32\phi}{2} .$$

Through software simulation, calculation, and analysis, the obtained results are shown in Table 4 below.

Table 4. **Migrant income estimates**

Migration behavior pattern	Mean $\hat{\mu}$	Variance σ^2	Covariance ϕ	Approximate value of variance $\mathrm{var}(\hat{\mu})$	Standard deviation ε
FPF (d)	13.14	0.021	0.001	0.013	0.118
DA (d)	12.95	0.119	0.001	0.01	0.099
TTC (d)	11.78	0.024	0.001	0.019	0.163
FPF (r)	13.89	0.115	0.003	0.003	0.072
DA (r)	13.91	0.218	0.024	0.025	0.188
TTC (r)	15.47	0.326	0.063	0.066	0.264

According to the results shown in Table 4 above we can know that, for the three kinds of migration behaviors under the condition of set experimental environment, the final whole-society utility sum is DA>TTC>FPF. When rational individual migration behavior occurs, TTC is more efficient than FPF (in a set environment, the probability P is 0.007; in a random environment, the probability P is 0.012), and DA is more efficient than FPF. By comparing the three mechanisms based on the preference reversal situation, we found that the efficiencies of DA and TTC are significantly higher than that of FPF under both environmental conditions. Under random conditions, the efficiency of TTC is higher than that of DA, but the difference is not big, especially under the set conditions, the difference in the efficiencies of the two is not obvious. It explains the population's transformation from rational choice to irrational choice, and verifies that the individuals' rational migration choice and irrational choice are compatible.

CONCLUSION

Under the current background of urbanization in China, there is a phenomenon called "plurality chasing" in the population migration behavior. The individuals' rational behavior will lead to irrational choice of the group. That is to say, whether the group selection behavior in migration behavior is rational or irrational depends on "the law of large numbers" of individual choice behavior in the sense of probability. The changes in psychology, environment, and information make people do not necessarily make selections according to the probability but based on the decision weights reflecting changes in wealth when the probability of expected migration income is relatively low, the emotional intervention of the migrants makes them reverse their preferences, there is a phenomenon that individual rational behavior transforms into irrational behavior, but for some individual's rational choice, it cannot be excluded.

The "plurality chasing" phenomenon in population migration reflects the obvious compatibility of rational behavior and irrational behavior. As the expectations of local policy and land policy aggravate the changes in the migrants' emotions (cognition), the preference

reversal and preference inconsistency have been strengthened. There are two ways for the preference changes to affect the migration decision-making process: the first is the emotional preference - the migration decision-making, due to the hometown complex and the living and cultural habits, there is no cognitive processing in the migration choice; the second is the emotion-cognition-decision. This paper adopted behavioral experiments to analyze the population migration phenomenon in China and proved that people's preferences (including time preference and risk preference) are inconsistent, wherein the reversal of rational and irrational preferences caused by emotional intervention is an important reason. From the perspective of population migration, the paper explained the phenomenon of preference reversal (it comes from psychological, environmental, and informational changes) and the idea of the compatibility of rationality and irrationality. Replacing the "utility maximization" hypothesis in reality with the ideal "optimum" is a useful exploration of the selection theory based on the hypotheses of "preference consistency" and "utility maximization", and it has changed the research paradigm of the single "rational individual" attribute.

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