

# ZHENGZHOU SOCIAL EXTERNALITY SURVEY

MIT Department of Urban Studies & Planning, Sustainable Urbanization Lab: China Future City Innovation  
Tsinghua University  
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**NOTE:** *This survey was implemented in Qualtrics in Mandarin Chinese. The survey transcript below is an English translation.*

## O. CONFIDENTIALITY AND CONSENT

This research project is jointly carried out by Tsinghua University and the China Future City Innovation Laboratory of MIT. Thank you for taking the time out of your busy schedule to participate in this research study. The survey you are about to take is focused on Zhengzhou residents' transportation behavior and preferences.

**Process:** The subject of this survey is a simple questionnaire, which takes about 20 minutes to complete.

**Risk/discomfort:** There is little risk in participating in this survey, but you may feel slight emotional discomfort with a few questions that require you to convey subjective value judgments.

**Benefits and participation methods:** Participation in this study is completely voluntary. Based on your participation, our researchers will better understand how to provide a variety of transportation services to meet the needs of Zhengzhou residents. You have the right to refuse participation completely or to withdraw at any time during the research. If you decide to withdraw from the survey, please inform one of the research staff members at your survey location.

**Data confidentiality:** All data obtained from participants are strictly confidential, and only aggregate results will be reported. The data will be safely stored in a professional questionnaire software system specially designed to abide by the confidentiality standards of the Massachusetts Institute of Technology (MIT), and will be promptly cleared by our core research staff after the research program is complete. Unless additional permission is obtained, your original, individual data will not be accessed by any person outside of the core research team.

**Questions about the content of the research or the rights of research participants?** If you have any questions about this research, you can contact Professor Jianghao Wang of the Chinese Academy of Sciences and Visiting Researcher at MIT (wangjh@mit.edu), or contact Professor Siqi Zheng of Tsinghua University and MIT (sqzheng@mit.edu). If you do not want to contact the researchers directly, you can also contact the MIT Committee on Social Experiment Projects (COUHES) at couhes@mit.edu or through its official website, <https://couhes.mit.edu/contact-us>.

Answering "Agree" to the question below means that you have reached the age of 18 and agree to participate in this survey.

- I have read the above and agree to continue participating in the survey: Agree/Disagree

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## 1. CURRENT COMMUTE BEHAVIOR (BASELINE / SCREENING FOR CAR COMMUTERS)

1.1 How many cars does your household currently own? Note: "Household" only includes family members living together in the same house. *[0, 1, 2, 3 or more]*

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**If answer to above was not 0, present questions 1.2 and 1.3**

1.2 What was the purchase price of your most recently acquired car?

- *Under RMB 50,000*
- *RMB 50,000 – 100,000*
- *RMB 100,000 – 150,000*
- *RMB 150,000 – 200,000*
- *RMB 200,000 – 300,000*
- *RMB 300,000+*
- *I do not know, because another household member purchased the car*

1.3 Was your most recently acquired car an electric car? *[Yes/No/Hybrid]*

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1.4 How many days per week do you commute to the office? *[0, 1, 2, 3, 4, 5, 6, 7]*

1.5 Do you go home in the middle of the workday to rest? *[Usually yes, usually no]*

1.6 Do you have flexibility in when you have to arrive at or leave work?

- Very flexible (e.g., freelance work)
- Somewhat flexible
- Not flexible at all—fixed work hours

1.7 How do you usually commute to and from work?

- Motorized vehicle: personal car/hired car including taxi, ridehail
- Public transit: Bus/subway
- Electric bike
- Bike: shared
- Bike: personal
- Walking
- Other (please specify)

1.8 How many days per week do you use each of the following modes for your commute (do not consider travel for other activities)?

*[Sliders for 0-7 days for each mode.]*

- *Personal car*
- *Hired car (including ridehailing like DiDi)*
- *Bus*
- *Subway*
- *Electric bike*
- *Bike*
- *Walking*
- *Other (please specify)*

1.9 Do you pick up or drop off kids during your commute? *[Yes/No]*

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**SURVEY BELOW CONTINUES ONLY FOR RESPONDENTS WHO, FOR QUESTION 1.7, SELECTED  
“MOTORIZED VEHICLE: PERSONAL CAR/HIRED CAR INCLUDING TAXI, RIDEHAIL”**

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1.10 Think about your actual commute to and from work next month. If the government now decides to provide subsidies for green commuting options, would you be willing to choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute?

- Yes, as long as the subsidy is sufficient.
- No, I will not change to bus, subway, cycling or walking.

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**If response to 1.10 above is “Yes, as long as the subsidy is sufficient.”**

1.11 What is the minimum subsidy for each one-way commute to/from work, at which you will choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute? Note: The subsidy is only effective when you actually change the mode of transportation. Unrealistic subsidies will not be implemented. *[Integer options from 1 RMB – 10 RMB. Fill-in option available for respondents who desire over 10 RMB]*

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## 2. STAGE 1 (SOCIAL EXTERNALITY TREATMENT FOR THE TREATMENT GROUP)

Participants are randomized 50/50 into the control or treatment group

### CONTROL GROUP

**Received information:** Research survey staff volunteer provides respondent with a separate iPad, opened to the study's customized webpage pulling travel information from the Amap API. Control group respondents inputted their home location, work location, and typical morning departure time. They were given a personalized table containing modal alternative-specific variables, where distances were in kilometers, time in minutes, and cost in RMB.

- Car/taxi: Trip time
- Car/taxi: Trip distance
- Taxi: Trip cost
- Public transit (for more convenient of either bus or subway): In-vehicle time
- Public transit (for more convenient of either bus or subway): Walking time necessary for last-mile connections
- Public transit (for more convenient of either bus or subway): Total trip time
- Public transit (for more convenient of either bus or subway): In-vehicle distance
- Public transit (for more convenient of either bus or subway): Walking distance of last-mile connections
- Public transit (for more convenient of either bus or subway): Total trip distance
- Public transit (for more convenient of either bus or subway): Total trip cost
- Biking: Trip distance
- Biking: Trip time
- Walking: Trip distance
- Walking: Trip time

#### Questions:

2.1 Earlier you mentioned the way you typically commute to and from work. Now please think about your commute plan for next month. Considering the personalized information just provided for you, which mode of transportation will you mainly use for commuting next month?

- Motorized vehicle: personal car/hired car including taxi, ridehail
- Public transit: Bus/subway
- Electric bike
- Bike: shared
- Bike: personal
- Walking
- Other (please specify)

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If response to 2.1 above is "Motorized vehicle: personal car/hired car including taxi, ridehail"

2.2 Think about your actual commute to and from work next month, and the personalized information table provided for you. If the government now decides to provide subsidies for green commuting options, would you be willing to choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute?

- Yes, as long as the subsidy is sufficient.
- No, I will not change to bus, subway, cycling or walking.

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If response to 2.2 above is “Yes, as long as the subsidy is sufficient.”

2.3 Consider the personalized information just provided for you. What is the minimum subsidy for each one-way commute to/from work, at which you will choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute? Note: The subsidy is only effective when you actually change the mode of transportation. Unrealistic subsidies will not be implemented. *[Integer options from 1 RMB – 10 RMB. Fill-in option available for respondents who desire over 10 RMB]*

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## TREATMENT GROUP

Received information: The treatment group received the same information as the control group did. In addition, their personalized information table contained another row showing the **carbon emissions from commuting by each mode, in terms of the number of new trees needed to absorb the carbon released from commuting by that mode for one year**. The emissions figures are based on the time and distance of the person’s commute trip by each mode.

Questions:

2.1 Earlier you mentioned the way you typically commute to and from work. Now please think about your commute plan for next month. Considering the personalized information just provided for you, which mode of transportation will you mainly use for commuting next month?

- Motorized vehicle: personal car/hired car including taxi, ridehail
- Public transit: Bus/subway
- Electric bike
- Bike: shared
- Bike: personal
- Walking
- Other (please specify)

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If response to 2.1 above is “Motorized vehicle: personal car/hired car including taxi, ridehail”

2.2 Think about your actual commute to and from work next month, and the personalized information table provided for you. If the government now decides to provide subsidies for green commuting

options, would you choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute?

- Yes, as long as the subsidy is sufficient.
- No, I will not change to bus, subway, cycling or walking.

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**If response to 2.2 above is “Yes, as long as the subsidy is sufficient.”**

2.3 Consider the personalized information just provided for you. What is the minimum subsidy for each one-way commute to/from work, at which you will choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute? Note: The subsidy is only effective when you actually change the mode of transportation. Unrealistic subsidies will not be implemented. *[Integer options from 1 RMB – 10 RMB. Fill-in option available for respondents who desire over 10 RMB]*

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**All participants receive the same questions from this point onward.**

2.4 How do you usually access information about the air pollution level?

- *I make my own judgement about the pollution level based on the level of visibility outside*
- *I use an app on my cell phone (e.g. a weather app)*
- *I check the official website of the Ministry of Environmental Protection*
- *I use a search engine (e.g. Baidu), or other non-governmental websites*
- *I have a personal, portable air quality monitor*
- *Other channels (please specify)*
- *I do not regularly monitor the air pollution level*

The following four questions are meant to provide a sense of your air pollution knowledge.

2.5 What do you think was the worst average air quality index (AQI) reached last month in the city? Note: AQI is the official published air pollution value. If you do not know, please enter “0.” *[Numeric entry]*

2.6 Air pollution and smoking are both harmful to health. For the most severely polluted month last year, what do you think the PM2.5 pollution level is equal to in terms of cigarettes smoked per day?

- *Under 1 cigarette/day*
- *1-2 cigarette/day*
- *2-3 cigarette/day*
- *3-4 cigarette/day*
- *4-5 cigarette/day*
- *More than 5 cigarette/day*

2.7 When you are taking different types of transportation, your exposure to PM2.5 will be different. Consider the following transportation modes, which are all typically used to get to and from work. How would you rank each in terms of the exposure to PM2.5 pollution encountered when using that

particular mode? Note: 1 is least severe pollution exposure, 5 is most severe exposure. Please fill in a value from 1 to 5 in the boxes below.

*[Respondent fills in a numeric value, 1-5, for each of the following]*

- *Public bus*
- *Subway*
- *Personal car/hired car like taxi or ridehail*
- *Biking*
- *Walking*

2.8 Which of the following diseases do you think is most closely associated with PM2.5 pollution exposure? Please pick 3.

- *Asthma*
- *Diarrhea*
- *Influenza*
- *Heart disease*
- *Obesity*
- *Stroke*
- *Lung cancer*
- *Breast cancer*
- *High blood pressure*
- *Tuberculosis*
- *None of the above are associated with PM2.5 pollution*

2.9 Of the preceding four questions regarding air pollution knowledge (AQI, its equivalent in cigarettes per day, pollution exposure levels, diseases related to PM2.5 exposure), how many do you think you got right? [0, 1, 2, 3, 4]

### 3. STAGE 2 (LOCAL POLLUTION LEVEL INFORMATION)

3.1 During the most polluted month in Zhengzhou last year, the monthly average PM2.5 level was 117 micrograms/m<sup>3</sup> as shown in the photo below.



If next month is polluted to a similar level, given the information you have seen, what method would you choose for traveling to and from work next month?

- *Personal motorized vehicle: My own car/hired car*
- *Public transit: Bus/subway*
- *Electric bike*
- *Bike: shared*
- *Bike: personal*
- *Walking*
- *Other (please specify)*

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If response to 3.1 above is “Motorized vehicle: personal car/hired car including taxi, ridehail”



3.2 Think about your actual commute to and from work next month, and the information provided regarding the local pollution severity, including the image below:



If the government now decides to provide subsidies for green commuting options, would you choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute?

- Yes, as long as the subsidy is sufficient.
- No, I will not change to bus, subway, cycling or walking.

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If response to 3.2 above is “Yes, as long as the subsidy is sufficient.”

3.4 Consider the information provided to you regarding the local pollution severity, including the image below:



What is the minimum subsidy for each one-way commute to/from work, at which you will choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute? Note: The subsidy is only effective when you actually change the mode of transportation. Unrealistic subsidies will not be implemented. *[Integer options from 1 RMB – 10 RMB. Fill-in option available for respondents who desire over 10 RMB]*

3.5 What is your overall perception of Zhengzhou’s air quality in each season?

*[For each season, respondent is asked to select a value from a 5-point Likert scale: Very bad, bad, normal, good, very good]*

- *Spring*
- *Summer*
- *Fall*
- *Winter*

3.6 In your opinion, how much of the air pollution in Zhengzhou comes from vehicle traffic emissions?  
*[Slider, percentage 0-100%]*

3.7 How do you think the air pollution in Zhengzhou has impacted the following aspects of your life?

*[For each aspect, respondent is asked to select a value from a 5-point Likert scale: 1- No impact, 2-Small impact, 3-Medium impact, 4-Large impact, 5-Very large impact]*

- *Outdoor exercise*
- *Social activity*
- *Your own health*
- *Health of your child or parent*
- *Work efficiency*
- *Mood*

3.8 Please select all of the pollutants below you have heard of and care about:

- *Particulate matter (PM2.5, PM10)*
- *Nitrogen oxides (NOx)*
- *Ozone (O3)*
- *Carbon monoxide (CO)*
- *Sulfur dioxide (SO2)*
- *I have not heard of any of the above/I do not pay attention to any of the above*

3.9 How do you usually protect yourself and your family from air pollution? Please select all that apply

- *Wear masks*
- *Buy air purifiers*
- *Reduce outdoors exercise*
- *Do more shopping online, and order food deliveries*
- *Drive or call a car for more of your trips*
- *Take medicines or eat healthier foods*
- *Go to places with better air on weekends and holidays*
- *Other: Please specify*

3.10 If a delivery worker is bringing you a package on a day of heavy pollution (AQI > 200), how much would you tip the delivery worker? Suppose you purchase a product worth 100 RMB for delivery. *[Slider, integer values 0-100 with an optional checkbox for "more than RMB 100"]*

#### 4. STAGE 3 (POLLUTION IMPACT ON MORTALITY, MODAL POLLUTION EXPOSURE INFORMATION)

4.1 The "Air Quality Life Index," developed by the Energy Policy Institute at the University of Chicago based on recent research, shows that particulate matter pollution has surpassed smoking as one of the greatest threats to human health. Further, through comparisons between China's PM2.5 pollution level and recommended levels from the World Health Organization, it estimates that **China's average life expectancy has fallen by about 2.9 years due to PM2.5 pollution.**

On the separate iPad where the respondent had viewed a table with his/her personalized modal travel information (and emissions information if in the control group), the respondent sees an additional row with pollution exposure by travel mode. These values are based on field-research in Zhengzhou and existing literature.

Consider again your commute next month. Please keep in mind the information we have showed you, including that the average PM2.5 level in Zhengzhou next month can reach 117 micrograms/m<sup>3</sup> as shown in the photo below.



What method would you choose for traveling to and from work next month?

- *Personal motorized vehicle: My own car/hired car*
- *Public transit: Bus/subway*
- *Electric bike*
- *Bike: shared*
- *Bike: personal*
- *Walking*
- *Other (please specify)*

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If response to 4.1 above is “Motorized vehicle: personal car/hired car including taxi, ridehail”

4.2 Think about your actual commute to and from work next month, and the information provided so far, including the image below regarding Zhengzhou’s pollution level:



If the government now decides to provide subsidies for green commuting options, would you be willing to choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute?

- Yes, as long as the subsidy is sufficient.
- No, I will not change to bus, subway, cycling or walking.

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If response to 4.2 above is “Yes, as long as the subsidy is sufficient.”

4.3 Consider the information provided so far, including the image below regarding Zhengzhou’s pollution level:



What is the minimum subsidy for each one-way commute to/from work, at which you will choose a mode other than personal motorized vehicles (i.e. choose public transportation/biking/walking, etc) for your commute? Note: The subsidy is only effective when you actually change the mode of transportation. Unrealistic subsidies will not be implemented. *[Integer options from 1 RMB – 10 RMB. Fill-in option available for respondents who desire over 10 RMB]*

## 5. ATTITUDES AND PREFERENCES

5.1 The following questions are designed to help reflect some of your personal preferences. Please rate your willingness to act in each of the following ways on a scale from 0 (completely unwilling) to 5 (completely willing):

*[For each item below, respondents selected a value on a Likert scale from 0 (completely unwilling) to 5 (completely willing). There is also an option for “I do not know/not applicable”]*

- Overall, are you willing to take risks?
- Are you willing to give up immediate benefits in order to obtain more long-term benefits?
- Are you willing to punish those who have treated you unfairly, even if it might cost you?

- *Are you willing to punish those who are unfair to others, even if it might cost you?*
- *Are you willing to make charitable donations without expecting anything in return?*

5.2 Please evaluate whether the following statements are consistent with your beliefs. Select from the 5-point scale, where 0 means completely inconsistent, 5 means completely consistent.

*[For each item below, respondents selected a value on a Likert scale from 0 (completely inconsistent) to 5 (completely consistent). There is also an option for "I do not know/not applicable"]*

- *If others help you, you are willing to reciprocate.*
- *If you are treated unfairly, you will retaliate immediately, even if it costs you.*
- *You think people are well-intentioned.*
- *You tend to postpone tasks, even if you know it would be better to do it right away.*

5.3 Imagine the following situation: Today you happened to find 800 RMB by chance. How much of this money will you donate to charity? *[Slider, 0 RMB-100 RMB]*

5.4 What are the main reasons you choose to drive or used a hired car to commute? Note: Please only select up to three, and choose your most important reasons.

- *Prefer a more comfortable environment*
- *Driving a car shows personal economic strength and status*
- *Driving can reduce my pollution exposure and is not affected by extreme temperatures*
- *I have already purchased a car at home, do not use waste*
- *No bus or subway station near home or work*
- *Public transportation takes too long*
- *Send children to school/family to work etc.*
- *Other*

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***If response to 1.1 (number of cars owned by household) is greater than zero***

5.5 How do you usually respond to Zhengzhou's vehicle restriction policy on restriction days? (Multiple choice)

- *Use another, unrestricted private car*
- *Move all activities that may require driving to non-restricted days*
- *Travel during the non-restricted time (before 7 a.m. or after 8 p.m.) on a restricted day*
- *No travel on restricted days*
- *Use taxi/Didi instead*
- *Use public transit instead*
- *Use a bike instead (electric bike or normal bike)*
- *I drive an electric car, so the restrictions do not apply*

5.6 How much are you willing to pay to be able to drive on a restricted day (per day)? (Please enter an integer RMB value) *[Numeric input]*

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5.7 If the government decides to improve the overall traffic situation in your area, which of the following policies would you support? Note: Please select no more than 3 items.

- *Fix more roads*
- *Provide more parking spaces*
- *Discourage car use in the downtown area*
- *Create a no-car, pedestrian-only zone downtown*
- *Subsidize clean energy vehicles*
- *Expand the scope of public transportation services (bus/subway)*
- *Construct bus priority or bus lanes*
- *Reduce the cost of public transportation*
- *Build bike lanes*
- *Improve pedestrian-related infrastructure (sidewalks, zebra crossings, etc.)*
- *None of the above*

5.8 What is your level of concern about environmental issues?

- *Not concerned at all*
- *Not too concerned*
- *Somewhat concerned*
- *Fairly concerned*
- *Extremely concerned*

5.9 How much do you think your personal life is impacted by climate change (global warming)?

- *5 – Severely impacted*
- *4 – Strongly impacted*
- *3 – Somewhat impacted*
- *2 – A little impacted*
- *1 – Almost no impact*
- *0 – Absolutely no impact*

5.10 Are you willing to take the following actions to protect the environment? *[For each item below, respondent selects an answer from a 5-point Likert scale, ranging from “Extremely unwilling” to “Extremely willing.”]*

- *Recycling*
- *Conserving water*
- *Conserving electricity*
- *Eating less meat*
- *Driving less*

5.11 How is your health?

- *Very good*



- *Fairly good*
- *Average*
- *Not good*

5.12 Do you smoke?

- *Frequently smoke*
- *Occasionally smoke*
- *Never smoke*
- *Used to smoke, but not anymore*

## 6. SOCIODEMOGRAPHICS

6.1 What is your gender? *[Male/Female]*

6.2 Are you married? *[Yes/No]*

6.3 How many people are in your household, including yourself? Note: Only family members living in the same house are included. *[Multiple choice with options 1-6, and "more than 6"]*

6.4 Do you usually use a transportation card to take the bus and subway?

- *Yes*
- *No, I use my phone (e.g. WeChat)*
- *No, other payment methods (please specify)*

6.5 What is your age? *[Numeric input]*

6.6 Are you a Zhengzhou native, born and raised? *[Yes, I was born and raised in Zhengzhou/No, I came from another region]*

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**If answer to 6.6 was "No, I came from another region"**

6.7 Where is your native hometown? *[Text input boxes for province, city, county]*

6.8 When did you move to Zhengzhou? *[Numeric input boxes for year, month]*

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6.9 Do you live in a home you bought?

- *Yes: Home is purchased and paid in full*
- *Yes: Home has a mortgage*
- *No: Renting*

- *No: Home was purchased with financial help from family or friends*
- *No: Home is company property, or paid at least in part by the company*
- *Other (please specify)*

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**If answer to 6.9 was “Yes: Home has a mortgage,” “No: Renting,” or “No: Home is company property, or paid at least in part by the company”**

6.10 Approximately how much money do you spend on housing (mortgage/rent) each month?

- *0 RMB*
- *1-1,000 RMB*
- *1,000-2,000 RMB*
- *2,000-3,000 RMB*
- *3,000-4,000 RMB*
- *4,000-5,000 RMB*
- *More than 5,000 RMB*

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6.11 What is your household annual income?

- *Under 50,000 RMB*
- *50,000 – 150,000 RMB*
- *150,000 – 300,000 RMB*
- *300,000 – 500,000 RMB*
- *500,000 – 1,000,000 RMB*
- *Over 1,000,000 RMB*

What is the highest degree you have attained?

- *Middle school or below*
- *High school or equivalent*
- *Junior college*
- *College: Bachelor’s degree*
- *Master’s/professional degree*
- *Doctoral degree*

Are you a Communist Party member? [Yes/No]

According to the data agreement, all information in this survey is for internal use by the research team and will never be passed on. Thank you for your time and participation in this survey.