

Job Preferences of Undergraduate Pharmacy Students in China: A Discrete Choice Experiment

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Research

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Abstract

Background: Pharmacists are a crucial part of the health workforce and playing important role in achieving universal health coverage. In China, pharmaceutical human resources are in short and the distribution is unequal. This study aimed to identify the key job characteristics that influence the job preferences of undergraduate pharmacy students and to elicit the relative importance of different job characteristics to shed lights on future policy intervention.

Methods: A discrete choice experiment was conducted to elicit the job preferences of undergraduate pharmacy students from 6 provinces in mainland China. A face-to-face interview was used to collect data. Conditional logit and mixed logit models were used to analyze data and the final model was chosen according to the model fit statistics. A series of policy simulation was also conducted.

Results: In total, 581 respondents completed the questionnaire and 500 respondents who passed the internal consistency test were analyzed. All attributes were statistically significant except for open management. Monthly income and work location were most important to respondents, followed by work unit (which refers to the nature of workplace) and years to promotion. There exists preference heterogeneity among respondents, e.g. male students preferred open management and female students preferred a job in private institutions. Furthermore, students with an urban background or from a single-child family placed higher values on a job in the city as compared to their counterparts.

Conclusion: The heterogeneity of attributes showed the complexity of job preferences. Both monetary and non-monetary job characteristics significantly influenced the job preferences of pharmacy students in China. A more effective policy intervention to attract graduates to work in rural areas should consider both incentives on the job itself as well as the background of pharmacy school graduates.

Background

Overuse and misuse of drugs seriously threaten the life and health of patients, leading to the waste of scarce resources and widespread health hazards[1]. The World Health Organization (WHO) estimated that more than half of prescription drugs were improperly dispensed or marketed, and half of the patients used them incorrectly[1]. Pharmacists are an important part of the health workforce and an important force in achieving universal health coverage[2]. In the people-centred integrated care model, pharmacists play a vital role in providing drug knowledge, guiding clinical rational drug use, ensuring drug quality and providing pharmaceutical services[3-5].

Many countries in the world are facing a shortage of pharmaceutical human resources and the imbalance of internal distribution, which also occurs in China [6, 7]. Although the number of pharmacists in China has increased in recent years, the ratio of doctors, nurses and pharmacists is unbalanced. According to statistics, in 2018, the ratio of doctors, nurses and pharmacists in China was 7.71/8.76/1[8]. Furthermore, the distribution of pharmacists in rural and urban areas is unequal. In 2018, there are 25000 more pharmacists in urban than in rural areas[8]. In addition, pharmacists in China are faced with the problem of low education level[9, 10]. Less than a third of pharmacists have a bachelor's degree or above, and only 3.4% of them have graduate degrees[8].

One study found that pharmacists had the lowest job satisfaction compared with doctors, nurses and administrators[11]. The factors influencing pharmacists' job satisfaction were complex, including salary, working environment, leadership and management style, promotion and training opportunities, etc[11-13]. Pharmacy students are regarded as potential pharmacists. To promote a better allocation of pharmaceutical human resources and the development of pharmaceutical care, it is important to understand the job preferences of pharmacy students [14, 15].

Discrete choice experiments (DCEs) is a stated preference technique that has been widely used in the health workforce to facilitate the effective policy intervention for the recruitment and retention in both developed and developing countries[16]. In China, there has been an increasing number of applications of DCEs in the health professionals, including doctors, nurses and public health personnel in primary health institutions[17-21], as well as medical students, nursing students and health management students[22-24]. However, no study has been conducted with pharmacy students in China. Globally, there have been two DCE studies about job preference of pharmacy students. The first study identified six attributes and surveyed 283 students in total from the United States and Canada[25]. This study found significant differences between states and provinces in the job preferences of pharmacy students. The second one was from Uganda[26], in which pharmacy students as one of four types of trainee health professionals were surveyed. This study showed that pharmacy students placed high value on the opportunity to operate a private pharmacy in addition to working at a public health facility, referred to as dual practice or moonlighting.

This study aimed to investigate the relative importance of attributes influencing job preference of undergraduate pharmacy students in mainland China. Results from this study provide important information for policymakers to design and improve employment policies to improve the rational distribution of pharmaceutical human resources in China.

Methods

The DCE, which is based on a random utility theory, is a quantitative method that can be used to measure respondents' preferences, and it has been widely used in economics, marketing and psychology [27]. In the DCE, respondents were asked to choose their preferred option from hypothetical alternatives that contained one or more combinations of attributes and levels [28, 29]. In this study, the DCE was designed and analysed following the user guide published by the WHO [30] as well as the checklist published by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) [31].

Attributes and levels

Developing attributes and levels is a key step in DCE [32, 33]. Both a literature review and qualitative studies were conducted to ensure that the attributes and levels included are the most meaningful for respondents. Firstly, we identify 9 attributes from a literature review, including monthly income, work environment, work location, *bianzhi* (which refers to the established posts and can be loosely regarded as state administrative staffing), workload, training opportunity, career development opportunity, management style, and welfare [22-26]. Next, we consulted 3 experts and based on their opinion, the *bianzhi*, workload, welfare, and career development opportunity were removed; on the other hand, years to the promotion was suggested to be added and the monthly income level was suggested to be adjusted. Finally, one additional attribute the work unit (which refers to the nature of your workplace) was added and the work environment attribute was removed after 6 in-depth personal interviews and a focus group discussion (with 7 people) from Shandong University. The final 6 attributes and levels are shown in Table 1.

DCE design

Of the 6 attributes, 2 are two-level, 3 are three-level, and 1 is four-level, a full factorial design will produce 432 ($=2^2 \times 3^3 \times 4^1$) hypothetical scenarios and 93,096 ($= (432 \times 431) / 2$) pairwise choice tasks. A D-efficient design was used to generate a manageable 24 choice sets using the Ngene DCE design software [34]. To reduce the response burden of respondents, the 24 choice sets were further divided into two blocks. An opt-out was included in the second-stage question after each DCE task to allow for unconditional choices [35]. In the first step, respondents were asked to choose the job they preferred from two hypothetical jobs, and in the second step, they were asked to answer whether they would take the job if the job appeared in the real life. An example of a DCE choice set is shown in Table 2. To check for internal consistency, one choice set was duplicated. Hence, in total every respondent answered 13 DCE questions. For those respondents who failed the consistency test, they were excluded from the main analyses following the previous literature [36, 37].

Sampling

The final year undergraduate pharmacy students were chosen as the targeting respondents in this study given it is highly relevant for these students that they would be on the job market soon. A multistage cluster sampling design was used. Firstly, according to the level of economic development and geographical location, we selected six provinces: eastern (Hebei, Shandong and Jiangsu), middle (Henan) and western (Shaanxi and Ningxia). Second, a representative university offering pharmaceutical courses was selected in each province. Next, 6 universities were surveyed, including 3 comprehensive universities and 3 medical universities, namely Shandong University, Henan University, Xi'an Jiaotong University, Hebei Medical University, China Pharmaceutical University and Ningxia Medical University. Finally, 1 to 2 graduation classes of students majoring in pharmacy were randomly selected from each school. The sampling map is shown in Fig. 1.

The sample size for DCE is not straightforward, which depends on many factors such as the number of attributes and levels, the number of choice tasks, and the accuracy of expected results [38]. A rule of thumb which based on the number of attributes and attribute levels is commonly used to estimate the sample size [39]. Accordingly, it was calculated that the sample size required for this study should be more than 83 respondents ($500 \times 4 / 2 \times 12 = 83$). Combined with de Bekker-Grob's sample size requirement [40] (i.e. how to calculate the sample size for healthcare-related DCE studies), we decided that the total sample size should be not less than 400 respondents; in addition, there should be more than 100 respondents in the eastern, middle and western China, respectively.

Data collection

Before the formal survey, we conducted a pilot survey among final year undergraduate pharmacy students at Shandong University. In the pilot survey, we tested whether the attributes and corresponding levels were reasonable and easy to understand. Minor adjustments were made based on the pilot. Finally, a face-to-face anonymous survey was conducted from April to July 2017.

The questionnaire consists of two parts: section one contains personal background and section two is the DCE. Prior to the survey, we obtained the oral informed consent from all respondents. This study was approved by the Ethics Review Board of the School of Preventive Medicine, Shandong University (Reference No. 20170301).

Data analysis

The DCE data were analysed using a conditional logit (CL) model (which assumes a homogeneous preference among respondents) and a mixed logit (MIXL) model (which allows for potential preference heterogeneity). Based on the random utility framework, the utility function can be expressed as:

$$U_{njt} = V_{njt} + \varepsilon_{njt} = \beta'_n X_{njt} + \varepsilon_{njt}$$

Where U_{njt} refers to the utility obtained by the respondents n by choosing the alternatives j in the choice scenario t . V_{njt} and the unobservable component ε_{njt} . The observable component is equal to the attributes levels vector X_{njt} multiply the coefficient vector β'_n and the unobservable component is a random error term. Except for the monthly income which was treated as a continuous variable for the calculation of willingness to pay (WTP), all other attributes were

coded as dummy variables [41]. WTP is calculated by $-\frac{\beta_q}{\beta_m}$, where β_m is the monthly income coefficient and β_q is the coefficient for attributes levels q [42]. In this context, the WTP shows the relative monetary value that pharmacy students place on different job characteristics and it will facilitate our understanding of the relative importance of non-monetary attributes in the DCE.

In MIXL, coefficients of attributes levels are usually assumed to follow a normal distribution (described based on a mean coefficient and a standard deviation). The mean coefficients reflect the relative preference weights and standard deviation reflects the extent of preference heterogeneity [43, 44]. The choice between CL and MIXL were guided by model fit statistics, including log-likelihood ratio tests, Akaike information criterion (AIC) and Bayesian information criterion (BIC). The distance between the best and worst preference weights within each attribute can be used to compare the relative importance of different attributes to the

respondents. Sub-group analyses were also conducted. After estimating the regression coefficients, a series of policy simulations were conducted to predict the probability of job choices given the changes in job properties, the results of which would be of interests to policymakers. Descriptive statistics were also presented. All statistical analyses were conducted using Stata software version 15.1.

Results

A total of 617 final-year undergraduate pharmacy students were surveyed; among them, 36 (5.8%) students did not complete the questionnaire. As shown in Table 3, the mean age of the remaining 581 (94.2%) students were 22.3 years old. Over 70% were female students, nearly two-thirds were non-single child, and more than half were born in township or village. As for career planning, more than 80% of them would pursue a career related to pharmacy or continue to study in pharmacy. Most respondents wanted to work in public institutions and foreign pharmaceutical companies. Of 581 respondents returned the questionnaire, 81 (13.9%) failed the consistency test consequently. There were no statistical differences on respondents characteristics between those who failed the test and those who were included in the main analyses. CL was used for sensitivity analysis. There were also no significant difference in preferences between the full sample, the forced choice sample and the respondents who passed the consistency test (See STable1-3 for detail). Given the use of opt-out is more realistic, so we analysis the data containing opt-out and finally 500 respondents were included in the main analyses.

Ranking results

Among the attributes, monthly income was the most important one to the respondents, followed by work location, whereas training opportunity and years to promotion were less important. For example, among 500 respondents, more than one third regarded monthly income as the most important attribute and nearly one third considered training opportunity was the least important attribute. The relative importance of attributes from analyzing the ranking question is shown in Fig. 2.

DCE results

Both CL model and MIXL model were initially applied for data analysis. Based on information criteria (i.e. the loglikelihood ratio test, AIC and BIC), the MIXL estimates were preferable and it was reported in Table3, whilst the CL estimates can be found in Table S1. According to the MIXL estimates, all attributes levels were statistically significant except management style. On average, respondents preferred jobs in the city, with high monthly income, to work in public institutions, sufficient training opportunity, and fewer promotion years. The statistically significant SDs indicate that there existed preference heterogeneity among respondents in all significant attributes. See Table 4 for details.

Willingness to pay

We found a clear preference among respondents for work location. Respondents were willing to pay 2889 yuan (US\$427) for a job in the city than a job in the county or village. If the training opportunity increased from insufficient to sufficient, respondents were willing to pay 1166 yuan (US\$172) per month. Furthermore, they were willing to pay almost the same money to work in public institution or shorten the promotion years from 5 years to 2 years.

Policy simulation

The changes in the probability of taking a job in the rural (township or village) are shown in Fig.3. We set the monthly income of 3000 yuan (US\$444), public institutions, insufficient training opportunity, and 5 years to promotion as the baseline scenario. The initial probability of taking a job in the city is 0.869, whereas the probability of taking a job in the rural is only 0.131. In the policy simulation analyses, holding all else the same, when the monthly income increased from 3000 yuan (US\$444) to 9000 yuan (US\$1332) and others remained constant, the probability of working in the rural increased to 0.884. The effect of single non-economic incentive for taking the rural job was not very obvious. For the multiple incentives, the combination “ $\Delta + \Delta + \Delta$ ” was the most effective one, and the probability of choosing a job in rural was 0.942.

Sub-group analysis

The detail results of sub-group analysis are shown in STable 4-8 and the result of WTP for sub-group are shown in Table 5. We found that the respondents who were only children or from the city were more likely to work in the city (bases on the calculated WTP values, 95%CI). In addition, female students preferred to work in the city compared with male students. Open management was statistically significant for male but not for female and public institution were placed more value by students in the eastern and middle China. As for training opportunity, students in the east valued more and they were willing to pay 1306 yuan (US\$193) to obtain sufficient training opportunity. Students in the middle paid more attention to years to promotion and they were willing to pay 1683 yuan (US\$249) to reduce the years to promotion from 5 years to 2 years.

Discussion

So far there is very limited DCE studies on the job preference of pharmacy students globally. This is the first study to investigate the job preferences of undergraduate pharmacy students in China. Six job characteristics were identified from a literature review and qualitative studies and we found all of them were statistically significant except management style.

Work location was most important non-monetary attribute to pharmacy students. The less economic development status in rural areas hinders the attraction of human resources for health. Among respondents, we can see that students who were the only child in the family, female, with an urban background, or from a more wealthy family were placed stronger values on work location than their counterparts. This finding is consistent with a previous study in the United States, in which the authors found that female students preferred to work in the city and they required a bigger financial incentive to move to the rural area

[25]. When designing a more effective policy implementation to attract pharmacy students to work in the rural areas, it would be important to take into account their backgrounds, e.g. male students who are not the non-single child in their family and originally from rural areas would be more likely to take up a job in a rural area after graduation.

Compared with male students, female students preferred work in public institutions. The concepts of traditional Chinese family generally believe that girls are better suited to stable jobs such as pharmacists, nurses and teachers, while boys are more suitable for science and engineering majors. On the other hand, male students may more likely to choose a more challenging job offered by a foreign company. This finding is also reflected in another survey conducted in China, which found that nearly half of undergraduate pharmacy students chose sales positions in enterprises and most of them were male students [45].

The monetary attribute (i.e. income) remains an important factor for the job choice in pharmacists' job choice. Similar to a finding in a Canadian study [46], in our respondents, monthly income was perceived to be the most important factor in the ranking analysis. Meanwhile albeit some non-monetary attributes (e.g. training opportunity and the number of years to promotion) significantly influenced pharmacy students' job preferences, the strengths of their influences were weak. In rural or less developed areas where it is infeasible to purely rely on monetary incentives, a combination of both monetary and non-monetary interventions could be a more feasible and equally effective approach. When a job with 6000 yuan (US\$888) monthly income, sufficient training opportunity and 2-year promotion, the probability of taking a rural job is up to 86%, which has almost the same effect as increasing monthly income to 9000 yuan (US\$1332).

The open management had no statistical significance for the respondents. This means when respondents trading off the 6 attributes, open management is not very important. However, in the results of the gender sub-group analysis, we found that male had a positive preference on open management. Therefore, we speculated that the reason why the open management coefficient was not significant was that more than 70% respondents are female students in our study. But it reflected the gender composition of the pharmaceutical human resources. According to statistics, the proportion of male and female pharmacists in 2018 was 33% and 67% respectively[8]. Therefore, in the future, it can be further clarified how females understand management style and what kind of management style they prefer.

In China, pharmacy students receive less attention compared with medical students and nursing students[47]. and their job preferences could vary. This would be helpful for policy-maker to implement policies between different targeted population. Hence, we roughly compared their preferences based on previous findings of DCE studies in China[23, 24]. Although there could be some differences in attributes and levels, some results were comparable. For example, three types of students all placed a high value on monthly income. The difference was that work location was the most important for pharmacy students and medical students, but was the least important for nursing students. And nursing students value workload more than anything else. Therefore, students from different majors could focus on different attributes. The characteristics of the major should be taken into account when formulating health workforce policies.

It is the first DCE study in China that focuses on pharmacy students' job preferences. In addition, we were able to recruit respondents from 6 provinces in China that covered different geographic locations and development stages. This recruitment increased the representative of the findings presented in this study. Meanwhile, there are also some limitations. Firstly, we only considered 6 most important attributes in this DCE and there could be other factors that influenced pharmacy students' job choice been omitted. This was a trade-off between the extensiveness of information to be presented versus the cognitive burden of the respondents. Secondly, in this study we adopted an unlabeled DCE whilst given different career pathways of pharmacist students, a different type of labelled DCE may also be considered, in which jobs in different sectors will be directly included in the DCE. The future study should consider exploring the difference between a labelled versus unlabelled DCE in job preferences. Lastly, not unique to this DCE study, the external validity of results has not yet been explored. Given the different health system in different countries, to what extent the results from Chinese pharmacist students can apply to other countries is unknown.

Conclusions

As China's population ages and the prevalence of chronic diseases increases, there is a growing demand for pharmaceutical care. Undergraduate pharmacy students are potential pharmaceutical human resources. This study found monthly income and working location were top two important characteristics for students' job preference. Preference heterogeneity was observed that student's background also influenced their job preference. The findings from this study will be relevant to policymakers to design a more effective recruitment plan for pharmacy students in China.

Declarations

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Availability of data and materials

The data used and/or analyzed during the study are available from the corresponding author on reasonable request.

Authors' contributions

SPL and GC designed the study. SML, TTG and QL collected the data. PL completed the data analyses and wrote the manuscript. SPL, SML, TTG, QL and GC edited the manuscript. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The study has been approved by the Ethics Review Board of the School of Preventive Medicine, Shandong University (Reference No. 20170301). Informed consent was obtained from all participants prior to questionnaire administration.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

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Tables

Table 1 Attributes and attributes levels for DCE choice questions

Attributes	Definition	Attributes levels
Monthly income	Monthly income including salary, bonus and welfare benefits.	3000 yuan
		6000 yuan
		9000 yuan
Work location	Location refers to working in different regions.	Township or village
		County
		City
Work unit	Work unit refers to the nature of your workplace. Public institutions such as hospitals, food and drug administration, etc; Foreign-funded enterprises include pure foreign-capital and sino-foreign joint ventures; State-owned enterprises include state-owned enterprises, central enterprises and so on; Private enterprises such as private medical enterprises.	Public institutions
		Foreign-funded enterprises
		State-owned enterprises
		Private enterprises
Management style	Management style refers to the understanding, support and adoption of the work and Suggestions of the employees by the company or leadership, as well as the degree of freedom of the employees in the work.	Semi-open management
		Open management
Training opportunity	Training opportunity refers to during the employment period to accept the company to provide a variety of skills training opportunity.	Insufficient
		Average
		Sufficient
Years to promotion	Years to promotion refers to the number of years required for promotion.	5 years
		2 years

Note: According to the Organization for Economic Co-operation and Development (OECD) data, the average annual exchange rate between US\$ and CNY in 2017 was 1\$ = 6.759 yuan.

Table 2 An example of DCE choice set

Attributes	Job 1	Job 2
Monthly income	6000 yuan	9000 yuan
Work location	City	County
Work unit	Foreign-funded enterprises	Public institutions
Management style	Open management	Semi-open management
Training opportunity	Average	Sufficient
Years to promotion	5 years	2 years
Which job do you prefer?	£	£
Would you choose this job in real life?	Yes £	No £

Table 3 Socio-demographic characteristics of the respondents

Characteristics of respondents	All (N=581)	Respondents who passed the consistency test (N=500)	Respondents who failed the consistency test (N=81)	χ^2	P value
Age(years), Mean,(± SD)	22.3(±1.0)	22.3(±1.0)	22.4(±1.3)		
Gender					
Male	169(29.1%)	142(28.4%)	27(33.3%)	0.823	0.364
Female	412(70.9%)	358(71.6%)	54(66.7%)		
Birthplace					
City	156(26.9%)	132(26.4%)	24(29.6%)	0.640	0.726
County	109(18.8%)	96(19.2%)	13(16.0%)		
Township or village	316(54.4%)	272(54.4%)	44(54.3%)		
Single child					
Yes	216(37.2%)	185(37.0%)	31(38.3%)	0.048	0.826
No	365(62.8%)	315(63.0%)	50(61.7%)		
Monthly consumption(yuan)					
≤800	90(15.5%)	75(15.0%)	15(18.5%)	3.409	0.333
800-1500	377(64.9%)	328(65.6%)	49(60.5%)		
1500-2500	100(17.2%)	87(17.4%)	13(16.0%)		
≥2500	14(2.4%)	10(2.0%)	4(4.9%)		
Family income(yuan)					
≤30000	138(23.8%)	112(22.4%)	26(32.1%)	8.253	0.083
30000-50000	170(29.3%)	151(30.2%)	19(23.5%)		
50000-70000	104(17.9%)	87(17.4%)	17(21.0%)		
70000-90000	69(11.9%)	65(13.0%)	4(4.9%)		
≥90000	100(17.2%)	85(17.0%)	15(18.5%)		
Career planning					
Engaged in pharmaceutical work	138(42.2%)	217(43.4%)	28(34.6%)	6.313	0.097
Continue to study pharmacy	170(44.1%)	221(44.2%)	35(43.2%)		
Continue to study in other fields	104(8.8%)	39(7.8%)	12(14.8%)		
Others	69(5.0%)	23(4.6%)	6(7.4%)		
Work unit					
Public institutions	222(38.2%)	186(37.2%)	36(44.4%)	2.699	0.609
Foreign-funded enterprises	209(36.0%)	185(37.0%)	24(29.6%)		
State-owned enterprises	109(18.8%)	93(18.6%)	16(19.8%)		
Private enterprises	23(4.0%)	21(4.2%)	2(3.7%)		
Others	18(3.1%)	15(3.0%)	3(2.5%)		

Table 4 Mixed logit model results

Attributes	b	SE	SD	SE	WTP	95%CI	
Opt-out	5.811***	0.257	2.402***	0.167	-	-	-
Monthly income	0.000654***	0.000025	0.000202***	0.000019	-	-	-
Work location (ref. Township or village)							
County	0.890***	0.084	0.772***	0.126	1360.7	1117.9	1611.8
City	1.890***	0.105	1.399***	0.108	2888.8	2587.3	3200.8
Work unit (ref. Private enterprises)							
State-owned enterprises	0.777***	0.096	0.789***	0.138	1186.8	907.1	1471.4
Foreign-funded enterprises	0.930***	0.091	0.508**	0.178	1421.2	1164.5	1682.5
Public institutions	0.976***	0.098	0.888***	0.127	1490.9	1208.1	1782.3
Management style (ref. Semi-open management)							
Open management	0.052	0.055	0.075	0.160	80.2	-84.3	247.5
Training opportunity (ref. Insufficient)							
Average	0.360***	0.075	0.211	0.258	550.0	324.9	783.6
Sufficient	0.763***	0.078	0.556***	0.141	1166.0	936.9	1404.7
Years to promotion (ref.: 5years)							
2 years	0.971***	0.066	0.700***	0.095	1484.2	1285.1	1688.1
AIC	8216.947						
BIC	8388.505						
Log likelihood	-4086.473						
Respondents, n	500						
Observations, n	18000						

Note: β -coefficient, SE-standard error, SD-standard deviation, ref-reference, AIC-Akaike information criterion, BIC-Bayesian information criterion, -none or not applicable, 95% CI = 95% Confidence Interval, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5 Willingness to pay for subgroups; 95%CI

Attributes levels	City	Country or Rural	Family income<50000	Family income150000	Male	Female	Single child	Non- single child	East	Middle	West
Work location (ref.Township or village)											
County	1231.8	1399.4	1298.5	1400.8	1220.8	1411.8	1428.0	1297.8	1073.5	1771.4	1666.0
City	4392.1	2312.4	2256.2	3469.6	2566.7	3044.7	3654.9	2382.5	2675.5	3006.5	3332.2
Work unit (ref.Private enterprises)											
State-owned enterprises	1577.0	1041.8	1061.3	1320.3	1062.3	1224.4	1203.9	1139.9	1100.5	821.1	1683.5
Foreign-funded enterprises	1432.4	1395.6	1287.9	1554.8	1336.0	1432.1	1386.7	1385.0	1477.0	1015.0	1680.6
Public institutions	1465.6	1535.4	1420.9	1573.5	1103.6	1652.8	1315.7	1597.6	1477.2	1433.4	1266.5
Management style (ref.Semi-open management)											
Open management	-	-	-	-	526.0	-81.0	-	-	-	-	-
Training opportunity (ref.Insufficient)											
Average	1009.8	406.5	278.0	847.4	580.2	546.7	965.9	318.9	645.9	347.3	330.7
Sufficient	1380.1	1095.3	1116.6	1208.1	1262.3	1150.2	1219.9	1136.4	1306.2	564.2	1236.6
Years to promotion (ref.5years)											
2years	1225.0	1416.4	1438.6	1548.8	1400.9	1528.6	1373.4	1538.9	1319.4	1682.7	880.6

Note: According to the Organization for Economic Co-operation and Development (OECD) data, the average annual exchange rate between US\$ and CNY in 2017 was 1\$ = 6.759 yuan. ref-reference, - not applicable.

Figures

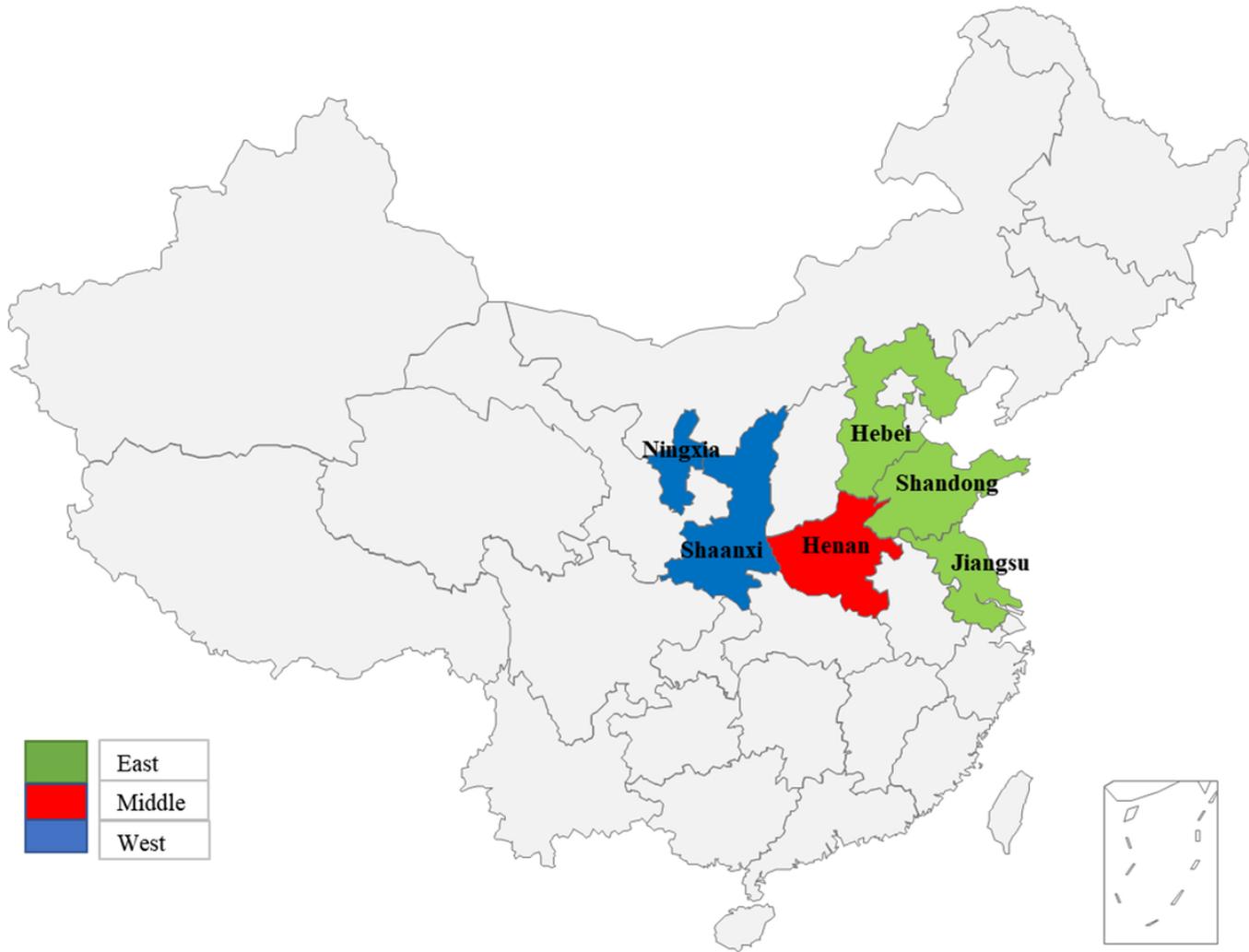


Figure 1
 Sampling map Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

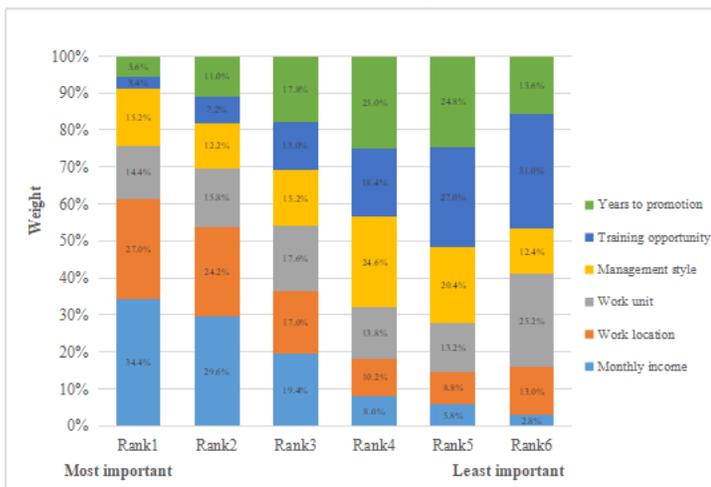


Figure 2
 Relative important of attributes

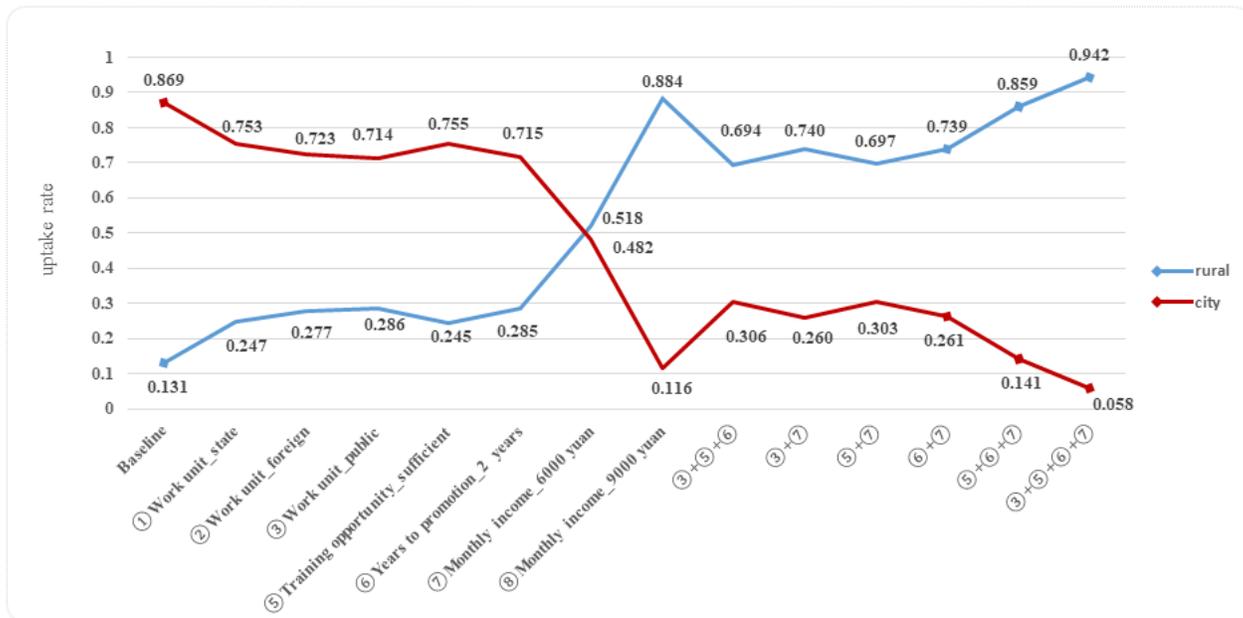


Figure 3

Policy simulation

Supplementary Files

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- [SupplementaryTable.docx](#)