**The Game Theory and Probability of Marriage and Romance:**

**A Quantitative Analytical Framework for Chinese Society**

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**Abstract**

Economic and social transformations have profoundly shaped China's patterns of marriage and romance, yet these pivotal life experiences remain understudied in academic discourse. This paper constructs a quantitative analytical framework grounded in game theory and probability models to reveal the core logic underlying the formation and maintenance of romantic relationships. By modeling publicly available data from sources such as the National Bureau of Statistics, the study employs Monte Carlo simulations to map multidimensional individual attribute spaces, fitting real-world population distributions. Game models, including the stable marriage problem, are applied to evaluate matching strategies. This framework defines relationship strength as a quantitative metric, focusing exclusively on heterosexual dyads. The research aims to provide both theoretical insights and practical guidance models for contemporary marriage and dating behaviors.

The relevant code and data have been open-sourced at <https://github.com/RanchoTao/LoveAndMarriage>.

**Keywords:** Marriage, Romance

Research Background: By October 2025, declining marriage and birth rates had become a stark reality facing Chinese society. The development of the internet and large-scale models enabled rapid information dissemination, leading many middle-aged couples to no longer endure marital suffering and opt for divorce. Meanwhile, numerous young adults and even teenagers, constrained by societal pressures and personal economic circumstances, chose not to pursue romantic relationships or marriage. This trend caused China's marriage and birth rates to continuously decline, severely impacting the nation's future demographic structure and social development.

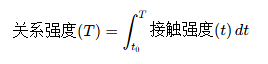
Research Questions: How can we quantitatively understand China's marriage and dating culture? How can we regulate domestic marriage and birth rates? How can we influence and transform China's marriage and dating culture? How can we quantify and calculate the evolution of romantic relationships? How should individuals select marriage and dating partners? How can we predict the success rates of marriages and romantic relationships?

**Research Significance and Innovation:** Sociological and psychological studies on marriage and romance have a long history, but they have primarily focused on qualitative research, theoretical construction, and empirical analysis using small to medium-sized samples. Disciplines such as economics and computer science, which excel at quantitative modeling, have traditionally rarely treated “emotion”—a difficult-to-quantify variable—as a core research subject. This study aims to break through this barrier by establishing a quantitative framework. It provides a theoretical foundation for individuals to understand marriage and romance while offering evidence for Chinese government policy-making. This theoretical contribution fills a gap in existing research, advancing the field from qualitative description toward quantitative predictive modeling.

Research Methodology

Definition

* 1. Relationship Intensity



Relationship intensity refers to an individual's unilateral subjective assessment of their connection to another person. It is the integral of contact intensity over time.

This paper defines relationship intensity with upper and lower bounds.

1.2 Contact Intensity

Contact intensity refers to the intensity and complexity of an individual's unilateral social behaviors toward another person. It can be quantified through interpersonal distance and the degree of information and material exchange during social interactions.

2.1 Marriage and Romance

The marriage and romantic relationships studied herein are limited to simple heterosexual unions between two individuals of Chinese nationality residing in mainland China. The purposes of marriage and romantic behavior are restricted to alleviating loneliness and reproduction. Any other behaviors cannot be recognized as marriage or romance in this study.

3.1 Ordinary Individuals

“Ordinary” in this study denotes samples falling within one standard deviation above or below the mean across all datasets. An ordinary or typical individual is one who simultaneously falls within one standard deviation of as many attributes as possible.

3.2 Relatives

Relatives are blood-related individuals or spouses—those with close ties and deep emotional bonds. Relatives maintain high contact intensity over extended periods, measured in years and often spanning decades.

3.3 Spouses

Spouses are intimate partners bound by affection. They maintain medium-term high contact intensity, with interaction durations significantly shorter than relatives but still substantial—measured in years and typically spanning several years.

3.4 Lovers

Lovers are two individuals mutually attracted, living together, and deeply affectionate toward each other. They experience short-term high contact intensity, with interaction durations far shorter than spouses—measured in months and typically lasting less than twenty-four months.

3.5 Friends

Friends are two individuals connected by friendship whose spheres of life overlap. This overlap can exist in both real-world and virtual contexts, such as online communities. Friends share emotional bonds, though romantic elements are minimal or absent. Their interaction intensity falls within the low-to-medium range, with no strict time constraints. However, sustained contact over a period is essential for the relationship to develop into friendship.

3.6 Strangers

Strangers are two individuals who are completely unfamiliar with one another. This unfamiliarity signifies a complete absence of prior contact—they have never appeared within each other's spheres of life. Both parties possess no knowledge or understanding of the other, representing two lives whose spheres do not overlap at all.

4.1 Love

Love denotes a profound emotional attachment and devotion toward a person or object, typically characterized by devotion, tolerance, and sincerity.

4.2 Emotion

Emotion constitutes a component of the overall attitude construct. It exhibits consistency with the attitude's internal feelings and intentions, representing a physiologically complex and stable evaluation and experience. Emotion encompasses both moral and value dimensions. Emotion is unidirectional. This unidirectionality stems from physical limitations preventing complete knowledge of another's true thoughts. Thus, any emotion-driven contribution is inherently one-sided and unrequited—a key distinction from rational exchange or transaction. Emotional bonds form only when both parties willingly give without seeking return. Any social interaction centered on reciprocity cannot be considered emotion-driven exchange.

4.3 Contact

Contact refers to overlapping spheres of life between individuals. The closer the centers of these spheres are to each other, the higher the intensity of contact.

4.4 Sphere of Life

The sphere of life is the field of vision centered on an individual. Any information outside this field cannot be observed by the individual at its center.

5.1 Sample Attributes

This study designs a social matching model for marriage and romance by analyzing fourteen sample attributes.

The fourteen sample attributes are:

Biological Attributes: Gender, Age, Height, Weight, Health Status, Appearance, IQ

Social Attributes: Region of Residence, Household Registration Status, Occupation, Educational Background (or Level of Education), Family Background, Personal Financial Status

6.1 Marriage and Romantic Relationships

Marital and romantic social relationships are primarily defined by the strength and duration of the bond between partners. This paper establishes upper and lower limits for relationship strength. Since subjective feelings and thoughts are unmeasurable, relationship strength is confined to physical proximity and excludes subjective emotional intensity. The upper limit is defined as 100, representing the self, as the self physically overlaps with itself at all times and exists continuously in time. Thus, the self maintains maximum contact intensity at all times. 80 represents family members, 60 represents spouses, 40 represents romantic partners, 20 represents friends, and 0 represents strangers.

Research Data

Sample reference attributes include: gender, age, height, weight, region of residence, household registration status, educational background or level of education, health status, physical appearance, IQ, family background, and asset status.

Data sources: National Bureau of Statistics (http://www.stats.gov.cn/), National Data Platform (http://data.stats.gov.cn/), Population Census Data (http://www.stats.gov.cn/zs/tjll/tjzs/202302/t20230203\_1901531.html) China Social Conditions Survey (http://css.cssn.cn/) China Family Panel Studies (http://www.isss.pku.edu.cn/cfps/) China General Social Survey (http://cgss.ruc.edu.cn/)

As of 24:00 on December 31, 2024, China's national population stood at 1,408.28 million people, approximately 1.408 billion. This included 719.09 million males (approximately 720 million) and 689.19 million females (approximately 690 million). The population aged 15-64 was 965.65 million, approximately 970 million. The census recorded 15,467 individuals per 100,000 with college education or higher, 15,088 per 100,000 with high school or technical secondary education, and 34,507 per 100,000 with junior high school education. The number of people with primary education per 100,000 population in the census was 24,767. The number of illiterate people in the census was 37.75 million, with an illiteracy rate of 2.7%.

Sexual minorities (gay men, lesbians, non-binary individuals) account for approximately 5% of the population, according to data from a United Nations Development report.

Research Model

Using the sample reference attributes to design a quantitative framework, a model (parameters) capable of fitting reality is calculated via Monte Carlo methods.

As long as the model data aligns with historical real-world statistics (successful fit), the model can be regarded as a fitting representation of actual conditions.

Sociological experiments often entail significant costs—both in time and funding—which the author cannot afford. Constrained by expenses and public/personal privacy concerns, the necessity for real-world experiments does not exist.

Population age groups: 10-19, 20-24, 24-34, 34-44, 44-54, 54-death

Since sexual maturation typically occurs after age 10, with the age of sexual consent set at 14 and adulthood at 18, the 10-18 age range constitutes adolescence. While this is not the legally permitted age for marriage, de facto marriages and even childbearing exist in some regions. Therefore, individuals under 10 are excluded from this study.

Population categorized by gender: male and female. Mainland China does not recognize same-sex or transgender marriages, thus excluding same-sex marriages (e.g., male homosexual, female homosexual...)

Classify individuals by BMI based on weight

Classify individuals by body fat percentage

Classify individuals by region into different provinces, regions of varying wealth, and cultural regions

Classify individuals by household (national) registration into different provincial registrations. In mainland China, this is divided into Beijing and Shanghai urban (suburban) registrations, provincial capital registrations, and other registrations

Classify populations by educational attainment: Doctorate, Master's, Bachelor's (undergraduate), Associate's, High School, Technical Secondary School, Junior High, Elementary School, Illiterate

Undergraduate and above levels further categorized as: Peking/Tsinghua, Top-tier 985, Mid-tier 985, Lower-tier 985, 211 Project, Undergraduate, Overseas degrees analyzed separately

Classify physical appearance on a 100-point scale

Intelligence Quotient (IQ) is categorized as:

Family background is classified as:

- Both parents alive and harmonious

- Both parents alive but discordant

- Both parents alive but separated

- Single parent alive

- Neither parent alive

- Harmonious single-parent relationship

- Discordant single-parent relationship

Asset status is categorized as:

Experiment

Detailed Analysis

Conclusion

This paper provides a theoretical framework for understanding marriage and romance in Chinese society, aiding readers in grasping their essence and revealing potential avenues for societal adjustment. Due to the author's limitations, readers are kindly requested to overlook any shortcomings in this work.

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