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Exam-Oriented Strategies, Innovation, and Employment Returns: Evidence from Chinese Education Reform

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Abstract:

Today, China has implemented the college entrance examination reform to promote quality-oriented education, enabling students not only to pass the exams but also to cultivate creativity, problem-solving skills, and critical thinking abilities, achieving all-round development. However, the reality is that society's expectations for students' performance in exams and students' own expectations for future salaries are still closely related to exam scores. This study has developed a strategy probability model aimed at calculating how students allocate limited efforts between exam preparation and innovative learning. The parameter θ is used to represent the student's inclination: if θ = 0, it indicates that the student is fully focused on innovation; if θ = 1, it indicates that the student is fully committed to exam preparation. Data from 500 students from several provinces were used to study the relationship between their learning strategies, comprehensive abilities, and expected salaries. The results show that in the labor market, rote exam-oriented learning methods are overestimated, while innovation ability is underestimated. This phenomenon indicates that the current form of education does not match the long - term development needs of the country in the future.

Keywords: College Entrance Examination Reform; Exam-Oriented Education; Innovation Ability; Strategy Probability Model; Expected Employment Returns.

1. Introduction

For years, there has been an obvious contradiction between exam-oriented education and quality-oriented education in the Chinese education system. Although the college entrance examination reform is now establishing a more comprehensive and integrated education system, students and parents still believe that only by focusing on exams can they have a good future and obtain high-paying jobs in the future. In 2024, there were 12.22 million graduates in China who remained unemployed after graduation,

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and approximately half of them failed to find employment. Although Huawei offers highly competitive salaries — with some doctoral graduates earning an annual income of up to 2 million yuan — it is still difficult to quickly recruit fully qualified talents [1]. At the same time, the new energy vehicle industry, especially the sector where BYD operates, is facing a talent gap of more than 1 million people. BYD recruited 4,000 employees at its Zhengzhou factory at one time, and plans to hire nearly 200,000 new employees in 2024. Such a large scale clearly indicates that this company has an urgent need for talent. In addition, the talent shortage in China's AI industry has expanded to more than 5 million people, and the demand for jobs has increased significantly, further reflecting the reality of the scarcity of high-end innovative talents [2]. Such a phenomenon seriously reflects the disconnect between the types of talents cultivated by the current education system and those needed by society. In 1978, China's industrial foundation was weak, and there was an urgent need for a large number of industrial workers and technicians who could operate machines and follow standard procedures. Therefore, the exam-oriented education system at that time, through unified textbooks, examinations, and evaluation standards, efficiently selected talents with strong learning abilities and execution capabilities, supporting China's rapid industrialization and facilitating the rise of cities like Shenzhen and Shanghai, completing in 20 years what took the West a hundred years to achieve.

However, now that China has shifted from manufacturing shirts and assembling mobile phones to researching and developing large aircraft, chips, and artificial intelligence, which requires innovation from scratch, the exam-oriented education system, which focuses on training students to find standard answers, suppresses the ability to break out of the framework. The large-scale application of AI has replaced positions that operate according to fixed rules (such as bank data analysts), and the abilities cultivated by exam-oriented education are highly consistent with such positions. The current situation is different from before, and contemporary 00s should value meaningful work more. For instance, nearly 19% of the 2024 graduating class chose „slow employment," refusing to sell their time and enthusiasm for a salary.

This indicates that students and parents often believe that only by studying hard can they earn higher salaries. Insufficient attention is given to innovation and quality. The main purpose of this study is to determine whether students' current learning strategies overly emphasize exam-taking abilities while neglecting the cultivation of innovative abilities.

A formal model is proposed using θ to represent the strategic allocation between exam-oriented and innovative learning. Real data are used to test and analyze the impact of the distribution of innovative strategies on expected salaries. Educational policies are called to shift from short-term exam-oriented benefits to long-term comprehensive quality returns.

Research Methods and Structure: This study employs a quantitative modeling approach. Firstly, a strategy probability model was constructed to describe the distribution of students' energy between exam preparation and innovative learning. Then, the model was empirically tested using data from 500 students from multiple provinces, where θ was used as a key parameter to assess students' overall abilities. The analysis was divided into defining the mathematical framework and theoretical hypotheses; substituting the actual data into the model to determine the relationship between overall ability and expected salary; and conducting a reading comprehension of the research results in relation to existing literature and policy impacts.

2. Literature review

2.1 Education as a Signal in the Labor Market

Education and employment are closely related. Spence demonstrated that education not only enhances an individual's knowledge and skills but also serves as a signal that employers can use when faced with incomplete information about job seekers to infer the job competence of the seekers. In this way, the obvious data such as exam results will gain high recognition in the job market. Whoever performs well in the exam will be admitted. Although these results cannot directly reflect the skills relevant to the job, this explains why students consider focusing on exam performance to be the most important thing, rather than innovation [3].

2.1.2 Beyond Scores: Innovation, Soft Skills, and Long-term Returns

Sen demonstrated from the aspect of ability that the value of education is not only in economic returns, but also in enhancing freedom, creativity and problem-solving abilities. This is consistent with the methods of quality-oriented education. However, these abilities are difficult to quantify, and employers will not pay attention to them in the short term and will not directly reward these qualities with higher salaries [4].

What is the role of education in the job market? Altonji and Pierret proposed the employer learning model. The research found that employers relied more on academic qualifications and grades in the early stages of their careers to judge the work ability of job applicants, but as work experience accumulated, they gradually adjusted their judgment based on actual abilities. This indicates that examination results were very important in the past workplace and became the key to being hired, but now they judge based on an individual's real abilities and qualities,

rather than just grades [5]. Autor, Levy, and Murnane's research showed the impact of technological change on the skills needed by people. Computers and automation easily replace repetitive, rule-based and assembly-line jobs; conversely, those who possess analytical skills and the ability to deal with situations have become increasingly important. That is to say, relying solely on the fixed skills cultivated through examinations is no longer beneficial in the current workplace and has become less competitive [6]. Deming proposed that social skills are very important. Since 1980, the rewards for social skills and teamwork abilities in the workplace have been increasing, which exactly matches the communication and cooperation abilities in quality-oriented education [7]. Heckman and Kautz pointed out that things like perseverance and responsibility cannot be measured through examinations, and these soft skills play a significant role in school and job hunting, which cannot be measured by examinations alone, so such results have been overlooked [8]. Piopiunik's experimental research shows that pointing out one's cognitive skills and soft skills, that is, one's perseverance and responsibility, leads to a significantly greater chance of getting an interview. This is in line with the current employment phenomenon [9].

2.2 The Chinese Context: Education Reform and Labor Market Mismatch

In China, educational qualifications and academic performance play a significant role in conveying signals. Zhang's study found that between 1988 and 2001, in China's urban areas, the returns from attending school increased significantly. The weight of educational attainment in determining one's salary became increasingly important [10]. The research by Démurger, Hanushek, and Zhang indicates that the reputation of a university can brings significant advantages when looking for a job. Over time, the boss will gradually reevaluate based on the actual work results of the employees [11]. However, at the beginning of a career, education can play a decisive role.

However, according to the latest reports from Sheffield University and Xinhua News, a contradiction has emerged between the returns from education and labor market demand. On the one hand, businesses are increasingly prioritizing innovative talent, particularly in the finance, high-tech, and information technology sectors, where employers prioritize practical skills, interdisciplinary innovation, and international competence [12]. On the other hand, according to SCMP and Reuters, China's youth unemployment rate remains high, reaching 14.5% in 2024. Many university graduates are forced to accept low-paying jobs or rely on their parents for support. Even recent graduates with master's degrees face difficulties finding employment. In many industries, a master's degree has become a ticket to entry rather than an advantage, a phenomenon known as "unfinished youth." These phenomena reflect a mismatch between the talent supply of China's education system and actual market demand: an overabundance of academic credentials and an undersupply of innovative capabilities [13,14].

In response to this contradiction, the Chinese government has initiated a new round of college entrance examination reforms, aiming to cultivate more talents that better meet the demands of the future market through diversified evaluation and quality-oriented education. In the review by Xing and Wang (2024), it is mentioned that although the goal of the reform is to break away from the evaluation system that only focuses on scores, in actual practice, examination results still remain the key factor in university admissions and job allocation [15]. Furthermore, the examination results, innovative abilities and future salary expectations of the students provided by CEPS offer crucial support for the study of the relationship between students' choice of learning strategies and their returns in the labor market. When all the research and data are taken together, it can be seen that Chinese education still leads to a contradiction between examination-oriented approaches and quality-oriented education. The signals brought about by the examinations have dominated the job-hunting process in the short term, but society and industries are increasingly in need of innovative talents [16,17].

All in all, current international research indicates that education still holds a dominant position in the job market. While initial employment can be achieved, long-term development is more dependent on innovation and soft skills. Society is in urgent need of more innovative talents, yet a large number of highly educated graduates are facing employment difficulties due to a lack of experience, time and innovation ability. This highlights the need for the education system to re-examine the educational incentive mechanism and also provides a realistic background for this study on the model of students' comprehensive abilities.

3. Methodology

This model assumes that each student's overall ability is C, and this study divides their abilities into two aspects:

X: Test-taking ability (such as the skills for handling standardized tests)

Y: Innovation ability (such as creativity, problem-solving ability)

The calculation function for comprehensive ability is:

$C(X,Y;\theta) = X^{1-\theta} \cdot Y\theta$ (that is, X to the power of (1-θ) multiplied by Y to the power of θ) (1)

This is actually a Cobb-Douglas function, which is commonly used in economics to describe the production process. Here, the exponent (1-θ) and θ represent the relative

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importance of test-taking skills and innovation ability in the overall capability. If the value of θ is small, it indicates that test-taking skills have a greater influence in the overall capability; if the value of θ is large, innovation ability takes a more dominant role. This function is in the form of multiplication. It means that both abilities must be present: if either of the abilities is zero, then the overall combined ability must also be zero.

4. Results

4.1 Distribution of Student θ Angles

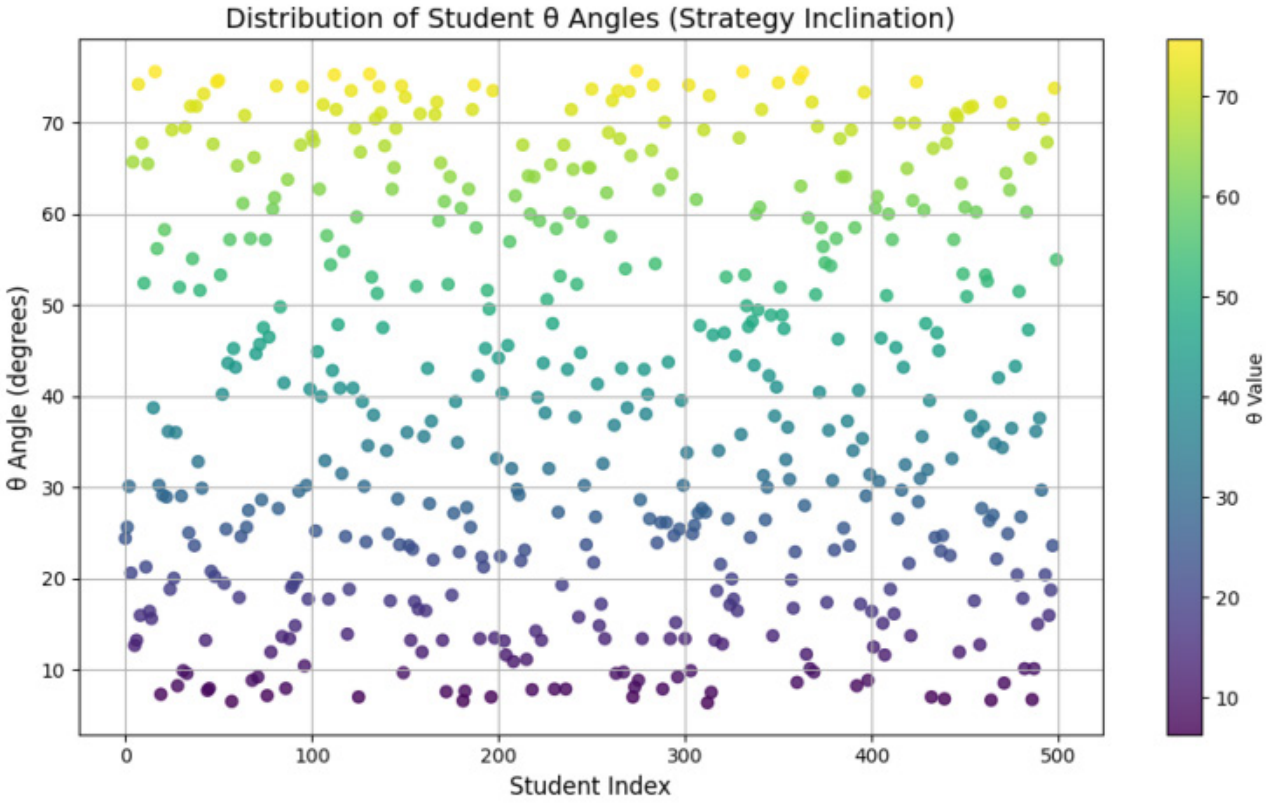

Fig. 1 Distribution of Student θ Angles

According to Fig.1, the distribution of the strategies adopted by 500 students. Let's take a look to see which side they are more inclined towards - the test-oriented learning strategy or the quality-oriented learning strategy. Student Index is the unique identification number for each student (there is no particular order; it is simply the sequence in the sample). θ Angle, degrees is the value of the strategy inclination angleθ. When theθvalue is low (approximately 0° to 30°), it indicates a clear preference for quality-oriented learning, with a greater emphasis on innovation, comprehensive abilities, and skills that are not for passing exams. When the θ value is high (approximately 60° to 75°), it shows a clear preference for exam-oriented learning, with a greater focus on exam preparation and standardized test scores. The middle value (30° to 50°) indicates a relatively balanced learning strategy. The color bar represents the magnitude of theθvalue. Purple indicates a low θ value (indicating an exam-oriented preference), while yellow indicates a high θ value (indicating a quality-oriented preference).

Main features and meanings can be summarized as follows. The stratification is quite obvious: The data points from several dense bands in differentθintervals, indicating that students' strategic tendencies are not uniformly distributed continuously but are concentrated in certain specific intervals. Those who are particularly exam-oriented are particularly concentrated: The proportion of students in the 30°to 50°interval is the highest, suggesting that the majority of students prefer exam-oriented strategies. Those who follow the quality-oriented path are relatively few: Although there are concentrated areas for quality-oriented approaches, the number is significantly less than that of those who are particularly exam-oriented. Extremely strategic approaches are rarely seen: Students withθvalues close to 0°or above 75°, that is, those who are completely exam-oriented or completely quality-oriented, are few in number.

4.2 Composite Ability & Expected Salary Cor- relation

Fig.2 Composite Ability & Expected Salary Correlation

Fig.2 illustrates the correlation between comprehensive ability (C) and students' expected salary, and it is drawn as a function of this correlation with respect to the student's strategic inclination parameter θ. Horizontal axis (θ): Strategy tendency parameter, with values ranging from 0 to 1. Close to 0 → Spend more time on innovation ability Y. Close to 1 → Spend more time on examination ability X. Vertical axis (correlation with expected salary): Pearson correlation coefficient, used to measure the degree of linear correlation between comprehensive ability C and expected salary. The curve shape: The orange curve shows the changes in correlation under different strategy tendencies.

Main features and meanings: The overall correlation is very low (-0.05 to 0.02), indicating that students do not attach much importance to comprehensive ability when considering expected salary. The range of θ values that are low (moderately quality-oriented) has a negative correlation, meaning that among quality-oriented students, the higher the comprehensive ability, the expected salary is slightly lower. This might be because students who focus on examinations place more emphasis on individual examination results and less on comprehensive qualities. The range of θ values that are high (moderately exam-oriented) has a slightly positive correlation, but the amplitude is very small, indicating that although following the exam-oriented path helps to increase salary expectations to some extent.

Research significance: This result supports the hypothesis that "the social evaluation system places too much emphasis on test scores and underestimates overall qualities". In the current environment, comprehensive ability C is difficult to generate high salary expectations among students, which reflects a structural deviation between education and the labor market.

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4.3 Correlation & θ

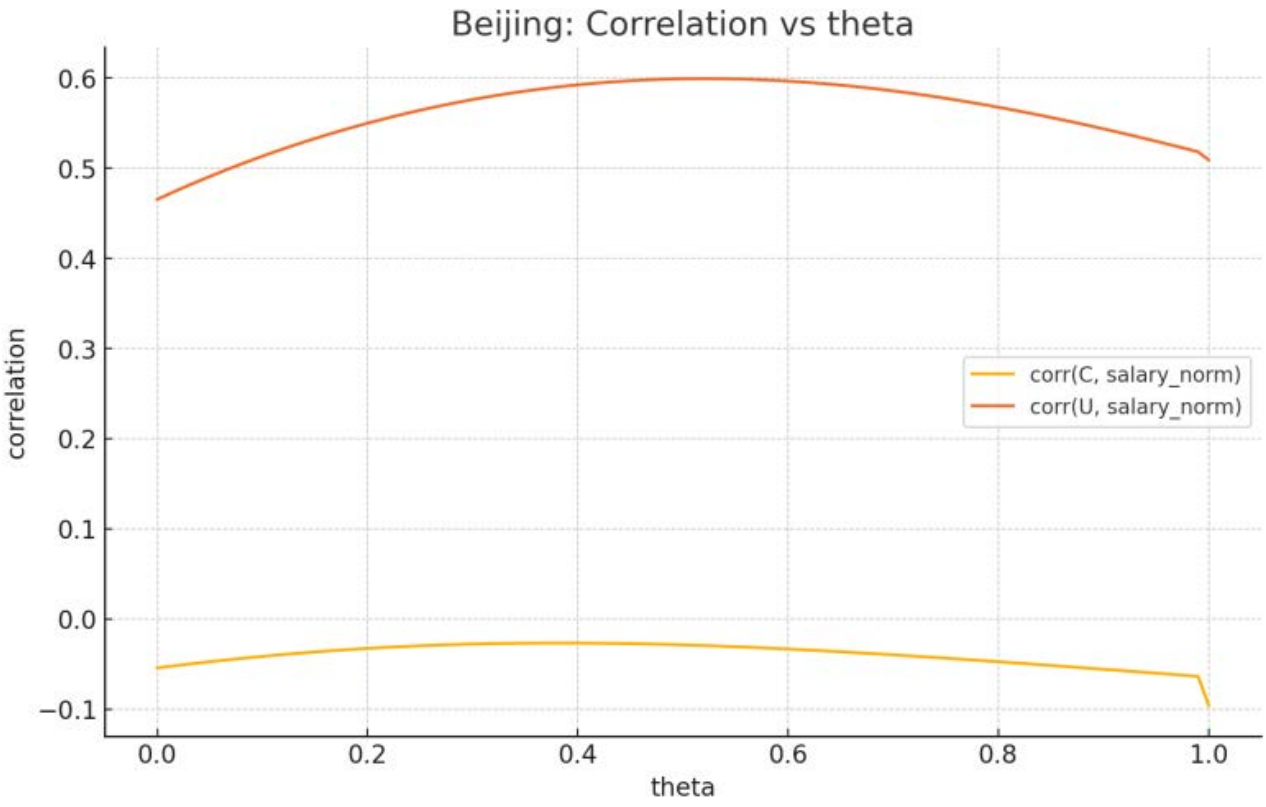

Fig.3 Beijing: Correlation vs theta

In the sample of Fig.3, the correlation curve between university ability (U) and standardized expected salary (salary norm) is clearly a single-peak shape with a peak in the middle and low values on both sides. The highest point is approximately at $\theta \approx 0.5$, and the correlation coefficient can reach around 0.60 at this point. This indicates that in Beijing, if students achieve a moderate balance in their learning strategies - that is, they take into account both exam-oriented and quality-oriented aspects - then the connection between their university ability and expected salary will be the tightest.

In contrast, the correlation between comprehensive ability (C) and expected salary shows little variation across the entire θ range, remaining relatively close to zero and showing a slight negative trend. This indicates that in the Beijing area, the influence of students' comprehensive ability on expected salary is relatively weak and cannot explain many issues.

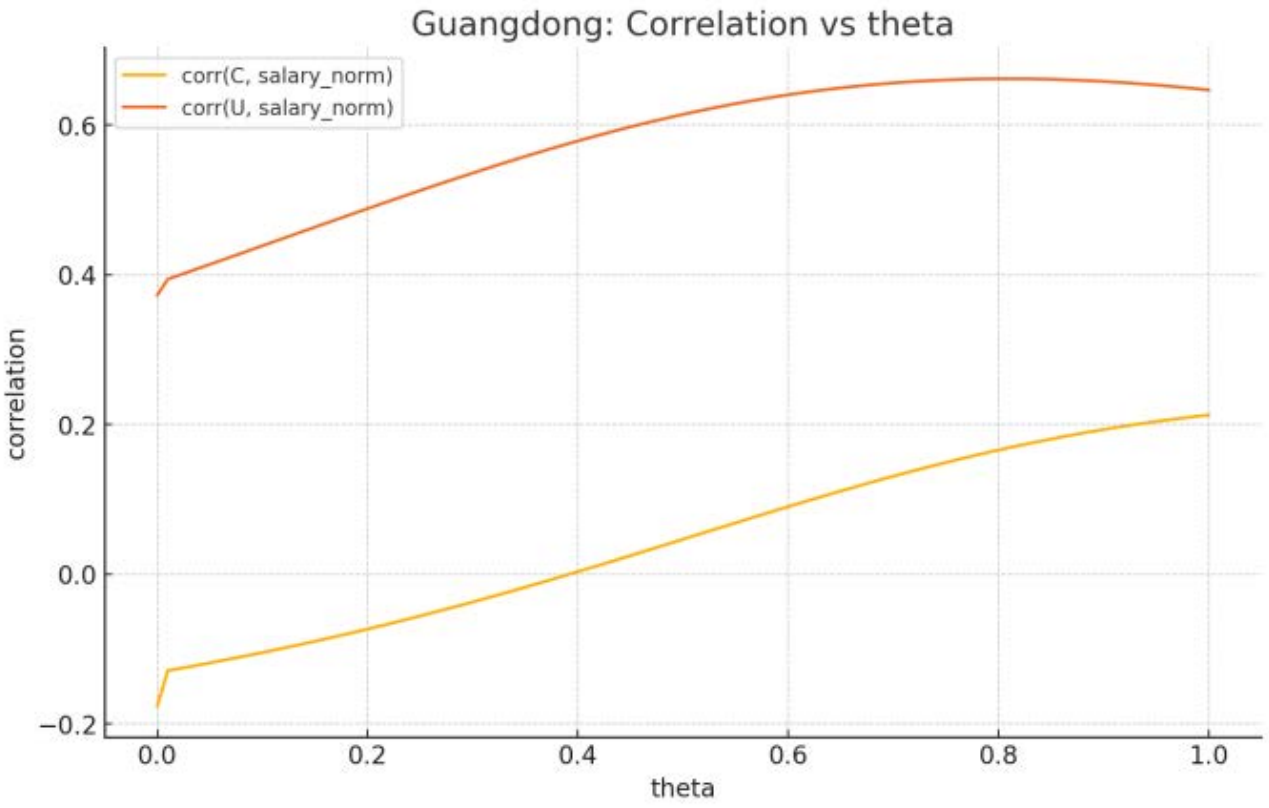

Fig.4 Guangdong: Correlation vs theta

In the sample of Fig.4, the correlation between university ability (U) and salary could reach approximately 0.63. This peak occurred at a θ value close to 0.6, which was slightly higher than the peak in other regions. This indicates that when students from Guangdong tend to adopt more exam-oriented learning strategies, the correlation between university ability and salary would be even stronger.

The correlation of the comprehensive ability (C) shows a change from negative to positive: when the θ value is low (indicating a preference for quality), the two are negatively correlated, reaching a minimum of -0.18; when the θ value is high (indicating a preference for examination-oriented learning), it gradually becomes positively correlated, reaching a maximum of 0.21. This indicates that in the Guangdong region, the value of comprehensive ability is more prominently manifested under the learning strategy that favors examination-oriented approaches by students.

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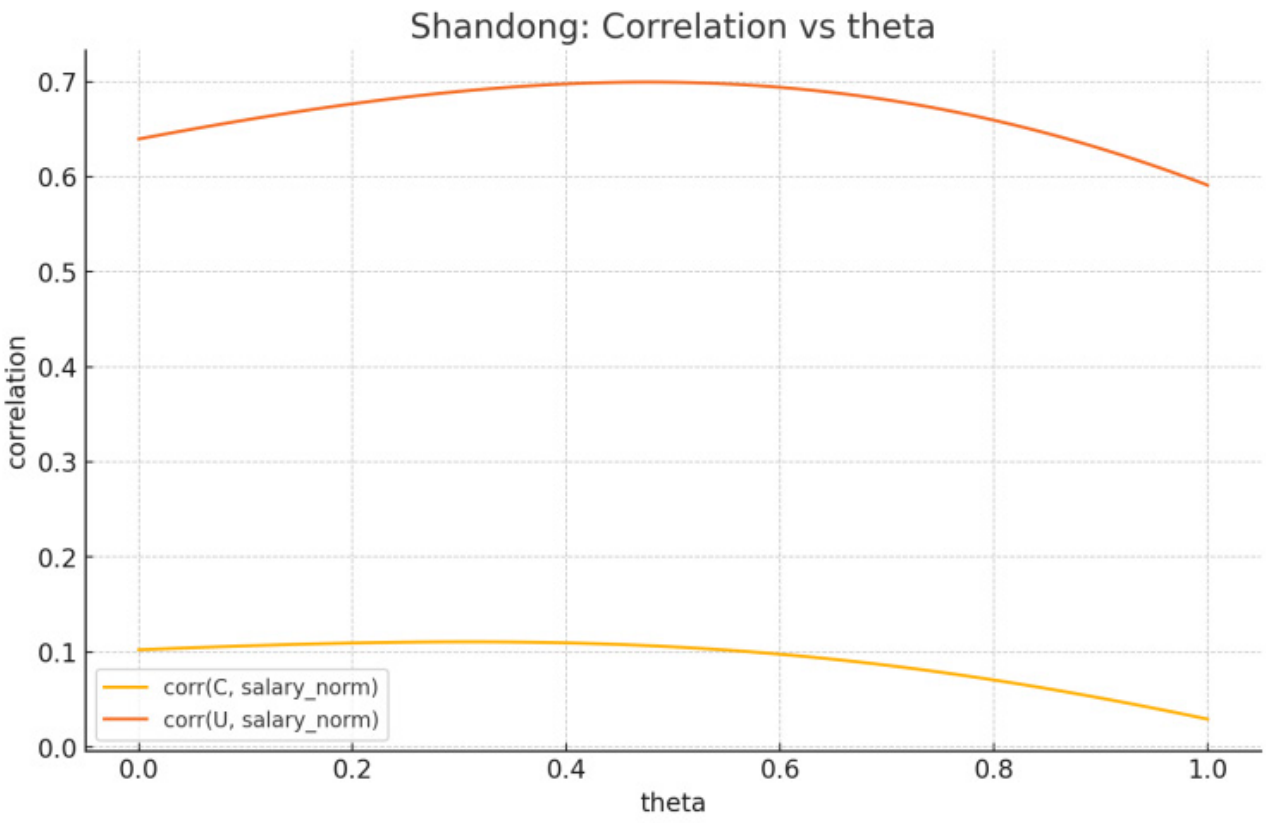

Fig.5 Shandong: Correlation vs theta

Among the Fig.5, the peak correlation between university ability (U) and salary is the highest in the country, reaching approximately 0.70, occurring at $\theta \approx 0.5$. This indicates that in Shandong, when students adopt a balanced learning strategy that combines exam-oriented learning and average quality, the predictive effect of university ability on salary is particularly significant.

And in the entire θ range, the comprehensive ability (C) maintained a slight positive correlation, approximately ranging from 0.08 to 0.12. This indicates that although comprehensive ability has a positive impact on salary, its effect is much smaller than that of university ability.

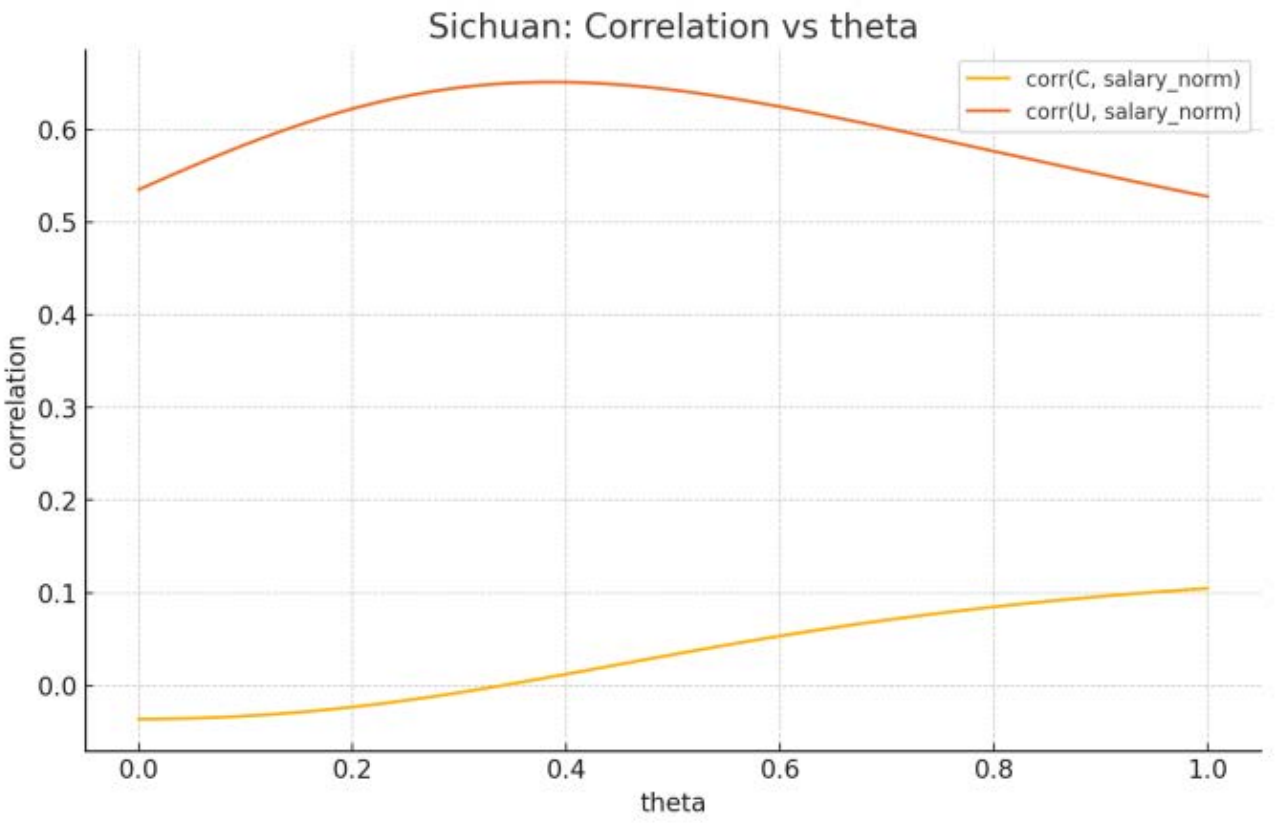

Fig.6 Sichuan: Correlation vs theta

In the sample of Fig.6, the correlation between university ability (U) and salary can reach approximately 0.65, occurring at $\theta \approx 0.4$. Moreover, the values will significantly decrease when θ becomes smaller or larger.

For the comprehensive ability (C), there is a slight negative correlation in the area with a low θ value (indicative of higher quality), with the lowest value being approximately -0.03; however, in the area with a high θ value (indicative of more exam-oriented), it gradually becomes positively correlated, with the highest value reaching 0.10.

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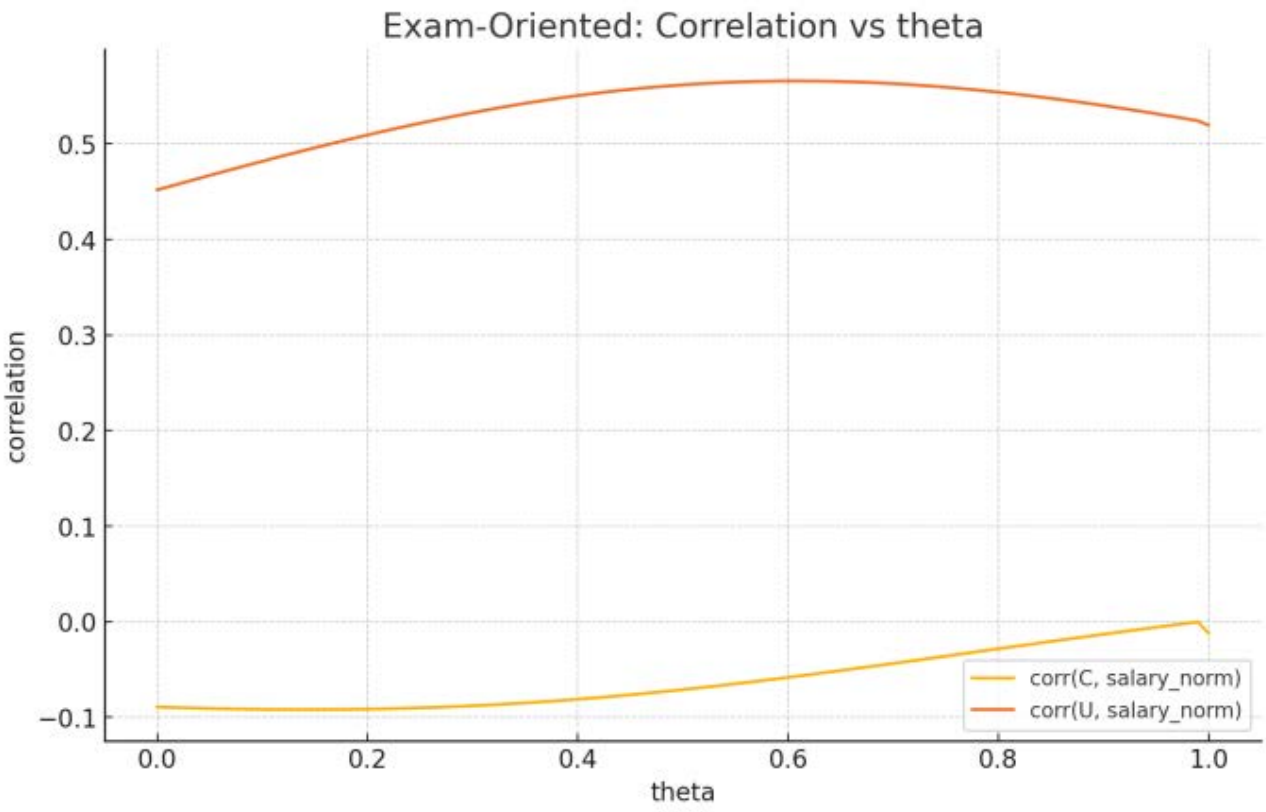

Fig.7 Exam-Oriented: Correlation vs theta

Among the Fig.7, those students who are mainly focused on exam preparation, the correlation between university ability (U) and salary also follows a single-peak distribution with a peak in the middle and low values at both ends. The highest correlation can reach around 0.56, occurring at $\theta \approx 0.5$. This indicates that even for students who mainly rely on exam preparation, simply following a single strategy is not as effective as combining strategies in a slightly mixed way.

The correlation between comprehensive ability (C) and salary is weakly negatively correlated in almost all θ ranges, with the lowest value approximately at -0.10. This indicates that in the quality-oriented group, an increase in students' comprehensive ability does not necessarily lead to an increase in expected salary; in some cases, it may even decrease instead.

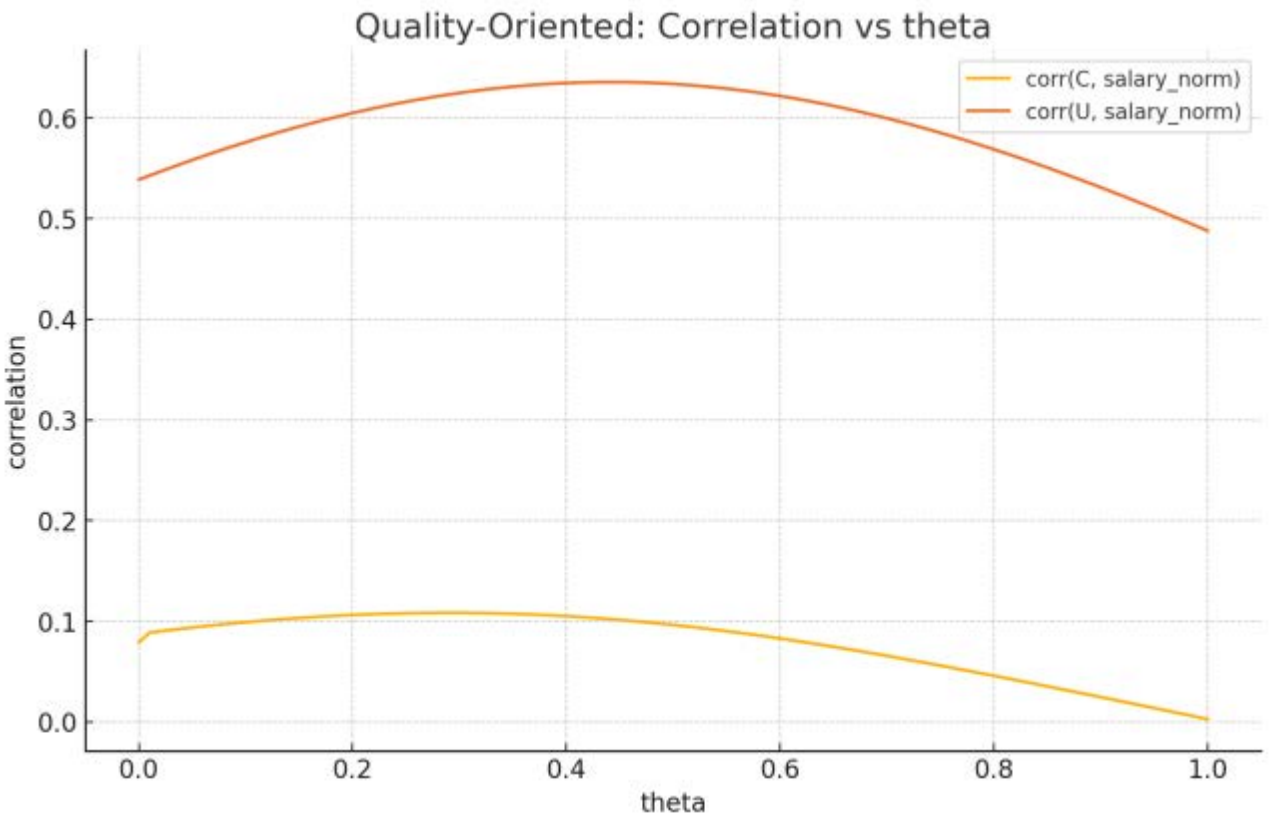

Fig.8 Quality-Oriented: Correlation vs theta

In Fig.8, among the less academically competent student group, the correlation between university ability (U) and salary reaches its peak at $\theta \approx 0.4$, with a value of 0.64, and then decreases towards both ends. This indicates that even for less academically competent students, in order to have the strongest correlation between university ability and salary, they still need to adopt a middle strategy.

Overall ability (C) shows a slight positive correlation within this group. The lowest value is approximately 0.12, and it is slightly higher around the median θ value. This indicates that overall ability does have a positive impact on salary, although the effect is relatively limited.

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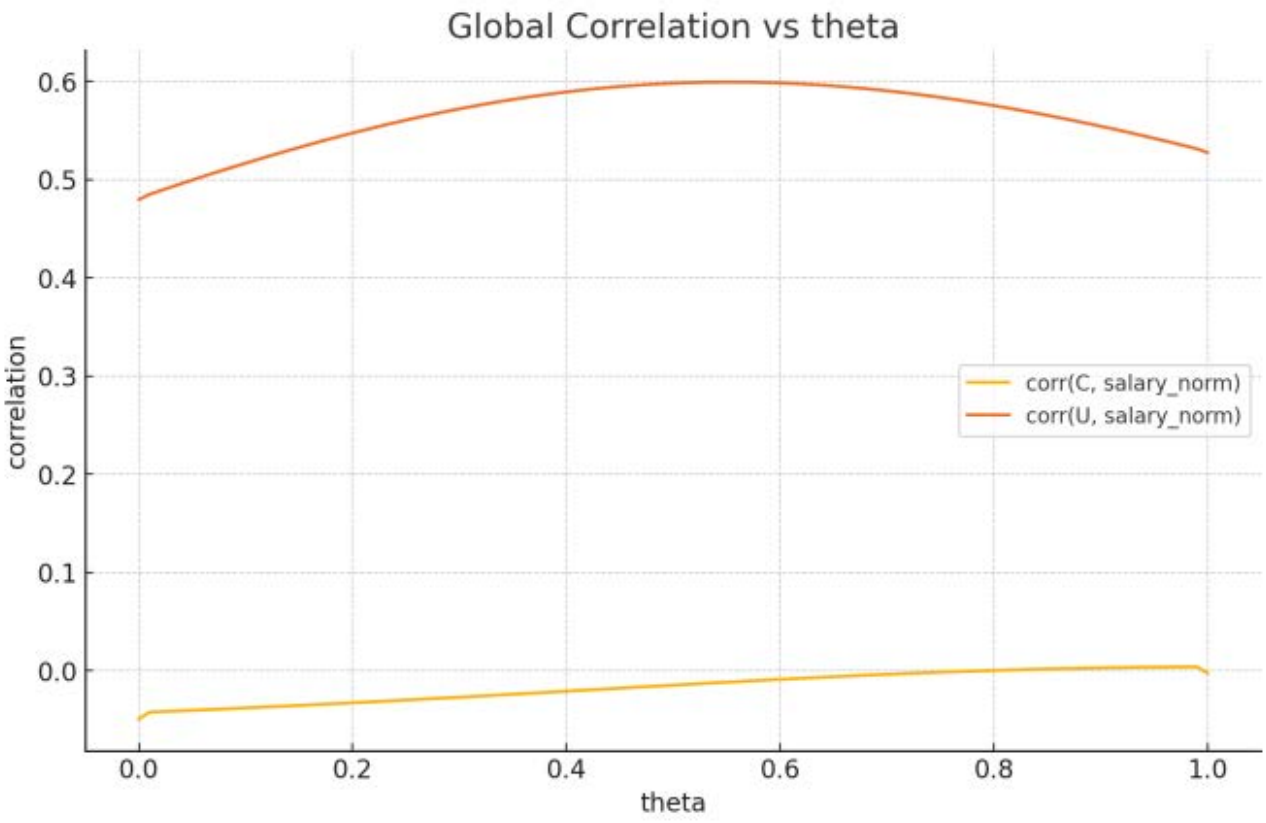

Fig.9 Global Correlation vs theta

According to Fig.9, when all the regional and type-specific samples are combined for analysis, the correlation between university ability (U) and salary can reach approximately 0.60, which also occurs at $\theta \approx 0.5$. This is consistent with the results in Beijing and the test-oriented group, indicating that adopting a moderate strategy tendency across the country may be most beneficial for salary returns.

The correlation of the comprehensive ability (C) at different θ values has always been close to zero. This indicates that, on the whole, comprehensive ability has little impact on the expected salary and cannot explain many issues.

5. Conclusion

The current learning strategies are seriously out of sync with social demands. Students are overly focused on examinations, but what society truly needs is innovation and problem-solving skills. This study must avoid the simplistic criterion of „salary level = examination performance ability“, where one‘s value is not limited to test scores. The ability to innovate and collaborate well is often more important. Such one-sided evaluation will cause education to deviate from social needs, restricting students‘ development and hindering social progress.

The representativeness of the sample is limited. After all, it only includes data from a portion of the students and may not fully reflect the overall situation. The expected salary of the students is the result of subjective estimation, and there is inevitably a deviation from the actual situation. Additionally, the research failed to control external interfering variables, such as regional economic differences and family background factors, which may have an impact on the results.

More background variables can be incorporated, such as family environment and school resources, to make the analysis more comprehensive. Government-level modeling can also be introduced, combined with policy orientations to explore the adjustment space of educational strategies. At the same time, international comparisons can be conducted to observe the experiences of other countries in balancing exam-oriented education and quality-oriented education, providing a broader perspective for the research.

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