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Tutoring Research on Gender Differences in the Employment Process of College Students Based on Ologit Model and Intelligent CAD

Li Meng

Vocational Technical Education Institute, Xinxiang Vocational and Technical College, Xinxiang, Henan, 453000, China, LImmmmm81@163.com

Corresponding author: Li Meng, LImmmmm81@163.com

Abstract: The gender difference in the employment process of college students may lead to a series of psychological problems, which need to be solved by appropriate psychological healthcare methods. Gender differences in employment may be reflected in many aspects, such as employment opportunities, career choices, salary levels, and career development. To explore the gender differences in the employment process of college students this paper combines the Ologit model and Psychological Healthcare to analyze the gender differences in the employment process of college students, considering a retry queuing system with supplementary services. In this system, an arriving recruiter can be said to have successfully completed his services only if he is served at both service desks. Considering that the two service desks can adopt two charging methods, advance payment and later payment, three pricing mechanisms are analyzed, and numerical comparisons are made according to the different affiliations of service desks. The experimental study shows that the gender difference research model in the employment process of college students based on the Ologit model and Psychological Healthcare proposed in this paper has a good effect.

Keywords: Ologit Model; Intelligent CAD; College Students; Intelligent CAD; Gender Differences
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1 INTRODUCTION

The mental health problems caused by gender differences in college students' employment need to be addressed through comprehensive psychological healthcare strategies and social support systems, which include providing career development guidance, enhancing self-efficacy, breaking gender stereotypes, balancing work and life, establishing social support networks, and upholding legal rights to promote gender equality and the overall well-being of individuals. The survey found that more than half of the employers put forward the requirement of "only males", which made the girls who also have the qualifications to lose the opportunity to compete. At the same time, the salary expectations of girls are reduced due to gender differences. Under the premise of controlling other influencing factors, the salary level that the employer intends to pay boys is 11% higher than that of girls [1].

Although some studies have shown that female college graduates are significantly weaker than male college graduates in their initial employment, the analysis of the causes of gender discrimination in college graduates' employment and the research on countermeasures and suggestions are relatively insufficient. In order to further understand the causes of gender discrimination and put forward reasonable policy recommendations, it is very important to carefully analyze the differences between men and women in their initial employment and the influencing factors [2].

As intellectuals with higher education, whether female college graduates enjoy the same fair employment opportunities and rights as male students is of great significance for the fair and healthy development of higher education and plays an important role in building a harmonious society based on gender equality and a legal society with fair treatment of different individuals [3].

Female college graduates are significantly weaker than male college graduates in their initial employment. So is this difference between men and women in their first employment caused by the difference in human capital or by gender discrimination in the labor market? The analysis and research on this will help to find out the unreasonable reasons in the labor market, provide strong evidence and reference for effective solutions, and improve the effective allocation of female human resources [4].

Finding problems is the premise and key to solving problems. Through the research on "the gender difference of college graduates' initial employment," we found gender problems in college graduates' employment, and we can prevent these problems through efforts. On the other hand, when these problems occur, the unreasonable factors behind the gender differences in the employment of college graduates can be eliminated through government administrative intervention, legislation, and other means to achieve equal employment and promote social equity and social development [5].

Gender inequality is easily intertwined with political concepts such as human rights, and gender discrimination often leads to political problems. Valery Bryson, a Western feminist, said that "if all political theories ignore feminist ideas, they will inevitably become one-sided and poor political theories." As a relatively independent biological individual like men, women also exist in human society as "half the sky" gender identity, and play an extremely important role in the development process of human society, which is irreplaceable [6]

The issue of racial discrimination and gender discrimination has gradually become an important research topic of labor economics. Later research mainly focuses on the measurement of discrimination, the causes of discrimination and the governance of discrimination, and a series of theoretical frameworks and econometric analysis methods have been derived from it [7]. The research on gender discrimination basically follows the analytical logic of racial discrimination, that is, to theoretically analyze the family, social, and institutional causes of gender discrimination, identify the sources of gender discrimination and the contribution rate of sub-factors by using empirical data, and discuss how to improve the market position of women through labor market policies and other social policies according to empirical conclusions [8].

With the popularization of higher education, college graduates have become the most important part of the new labor force in many countries. The gender gap in the employment process of college graduates has attracted the attention of some scholars. A study on the gender gap of college graduates in OECD countries believes that compared with other types of labor force, the gender gap of college graduates in employment is more significant, mainly because college students are mainly engaged in high-paying jobs, and the gap between industry income and occupational income is larger [9]. Some studies believe that the gender gap of college graduates in the labor market may be caused by professional choice; that is, female students tend to concentrate on majors with relatively poor employment prospects, leading to significant gender differences in job search, starting salary, and lifetime earnings of college graduates [10]. Professional differences can explain about 43% of the gender-starting salary difference of college students, and the unobservable gap is likely to be caused by gender discrimination in the labor market. Most empirical studies believe that discrimination in the labor market and differences in professional choice jointly lead to the gender gap of college graduates in the labor market.

The theory of market labor supply is the application of the theory of personal utility maximization under the constraint of neoclassical economics in the analysis of labor market supply behavior. The theory assumes that the individual's welfare is a function of consumer goods and leisure. The individual maximizes welfare by choosing between earning income from market work, buying consumer goods, and giving up market work to enjoy leisure. In this model, the relationship between income (total income, used to represent wealth), wages, and working hours is actually examined. Among them, the income effect means that if the income increases and the wages remain unchanged, the ideal working hours will decrease. The substitution effect refers to the fact that if the income remains unchanged and the price of leisure increases due to the rise in wages, the demand for leisure will decrease, resulting in an increase in working hours. This model can explain both male and female labor supply [11].

Early studies mainly explained the difference in labor supply between men and women from the perspective that workers of different genders have different preferences. The huge changes in the supply of female labor force after the Second World War have led some scholars to believe that the supply of female labor force is more flexible than that of men; that is, the supply of female labor force has a strong response to changes in wages [12]. More and more evidence shows that when there is no significant difference between women's working hours and men's, there is no significant difference between women's labor supply and men's response to wages. Therefore, the difference in labor supply between men and women needs to be explained from the perspective of division of labor within the family or family decision-making [13]. The literature [14] proposed that the role of women in the division of labor in the family should be considered, and the time women spent outside the labor market should be divided into leisure time and housework time. It is also believed that the relatively high labor productivity of women in housework was the main reason for the low participation of women in the market. Literature [15] divided personal decision-making time into employment, leisure, and housework and finally formed the family production theory. From the perspective of family production theory, the difference between men's and women's labor supply is mainly reflected in the difference in family division of labor. Women's investment in housework is higher than men's, which directly leads to women's labor supply in the market is lower than men's. Good evidence is that the use of household appliances, such as washing machines and microwave ovens, can effectively shorten women's time for housework when time-saving technological progress occurs in household production, thus helping to improve women's market participation. The investment of women in childbearing and nurturing children is higher than that of men. The birth process will bring about the interruption of women's market activities and the accumulation of work experience lower than that of men, which will eventually lead to a low market wage rate for women and a lower labor participation rate [16]. The transnational comparative study also found that female labor participation rate and labor supply behavior will be significantly affected by family policies, employment security policies, and social concepts, which can well explain national differences [17]. The research on the gender gap in labor supply shows that gender discrimination may not only be reflected in gender wage differences in the labor market but also may feed back to women's employment choices and labor participation decision-making, leading to the decline of women's labor participation rate in the whole society. At the same time, the gender wage gap in the labor market is partly due to gender division of labor, which can not be completely attributed to gender discrimination. The theoretical analysis in this field provides a theoretical basis for the later establishment of measurement and decomposition methods of discrimination [18].

This paper combines the Ologit model and psychological healthcare to analyze the gender differences in the employment process of college students, and provides a theoretical reference for solving the employment problem of college students.

2 THE PROCESSING MODEL OF COLLEGE STUDENTS' EMPLOYMENT DATA

2.1 Retry Queuing System with Supplementary Services

This paper considers a retry queuing system with two service desks, one of which provides immediate service, and the process of job seekers receiving services at the other service desk can be described by an M/M/1 retry queuing system. In this retry queuing system, the arrival process of job seekers is a Poisson process with the parameter human, and the required service time obeys an exponential distribution with parameter Λ. If the job seeker finds that the service desk is in an idle state after arriving, the job seeker directly occupies the service desk to start the service. Otherwise, the job seeker enters the retry space of the infinite waiting area to retry until it completes the service and leaves the service system. Moreover, the retry interval of job seekers follows an exponential distribution with parameter 0. If it is assumed that the job seeker does not know the state of the system after arriving, the job seeker needs to decide whether to enter the system or not based on his own average utility. If a job seeker chooses to stop, the job seeker will receive 0. To ensure that job seekers choose to enter the system when the service desk is idle, we assume that $R\mu \geq C$ holds. According to the example introduced above, for the sake of simplicity, we call the service desk that provides immediate service the recruiter, and the service desk that provides delayed service the computing node, then the network structure topology of the system we analyzed is shown in Figure 1.

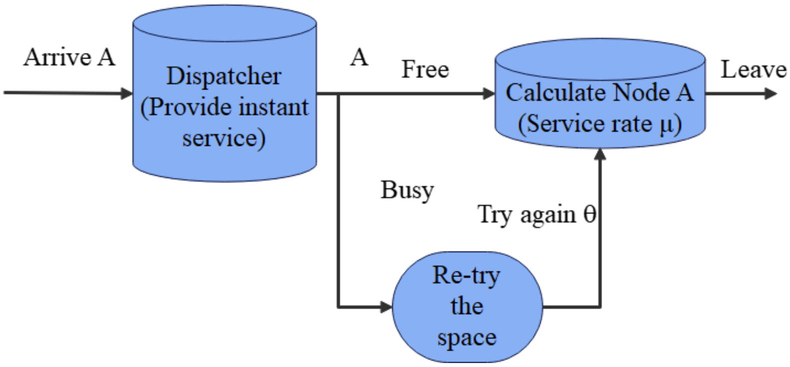


Figure 1: Network structure topology of retry queuing system with supplementary service.

The recruiter provides immediate service. Then, the average sojourn time of job seekers who choose to enter the retry queuing system with supplementary service is equal to the average sojourn time of job seekers in the retry queuing system. If it is recorded as W, then $W = \frac{\lambda + \theta}{\theta(\mu - \lambda)}$ (Falin et al.).

We assume that the prices of recruiters and compute nodes are p_N and p_S, respectively, and their corresponding unit-time returns are SR_N and SR_S.

2.2 Hybrid Pricing Mechanism

If it is assumed that recruiters charge in advance and computing nodes charge afterward, then if the true arrival rate of job seekers is λ, the average revenue per unit time of recruiters is $SR_N = \lambda p_N$, and the average revenue per unit time of computing nodes is $SR_S = \lambda p_S W$.

If it is assumed that two service desks belong to two different private institutions, and the goal is to maximize the respective benefits, the objective functions for recruiters and computing nodes are $\max_{p_N} SR_N(p_N) = \lambda p_N$ and $\max_{p_S} SR_S(p_S) = \lambda p_S W$, respectively. We set:

$$f_1(p_N) = \frac{\mu\theta R + \mu p_N + \mu C - \sqrt{\mu(\theta+\mu)(\theta R p_N + \theta R C + 2 p_N C + p_N^2 + C^2)}}{\mu\theta},$$

and $f_2(p_N)$ is the inverse of the function below.

$$p_N(p_S) = \frac{R\theta - p_S\theta}{\sqrt{\frac{(\theta+\mu)(R\theta + C - \theta p_S)}{\mu C}} - 1} - C$$

Then, there is at least one intersection between functions $f_1(p_N)$ and $f_2(p_N)$.

Certification: We first show that both functions are monotonically decreasing with respect to p_N. Obviously, the function $f_1(p_N)$ is monotonically decreasing with respect to p_N. For a function $f_2(p_N)$, proving that $f_2(p_N)$ decreases with respect to p_N is equivalent to proving that $p_N(p_S) = \frac{R\theta - p_s\theta}{\sqrt{\frac{(\theta+\mu)RQ\ C + - - p_S \rangle}{\mu C}} - 1} - C$ is monotonically decreasing with respect to p_S. If the function $p_N(P_S)$ is $f(p_S)$, then the first derivative of the function $f(p_S)$ with respect to p_S is:

$$f'(p_S) = \frac{g_1}{g_2} \tag{1}$$

Among them,

$$g_1 = -\theta\left(C\mu g - C\mu - 0.5\frac{R\theta^2}{g} - 0.5\frac{R\mu\theta}{g} + 0.5\frac{P_S\theta^2}{g} + 0.5\frac{P_S\mu\theta}{g}\right) \tag{2}$$

$$g_2 = \left(\sqrt{\frac{(R\theta + C - p_S\theta)(\theta+\mu)}{C\mu}} - 1\right)^2 \tag{3}$$

$$g = \sqrt{\frac{(R\theta + C - p_S\theta)(\theta+\mu)}{C\mu}} \tag{4}$$

We set:

$$g_3 = \left(C\mu g - C\mu - 0.5\frac{R\theta^2}{g} - 0.5\frac{R\mu\theta}{g} + 0.5\frac{p_s\theta^2}{g} + 0.5\frac{p_S\mu\theta}{g}\right)g$$
$$= \left(C\mu g - 0.5\frac{R\theta^2}{g} - 0.5\frac{R\mu\theta}{g} + 0.5\frac{p_s\theta^2}{g} + 0.5\frac{p_s\mu\theta}{g}\right)g - C\mu g$$
$$= \frac{\left(\left(C\mu g - 0.5\frac{R\theta^2}{g} - 0.5\frac{R\mu\theta}{g} + 0.5\frac{p\theta^2}{g} + 0.5\frac{ps\mu\theta}{g}\right)g\right)^2 - (C\mu g)^2}{\left(C\mu g - 0.5\frac{R\theta^2}{g} - 0.5\frac{R\mu}{g} + 0.5\frac{ps\theta^2}{g} + 0.5\frac{p\mu\theta}{g}\right)g + C\mu g}$$
$$\triangleq \frac{g_5}{g_4}.$$

It can be obtained by calculation that g_5 and g_4 are less than 0, that is, g_1 is less than 0. Therefore, the function $f' \; p_S$ is less than 0, and $f_2(p_N)$ decreases monotonically with respect to p_N .

Second, we can get $f_1(0) = \frac{\mu\ell R + \mu C - \sqrt{\mu C(\theta+\mu)(\theta R + C)}}{\mu\theta}, f_2(0) = \frac{R\mu - C}{\mu}$ and $f_1(0) < f_2(0)$ by calculation. Similarly, regarding the value of p_N , the former is greater than the latter.

Therefore, $f_1 \; p_N$ and $f_2 \; p_N$ decrease monotonically with respect to p_N , and $f_2 \; p_N$ first being higher than $f_1 \; p_N$ and then decreasing. Therefore, there is at least one intersection between these two functions. The certificate is complete.

The optimal pricing of service providers and the equilibrium behavior of job seekers can be inferred.

We set $\lambda^* = \frac{R\theta\mu - p_s^{\theta}\theta - \theta \;\; p_N^{+} + C}{R\theta - p_s^{*}\theta + p_N^{+} + C}$, where p_S^* and p_N^* are the solutions of the following system of formulas.

$$\begin{cases} p_S = \dfrac{\mu\theta R + \mu p_N + \mu C - \sqrt{\mu(\theta+\mu) \;\; \theta R p_N + \theta R C + 2p_N C + p_N^2 + C^2}}{\mu\theta} \\ p_N = \dfrac{R\theta - p_S\theta}{\sqrt{\dfrac{(\theta+\mu) \;\; R\theta + C - \theta p_S}{\mu C}} - 1} - C. \end{cases}$$

Then, there is:

(1) If $\lambda^* \le \Lambda$, there are equilibrium solutions $\lambda = \lambda^*, W = \frac{\lambda^* + \theta}{\theta\ \mu - \lambda^*}, p_S = p_S^*, p_N = p_N^*, SR_S = p_S^* \frac{R\theta\mu - p_s^*\theta\mu - \theta\ p_N^* + C}{R\theta - p_s^{\theta + p_N^* + C}}$ and $SR_N = p_N^*\ R - p_S^* \left(\frac{\mu}{p_N^* + C} - \frac{\theta + \mu}{R\theta - p_S^*\theta + p_N^* + C}\right)$.

(2) If $\lambda^* > \Lambda$, there are continuous equilibrium solutions $p_S \in \left[\frac{R\Lambda(\mu + \theta)}{2\Lambda\mu + \mu\theta - \Lambda^2}, R - \frac{C(\Lambda + \theta)}{\theta(\mu - \Lambda)}\right], p_N = \frac{\theta\ R - p_S\ (\mu - \Lambda)}{\Lambda + \theta} - C, SR_S = \Lambda p_S$ and $SR_N = \Lambda\left(\frac{\theta\ R - p_S\ (\mu - \Lambda)}{\Lambda + \theta} - C\right)\frac{\Lambda + \theta}{\theta(\mu - \Lambda)}$, where $\lambda = \Lambda, W = \frac{\Lambda + \theta}{\theta(\mu - \Lambda)}$.

Certification: We assume that Λ is large enough. From the perspective of job seekers, $R = p_S +\ p_N + C\ W$ should be satisfied under equilibrium, and then we can get:

$$\lambda = \frac{R\theta\mu - p_S\theta\mu - \theta\ p_N + C}{R\theta - p_S\theta + p_N + C}. \tag{5}$$

When taking formula (5) into $W = \frac{\lambda + \theta}{\theta(\mu - \lambda)}, SR_S = \lambda p_S, SR_N = \lambda p_N W$, we get

$$\begin{cases} SR_S = p_S \frac{R\theta\mu - p_S\theta\mu - \theta\ p_N + C}{R\theta - p_S\theta + p_N + C}, \\ SR_N = p_N\ R - p_S\ \left(\frac{\mu}{p_N + C} - \frac{\theta + \mu}{R\theta - p_S\theta + p_N + C}\right). \end{cases} \tag{6}$$

Through the first-order derivation analysis, the maximum point of SR_S and SR_N can be obtained as:

$$\begin{cases} p_S = \frac{\mu\theta R + \mu p_N + \mu C - \sqrt{\mu(\theta + \mu)\ \theta R p_N + \theta R C + 2 p_N C + p_N^2 + C^2}}{\mu\theta}, \\ p_N = \frac{R\theta - p_S\theta}{\sqrt{\frac{(\theta + \mu)\ R\theta + C - \theta p_S}{\mu C}} - 1} - C. \end{cases} \tag{7}$$

Next, we consider the case of $\lambda^* > \Lambda$. In this case, the service provider will increase the pricing given in formula (7) until the arrival rate becomes $\lambda = \Lambda$, then any solution that satisfies the following conditions is an equilibrium solution.

$$\begin{cases} R - p_S = \ p_N + C \ \dfrac{\Lambda + \theta}{\theta(\mu - \Lambda)} \\ p_S \geq \dfrac{\mu\theta R + \mu p_N + \mu C - \sqrt{\mu(\theta + \mu) \ \theta R p_N + \theta R C + 2 p_N C + p_N^2 + C^2}}{\mu\theta} \\ p_N \geq \dfrac{R\theta - p_S\theta}{\sqrt{\dfrac{(\theta + \mu) \ R\theta + C - \theta p_S}{\mu C}} - 1} - C. \end{cases} \tag{8}$$

We set $p_S = x$, and we get $p_N = \dfrac{\theta(R - x)(\mu - \Lambda)}{\Lambda + \theta} - C, x \in \left[\dfrac{R \wedge (\mu + \theta)}{2\Lambda\mu + \mu\theta - \Lambda^2}, R - \dfrac{C(\Lambda + \theta)}{\theta(\mu - \Lambda)}\right]$. The certificate is complete.

When two service desks belong to the same private institution, the private institution can be regarded as a monopoly whose goal is to maximize its own benefits. If the average revenue per unit of time generated by the monopoly by collecting service fees from job seekers entering the system is recorded as SR_M, then the objective function of the monopoly is $\max_{p\in,pN} SR_M \ p_S, p_N \ = \lambda \ p_S + p_N W$. Next, we first prove that the optimal pricing of the monopolist is also the socially optimal pricing.

The Nash equilibrium under monopoly is socially optimal.

Certification: If we assume that the social manager's average income per unit time is $SW \ p_S, p_N$, then there is $SW \ p_S, p_N \ = \lambda(R - CW)$. Considering that the income of all job seekers in equilibrium is equal to 0, that is, $\lambda \ R - p_S - \ p_N + C \ W \ = 0$, we can get:

$$SR_M \ p_S, p_N \ = \lambda \ p_S + p_N W \ = \lambda(R - CW) = SW \ p_S, p_N \ .$$

In other words, the objective functions of the monopolist and the social manager are the same, and the monopolist's pricing p_S and p_N can also maximize the social benefit. The certificate is complete.

We set $\lambda_M = \mu - \dfrac{\sqrt{C\mu(\theta + \mu)(C + R\theta)}}{C + R\theta}$.

There is always an equilibrium when two service desks are subordinate to the same private institution.

(1) If $\lambda_M \leq \Lambda$, then there is a continuous equilibrium $p_N = \dfrac{R\theta + C - \theta p_S \ \sqrt{C\mu(\theta + \mu)(C + R\theta)} - C(R\theta + C)(\mu + \theta)}{(R\theta + C)(\mu + \theta) - \sqrt{C\mu(\theta + \mu)(C + R\theta)}}$

$p_S = x, x \in \left[0, \dfrac{(R\theta + C)\sqrt{C\mu(\theta + \mu)(C + R\theta)} - C(R\theta + C)(\mu + \theta)}{\theta\sqrt{C\mu(\theta + \mu)(C + R\theta)}}\right],$, and there is $\lambda = \lambda_M$ under equilibrium.

$$W=\frac{(R\theta+C)(\mu+\theta)-\sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}},$$

$$SR_M=\frac{[\sqrt{C\mu(\mu+\theta)(C+R\theta)}-C(\mu+\theta)][R\mu\theta+C\mu-\sqrt{C\mu(\mu+\theta)(C+R\theta)}]}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}}.$$

(2) If $\lambda_M>\Lambda$, there is a continuous equilibrium $p_N=\frac{R-p_S\ \ (\mu-\Lambda)\theta-C(\Lambda+\theta)}{\Lambda+\theta}, p_S=x, x\in\left[0,\frac{R\theta(\mu-\Lambda)-C(\Lambda+\theta)}{(\mu-\Lambda)\theta}\right]$, and there is $\lambda=\Lambda, W=\frac{\Lambda+\theta}{\theta(\mu-\Lambda)}, SR_M=\Lambda\left(R-C\frac{\Lambda+\theta}{\theta(\mu-\Lambda)}\right)$ under the equilibrium.

Certification: When $\lambda_M\le\Lambda$, the objective functions of the monopolist and the social manager are the same, denoted as $SW=\lambda\left(R-C\frac{\lambda+\theta}{\theta(\mu-\lambda)}\right)$. Through the second-order derivation, it can be seen that SW is a concave function of λ, and the maximum point is:

$$\lambda=\mu-\frac{\sqrt{C\mu(\theta+\mu)(C+R\theta)}}{C+R\theta}=\lambda_M. \tag{9}$$

When formula (9) is brought into SW, we can get:

$$SW=SR_M=\frac{[\sqrt{C\mu(\mu+\theta)(C+R\theta)}-C(\mu+\theta)][R\mu\theta+C\mu-\sqrt{C\mu(\mu+\theta)(C+R\theta)}]}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}}. \tag{10}$$

Since the income of the job seeker is 0 in equilibrium, formula (5) still holds, then there is:

$$\mu-\frac{\sqrt{C\mu(\theta+\mu)(C+R\theta)}}{C+R\theta}=\frac{R\theta\mu-p_s\theta\mu-\theta\ \ p_N+C}{R\theta-p_s\theta+p_N+C}, \tag{11}$$

$$p_N=\frac{R\theta+C-\theta p_S\ \ \sqrt{C\mu(\theta+\mu)(C+R\theta)}-C(R\theta+C)(\mu+\theta)}{(R\theta+C)(\mu+\theta)-\sqrt{C\mu(\theta+\mu)(C+R\theta)}}. \tag{12}$$

Furthermore, $p_S\in\left[0,\frac{(R\theta+C)\sqrt{C\mu(\theta+\mu)(C+R\theta)}-C(R\theta+C)(\mu+\theta)}{\theta\sqrt{C\mu(\theta+\mu)(C+R\theta)}}\right]$ can be inferred from the non-negativity of p_S and p_N. Next, we consider the opposite case, namely $\lambda_M>\Lambda$.

In this case, the equilibrium arrival rate of job seekers is Λ, and the average return of job seekers is 0. Therefore, we have:

$$\frac{R\theta\mu-p_S\theta\mu-\theta\ \ p_N+C}{R\theta-p_S\theta+p_N+C}=\Lambda, \tag{13}$$

That is,

$$p_N = \frac{R - p_S \ (\mu - \Lambda)\theta - C(\Lambda + \theta)}{\Lambda + \theta}. \tag{14}$$

Similarly, $p_S \in \left[0, \frac{R\theta(\mu - \Lambda) - C(\Lambda + \theta)}{(\mu - \Lambda)\theta}\right]$ can be obtained from the non-negativity of p_S and p_N. The certificate is complete.

SW is the social benefit per unit time, SR_S^P is the unit time benefit of the private computing node, and SR_N^P is the unit time benefit of the private recruiter, then

$$SW = \lambda\left(R - C\frac{\lambda + \theta}{\theta(\mu - \lambda)}\right), SR_S^p = \lambda P_S, SR_N^p = \lambda P_N \frac{\lambda + \theta}{\theta(\mu - \lambda)}.$$

Because in the unbounded case, the income of the job seeker is equal to 0 in equilibrium, then formula (5) should be established, and then we can get:

$$SW = \frac{\theta \ Rp_N + Cp_S \ \ R\mu - p_S\mu - p_N - C}{C + p_N \ \ R\theta - p_S\theta + p_N + C}. \tag{15}$$

The objective function of the private institution has been obtained, as shown in formula (6). Next, we will perform an equilibrium analysis of this model.

(1) SW is a concave function with respect to p_S.

(2) When $0 \le p_S < \frac{R\mu\theta + C\mu - \sqrt{C\mu(\mu + \theta)(C + R\theta)}}{\mu\theta}, SW$ first increases and then decreases with respect to p_N. When $\frac{R\mu\theta + C\mu - \sqrt{C\mu(\mu + \theta)(C + R\theta)}}{\mu\theta} \le p_S < R, SW$ increases monotonically with respect to p_N.

Certification: It can be obtained by second-order derivation:

$$\frac{\partial^2 SW}{\partial p_S^2} = -\frac{2\theta(\mu + \theta) \ C + p_N \ (C + R\theta)}{C + p_N + R\theta - p_S\theta^{\ 3}} < 0 \tag{16}$$

Therefore, SW is a concave function with respect to p_S.

On the other hand, the first derivative of SW with respect to p_N is:

$$\frac{\partial SW}{\partial p_N} = -\frac{\theta \ R - p_S \ A_1}{C + p_N^{\ 2} \ C + p_N + R\theta - p_S\theta^{\ 2}}, \tag{17}$$

Among them,

$$A_1 = (R\mu + R\theta + C)p_N^2 + \ 2C^2 + 2RC\theta + 2C\mu p_S \ \ p_N + CA2$$
$$A_2 = -\mu\theta p_S^2 + (2R\mu\theta + 2C\mu)p_S + C^2 - CR\mu + CR\theta - R^2\mu\theta.$$

When $0 \le p_S < \dfrac{R\mu\theta + C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\mu\theta}$, A_2 is less than 0, otherwise, A_2 is non-negative. This shows that about p_N, when $0 \le p_S < \dfrac{R\mu\theta + C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\mu\theta}$, SW increases first and then decreases, otherwise SW increases monotonically. The certificate is complete.

According to the monotonicity of SW with respect to p_S and p_N, we can deduce the equilibrium pricing of the two service desks in the following two cases. In the first case, the compute node is affiliated with a public institution, and the recruiter is affiliated with a private institution. The second case is just the opposite.

We set $\lambda_P = \mu - \sqrt{\dfrac{C\mu(\mu+\theta)}{R\theta + C}}$.

When computing nodes are subordinate to public institutions and recruiters are subordinate to private institutions, there is always an equilibrium solution:

(2) If $\lambda_P > \Lambda$, then there is continuous equilibrium $\lambda = \Lambda, W = \dfrac{\Lambda+\theta}{\theta(\mu-\lambda)}, p_N = x, x \in \left[\dfrac{R\theta}{\sqrt{\dfrac{(R\theta+C)(\mu+\theta)}{C\mu}} - 1} - C, \dfrac{R\theta(\mu-\Lambda)}{\Lambda+\theta} - C\right], p_S = R - (x+C)\dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)}, SW = \Lambda\left(R - C\dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)}\right)$ and $SR_N = \lambda x \dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)}$.

Certification: We assume that Λ is large enough, that is, $\lambda_P \le \Lambda$. SW is a concave function with respect to p_S, so from the first-order optimization condition we get:

$$p_S = \frac{RC\mu\theta + p_N C\mu + C^2\mu - \ p_N + C \ \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{C\mu\theta}, \tag{18}$$

Furthermore, it can be seen from formula (7) that:

$$p_N = \frac{R\theta - p_s\theta}{\sqrt{\dfrac{(\theta+\mu)\ R\theta + C - \theta p_s}{\mu C}} - 1} - C, \tag{19}$$

Conversely, if $\lambda_P > \Lambda$, the service desk will increase the charge until $R - p_S - \ p_N + C \ \dfrac{\Lambda+\theta}{\theta(\mu-\lambda)} = 0$ is established.

Therefore, the price in equilibrium should satisfy the following conditions:

$$\begin{cases} R - p_S = P_N + C\dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)} \\ p_S \geq 0, \\ p_N \geq \dfrac{R\theta}{\sqrt{\dfrac{(\theta+\mu)(R\theta+C)}{\mu C}}-1} - C. \end{cases} \tag{20}$$

We set $p_N = x$. Considering the non-negativity of p_S and p_N , we can get:

$$\frac{R\theta}{\sqrt{\dfrac{(\theta+\mu)(R\theta+C)}{\mu C}}-1} - C \leq x \leq \frac{R\theta(\mu-\Lambda)}{\Lambda+\theta} - C.$$

The certificate is complete.

When recruiters are affiliated with public institutions and compute nodes are affiliated with private institutions, there is an equilibrium solution:

(1) If $\lambda_P \leq \Lambda$, then there is a unique equilibrium solution $\lambda = \lambda_P, W = \dfrac{\sqrt{C\mu(C+R\theta)(\mu+\theta)} - C\mu}{C\mu\theta}, p_S = \dfrac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta}, p_N = 0$ and $SW = SR_S = \dfrac{(\sqrt{C\mu(C+R\theta)(\mu+\theta)} - C\mu - C\theta)(R\mu\theta + C\mu - \sqrt{C\mu(C+R\theta)(\mu+\theta)})}{\theta\sqrt{C\mu(C+R\theta)(\mu+\theta)}}$.

(2) If $\lambda_P > \Lambda$, then there is a continuous equilibrium solution $\lambda = \Lambda, W = \dfrac{\Lambda+\theta}{\theta(\mu-\lambda)}, p_S = x, p_N = \dfrac{\theta(\mu-\Lambda)(R-x)}{\Lambda+\theta} - C,$

$x \in \left[\dfrac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta}, R - \dfrac{C(\Lambda+\theta)}{\theta(\mu-\lambda)}\right], SW = \Lambda\left(R - C\dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)}\right), SR_S = \lambda x$.

Certification: When $\lambda_P \leq \Lambda$, according to the monotonicity of SW with respect to p_N , we divide the analysis into the following two parts.

Part 1: We assume $\dfrac{R\mu\theta + C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\mu\theta} \leq p_S < R$, in which case SW decreases monotonically with respect to p_N . Therefore, SW takes its maximum value at $p_N = 0$.

From formula (7), we have:

$$p_S = \frac{\mu\theta R + \mu p_N + \mu C - \sqrt{\mu(\theta+\mu)\ \theta R p_N + \theta RC + 2p_N C + p_N^2 + C^2}}{\mu\theta}, \tag{21}$$

Therefore, in equilibrium there is $p_S = \dfrac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta}, p_N = 0$.

Part 2: We assume $0 \le p_S < \dfrac{R\mu\theta + C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\mu\theta}$, in which case SW increases first and then decreases with respect to p_N. By first-order derivation, we can get:

$$p_N = \frac{R - p_S\ \sqrt{C\mu(\mu+\theta)(C+R\theta)} - C^2 - RC\theta - Cp_S\mu}{C + R\mu + R\theta}, \tag{22}$$

Furthermore, by solving formulas (21) and (22) simultaneously, it can be found that there is no equilibrium solution in this case.

Therefore, when $\lambda_P \le \Lambda$, there exists a unique equilibrium solution $p_S = \dfrac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta}, p_N = 0, \lambda_P = \mu - \sqrt{\dfrac{C\mu(\mu+\theta)}{R\theta + C}}$.

In the following, we assume $\lambda_P > \Lambda$. Equilibrium pricing should satisfy the following conditions:

$$\begin{cases} R - p_s = \ p_N + C\ \dfrac{\Lambda+\theta}{\theta(\mu-\Lambda)}, \\ p_S \ge \dfrac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta}, \\ p_N \ge 0. \end{cases} \tag{23}$$

If $P_S = x$, we can deduce that

$$\frac{\mu\theta R + \mu C - \sqrt{\mu(\theta+\mu)\ \theta RC + C^2}}{\mu\theta} \le x \le R - \frac{C(\Lambda+\theta)}{\theta(\mu-\lambda)}.$$

The certificate is complete.

2.3 Fixed Pricing Mechanism

It is assumed that both service desks adopt a fixed pricing method. Considering that the proof is similar to the proof under mixed pricing in the previous section, here we omit the complete proof and only give the relevant results in the unbounded case.

Since the average return of job seekers in equilibrium is 0, we have:

$$\lambda = \frac{\theta(\text{R}\mu\text{-ps}\mu - p_N\mu - C)}{R\theta - ps\theta - p_N\theta + C} \tag{24}$$

Furthermore, the benefits of recruiters and compute nodes are:

$$\begin{cases} SR_S = \lambda p_S = p_S \dfrac{\theta\ \ R\mu - p_S\mu - p_N\mu - C}{R\theta - p_S\theta - p_N\theta + C} \\ SR_N = \lambda p_N = p_N \dfrac{\theta\ \ R\mu - p_S\mu - p_N\mu - C}{R\theta - p_S\theta - p_N\theta + C} \end{cases} \tag{25}$$

Through first-order derivation, the optimal pricing of the two service desks in equilibrium can be obtained as:

$$p_S^{Fixed} = p_N^{Fixed} = \frac{3C\mu - C\theta + 4R\mu\theta - \sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)}}{8\mu\theta}. \tag{26}$$

Putting formula (26) into formulas (24)-(25), the arrival rate of job seekers under equilibrium can be inferred, and the average stay time and the benefit of the service desk are respectively:

$$\lambda^{Fixed} = \mu - \frac{4C\mu(\mu+\theta)}{C(\mu+\theta) + \sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)}} \tag{27}$$

$$W^{Fixed} = \frac{C\theta - 3C\mu + \sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)}}{4C\mu\theta}, \tag{28}$$

$$SR_i^{Fixed} = \left(\mu - \frac{4C\mu(\mu+\theta)}{\sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)} + C(\mu+\theta)}\right) \frac{(4R\mu\theta + 3C\mu - C\theta - \sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)}}{8\mu\theta}, \quad (i = S, N) \tag{29}$$

The situation where two service desks belong to the same private institution is considered. Because for any pricing mechanism, the monopolist's optimal price is

$$p_M^{Fixed} = \frac{(C + R\theta)(\sqrt{C\mu(\mu+\theta)(C+R\theta)} - C\theta - C\mu)}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}} \tag{30}$$

By assumption, we notice $R\mu > C$, which shows that:

$$4\sqrt{\mu(C+R\theta)} - \sqrt{9C\mu + C\theta + 8R\mu\theta} > \sqrt{C(\mu+\theta)}. \tag{31}$$

Therefore,

$$\begin{aligned} p_M^{Fixed} &= \frac{(C + R\theta)(\sqrt{C\mu(\mu+\theta)(C+R\theta)} - C\theta - C\mu)}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}} \\ &= R + \frac{C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}}{\theta\mu} \\ &\le R + \frac{3C\mu - C\theta - \sqrt{C(\mu+\theta)(9C\mu + C\theta + 8R\mu\theta)}}{4\mu\theta} \\ &= p_S^{Fixed} + p_N^{Fixed}. \end{aligned}$$

When recruiters are affiliated with public institutions and compute nodes are affiliated with private institutions, their optimal pricing is $p_N = 0, p_S = \frac{R\mu + C\mu - \sqrt{C_\mu(\mu+\theta)(R\theta + C)}}{\mu\theta}$. Conversely, if recruiters are subordinate to private institutions and computing nodes are subordinate to public institutions, the pricing in equilibrium is symmetric. For the private institution, we can think of it as a monopoly whose price is equal to $p_M^{Fixed.}$.

2.4 Time-Dependent Pricing Mechanism

If y=f(x) is a continuous function on its domain, then the necessary and sufficient condition for the function y=f(x) and $y = f^{-1}(x)$ to have at least one intersection is that the function y=f(x) and y=x have an intersection.

The results parallel to the fixed pricing mechanism are as follows:

$$\lambda = \frac{\theta \ \ R\mu - p_S - p_N - C}{R\theta + p_S + p_N + C}, \tag{32}$$

$$\begin{cases} SR_S = \lambda p_S W = \dfrac{Rp_S\theta \ \ R\mu - p_S - p_N - C}{C + p_S + p_N \quad R\theta + P_S + p_N + C}, \\ SR_N = \lambda p_N W = \dfrac{Rp_N\theta \ \ R\mu - p_S - p_N - C}{C + p_S + p_N \quad R\theta + p_S + p_N + C} \end{cases} \tag{33}$$

By first-order derivation, we have:

$$\begin{cases} p_S = \dfrac{R\sqrt{\mu \ \ C + p_N \ \ (\mu+\theta) \ \ C + p_N + R\theta} - 2Cp_N - C^2 - p_N^2 - RC\theta - Rp_N\theta}{C + p_N + R\mu + R\theta}, \\ p_N = \dfrac{R\sqrt{\mu \ \ C + p_S \ \ (\mu+\theta) \ \ C + p_S + R\theta} - 2Cp_S - C^2 - p_S^2 - RC\theta - Rp_S\theta}{C + p_S + R\mu + R\theta}. \end{cases} \tag{34}$$

Obviously, the two functions in formula (34) are inverse functions of each other and are continuous on the domain $p_S \geq 0, p_N \geq 0$. When $p_S = p_N$, we calculate that the two functions in formula (34) have no solution in the range of $p_S \geq 0$. Therefore, the two functions in formula (34) have no intersection in the domain $p_S \geq 0, p_N \geq 0$.

If we consider from the monopolist's point of view, the monopoly's pricing is:

$$p_M^{Time-based} = \frac{(C + R\theta)(\sqrt{C\mu(\mu+\theta)(C+R\theta)} - C\theta - C\mu)}{C\mu + C\theta - \sqrt{C\mu(\mu+\theta)(C+R\theta)} + R\theta^2 + R\mu\theta} \tag{35}$$

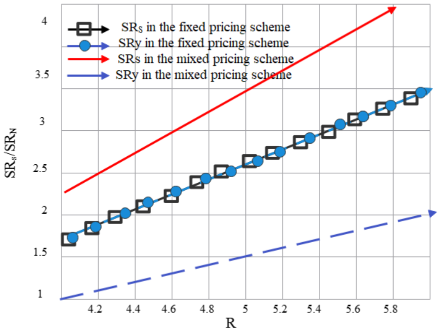
Finally, if recruiters are affiliated with public institutions and computing nodes are affiliated with private institutions, the optimal pricing of the two service desks in equilibrium is $p_N = 0, p_S = \frac{R\sqrt{C\mu(\mu+\theta)(R\theta+C)} - C^2 - RC\theta}{C + R\mu + R\theta}$, and the equilibrium pricing in the opposite case is symmetric.

In the fixed pricing mechanism and the time-dependent pricing mechanism, the first derivative of SR_S with respect to p_S and the first derivative of SR_N with respect to p_N are obtained respectively, we find that p_S p_N and p_N p_S are opposite numbers to each other and decrease monotonically.

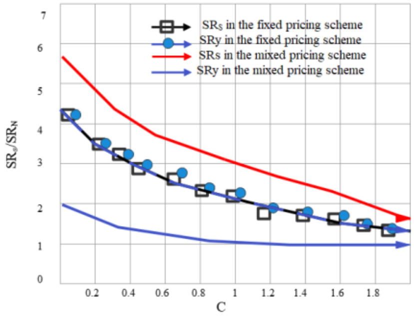
2.5 Numerical Example: Comparison of Different Pricing Mechanisms

When two service desks belong to different private institutions, Figures 2-5 show the effect of system parameters on service desk revenue under equilibrium. Clearly, service desk gains are monotonically increasing with respect to service rate and retry rate. This is because the increase in service rate and retry rate leads to a decrease in the average stay time of job seekers, so that more job seekers choose to enter the system, that is, the effective arrival rate increases. In real life, sellers generally adopt strategies to make more job seekers choose to enter the system. Similarly, the increase of service return scale, or the decrease of waiting cost C per unit time can attract more job seekers to enter the system, and ultimately the service desk revenue will increase.

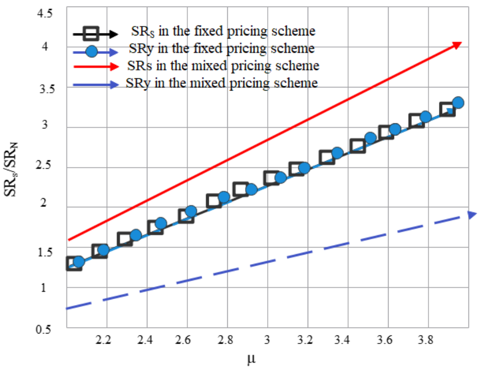
In addition, it can be observed from Figure 2 that there is $SR_s > SR_N$ under the mixed pricing mechanism and $SR_s = SR_N$ under the fixed pricing mechanism. Furthermore, we can infer that when one service desk chooses a fixed pricing method, another service desk will also choose a fixed pricing method in order to obtain more revenue. Conversely, if one service desk chooses a time-dependent pricing mechanism, the other service desk has no choice but to choose a fixed pricing mechanism. This is because no equilibrium solution exists under a time-dependent pricing mechanism.



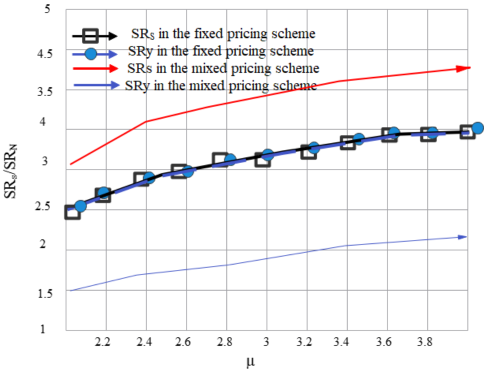
(a) Comparison of fixed and mixed pricing mechanisms in equilibrium VS.R, where $\mu = 3, \theta = 1, \mathrm{C} = 1$



(b) Comparison of fixed and mixed pricing mechanisms in equilibrium VS.C, where $\mu = 3, \theta = 1, R = 5$



(c) Comparison of fixed and mixed pricing mechanisms in equilibrium vs. μ, where $\theta = 1, C = 1, R = 1$



(d) Comparison of fixed and mixed pricing mechanisms in equilibrium VS. θ, where $\mu = 3, C = 1, R = 5$

Figure 2: Comparison of fixed pricing mechanism and mixed pricing mechanism in equilibrium.

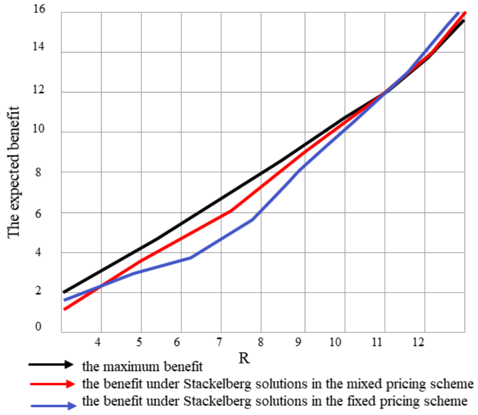
Under the three pricing mechanisms, when two service desks are subordinate to the same private institution, or one service desk is subordinate to a private institution and the other service desk is subordinate to a public institution, the social maximum benefit can always be achieved. Therefore, considering that there is no equilibrium solution in the time-based pricing mechanism, in this section we compare the maximum social benefit and equilibrium social benefit of two service desks subordinate to different private institutions under the mixed and fixed pricing mechanisms.

Based on the previous analysis, when $\lambda_m = \mu - \frac{\sqrt{C\mu(\theta+\mu)(C+R\theta)}}{C+R\theta} < \Lambda$, the social benefit per unit time can be expressed as the following formula:

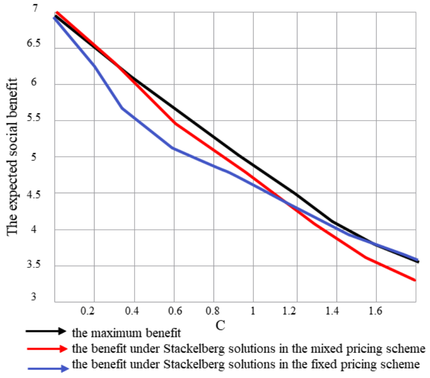
$$SW_m = \frac{[\sqrt{C\mu(\mu+\theta)(C+R\theta)} - C(\mu+\theta)][R\mu\theta + C\mu - \sqrt{C\mu(\mu+\theta)(C+R\theta)}]}{\theta\sqrt{C\mu(\mu+\theta)(C+R\theta)}}.$$

Otherwise, the social benefit per unit time is equal to $\Lambda\left(R - C\frac{\Lambda+\theta}{\theta(\mu-\Lambda)}\right)$. On the other hand, if h is the equilibrium arrival rate under the Steinberg game, the social payoff per unit time is $SW_s = \lambda(R - CW)$.

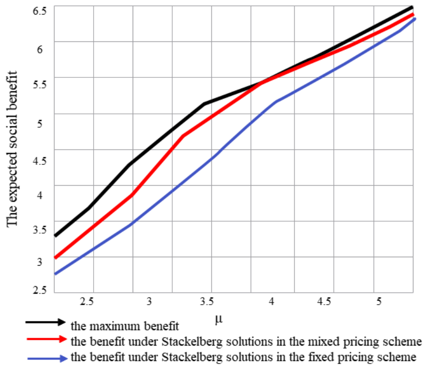
Figure 3 show the changes of social benefits with service return R, waiting cost per unit time C, service rate μ and retry rate θ. Obviously, the social benefit per unit time increases with the increase of service return R, service rate μ and retry rate θ, but decreases with the increase of waiting cost C per unit time. Otherwise, the social benefits in the three cases remain unchanged. The reason is that the effective arrival rate in this case is higher than the potential arrival rate, resulting in the social benefit always equal to $\Lambda\left(R - C\frac{\Lambda+\theta}{\theta(\mu-\Lambda)}\right)$. Therefore, in this case, there is no difference between the fixed pricing mechanism and the mixed pricing mechanism for social managers.



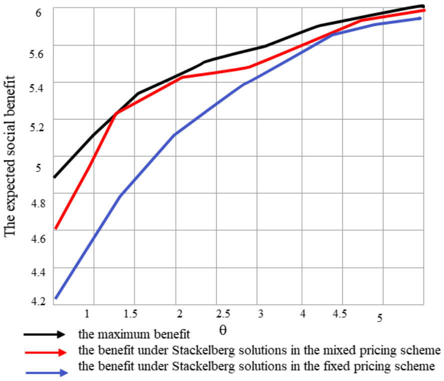
(a) Comparison of maximum social benefit and equilibrium social benefit VS.R, where $\mu = 3, \theta = 1, \mathrm{C} = 1, \Lambda = 1.5$



(b) Comparison of maximum social benefit and equilibrium social benefit VS.C, where $\mu = 3, \theta = 1, R = 5, \Lambda = 1.5$



(c) Comparison of maximum social benefit and equilibrium social benefit VS. μ, where $\theta=1, C=1, \mathrm{R}=5, \Lambda=1.5$



(c) Comparison of maximum social benefit and equilibrium social benefit VS. θ, where $\mu=3, C=1, R=5, \Lambda=1.5$

Figure 3: Comparison of maximum social benefit and equilibrium social benefit.

3 RESEARCH ON GENDER DIFFERENCES IN THE EMPLOYMENT PROCESS OF COLLEGE STUDENTS BASED ON OLOGIT MODEL AND PSYCHOLOGICAL HEALTHCARE-BASED MACHINE LEARNING

This paper mainly analyzes the gender differences in the initial employment of graduates from the two aspects of job search and employment results. Figure 4 presents the "opportunity-quality" two-dimensional analysis framework of gender differences in the initial employment of college graduates. If gender discrimination is an important reason, this paper will also construct a comprehensive security system based on gender differences to eliminate gender discrimination, so as to promote fair employment and improve the employment quality of female college students.

Through the analysis of the employer's needs, the questionnaire analysis of the evaluation indicators and the review of related research, the evaluation index structure of college students' employment competitiveness as shown in Figure 5 is finally constructed. This is a multi-dimensional and multi-level evaluation index system. As can be seen from the figure, the evaluation of employment competitiveness mainly includes five dimensions: professional ability, basic ability, personal quality, job-seeking ability, and relevant experience. Moreover, each dimension is composed of several specific ability evaluation items, including a total of 25 items, as shown in Figure 5.

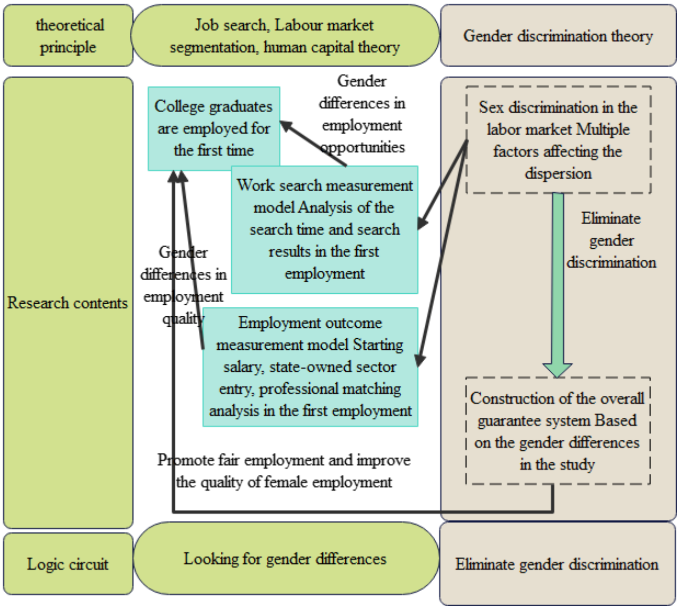


Figure 4: The "opportunity-quality" two-dimensional analysis framework of gender differences in graduates' initial employment.

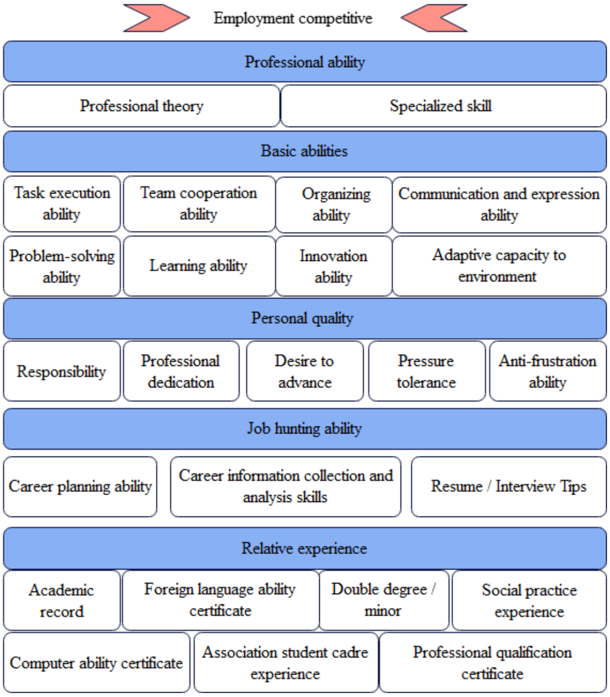


Figure 5: Structure of the evaluation index of college students' employment competitiveness.

This paper combines the Ologit model and psychological healthcare based machine learning algorithm to verify the effect of the gender difference analysis method proposed in this paper, and calculates the effectiveness of the system in this paper, and finally obtains the evaluation results shown in Figure 6.

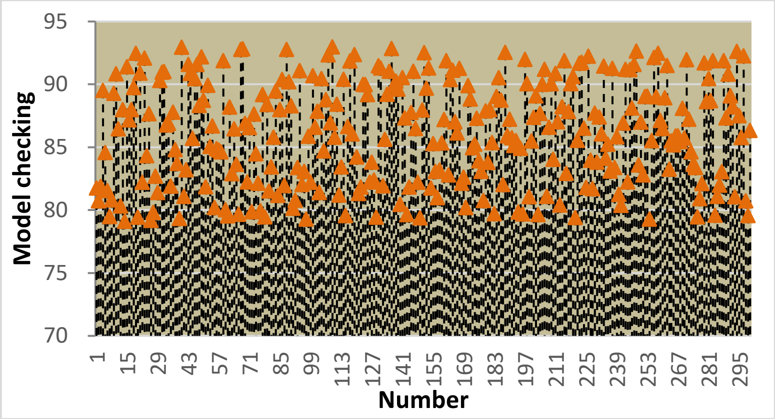


Figure 6: The research effect of gender differences in the employment process of college students based on the Ologit model and psychological healthcare-based machine learning.

From the above research, it can be seen that the gender difference research model in the employment process of college students based on the Ologit model and machine learning proposed in this paper has a good effect.

4 CONCLUSIONS

In the employment process of college students, gender differences may lead to more employment anxiety and self-undervaluation of women. These differences are not only reflected in employment opportunities and career choices but also may affect salary levels and career development speed. Women may feel limited in their career development due to gender stereotypes and gender discrimination, resulting in low self-esteem, frustration, and career confusion, which need to be solved through professional psychological intervention and support. Psychological healthcare can help female college students build self-confidence, improve their ability to cope with employment pressure, and promote their mental health and career development by providing career counseling, stress management, self-efficacy enhancement training, gender equality education, work-life balance guidance, and legal rights protection. It also requires universities, families, employers, and policymakers to work together to create a fair and inclusive employment environment by providing equal employment opportunities, increasing awareness of gender equality, building support systems, and enacting and enforcing anti-discrimination laws.

The employment of college graduates has always been the focus of attention from all walks of life. Previous studies have conducted in-depth discussions on the employment of college graduates from the perspective of labor market segmentation, factors affecting graduates' employability and quality, and employment mentality. Because female college students have always been in a relatively weak position in the job market, their employment opportunities, employment quality, salary and welfare benefits are more prominent. Therefore, the gender differences in the employment process of college graduates have also attracted the attention of the academic community. This paper combines the Ologit model and machine learning to analyze the gender differences in the employment process of college students, and provides a theoretical reference for solving the employment problem of college students. The research shows that the gender difference research model in the employment process of college students based on the Ologit model and psychological healthcare proposed in this paper has a good effect.

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Li Meng, https://orcid.org/0009-0009-6392-6349

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