The political effects of socio-demographic factors in China: an exposition of the generalized ordered logistic model

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Abstract

In "A War of (Mis)Information: The Political Effects of Rumors and Rumor Rebuttals in an Authoritarian Country," Haifeng Huang (2015) utilizes ordered probit models to explore the effects of online rumors and their rebuttals on citizens' trust in the government. With Huang's data on respondents' socio-demographic information and their levels of political trust in the authoritarian regime, we use a generalized ordered logistic model to evaluate the influence of socio-demographic influences on Chinese citizens' political trust. Specifically, we find that education has a moderating effect upon political views while masculinity may heighten extreme views on the Chinese government's ability to protect its citizens abroad. We also discuss the merits of generalized ordered logistic regression model. We posit that it may highlight significant findings obscured by the assumption of proportional odds in a traditional ordered logistic or probit model.

Introduction

Despite widespread attention to authoritarian regimes in political science, the literature on whether and how socio-demographic traits facilitate or impede trust in authoritarian governments is underdeveloped. In this paper, we propose using a generalized ordered logistic regression model to exploit rich survey data regarding levels of trust in the Chinese Communist Party and its policies. We find that the Chinese education system appears to

have a moderating effect upon political views and that gender may affect levels of trust in the Chinese government's ability to protect its citizens abroad.

The data used is drawn from a recent article by Haifeng Huang that investigates the question of whether rumors are detrimental to trust in the Chinese government. In "A War of (Mis)Information: The Political Effects of Rumors and Rumor Rebuttals in an Authoritarian Country", Huang aims to determine the effects of various types of rumors on citizen trust in government [7]. Huang's paper provides valuable insights into the effects of rumors on political trust. Moreover, his study is one of very few in the current literature that takes advantage of a survey technique in China. This survey data opens the door to a wealth of information about public opinion in authoritarian regimes. In this empirical study, we hope to build upon Huang's insights by exploiting some of the unexplored information available from his dataset. Specifically, we will employ the generalized ordered logistic regression model[1] to shed more light on the way that demographic features impact public trust in the Chinese government.

Huang's Contribution: The Effects of Rumors and Rebuttals

In his 2015 paper, Huang explores the effects of anti-government rumors on Chinese netizens' attitudes towards the government and investigates whether the authorities can recover people's trust in government with powerful, evidence-based rebuttals. In line with previous literature on psychological and sociological studies, Huang hypothesizes that while rumors will reduce people's trust in the government, only rebuttals that "offer vivid evidence and forceful explanations [or are] from credible sources can regain citizen political trust once it has been previously impacted by rumors." [7, p.7]

Huang tests his hypotheses with two online survey experiments. In both experiments, participants are recruited from a Chinese crowd-sourcing website similar to the Mechanical Turk, and are randomly assigned to one of five treatment groups that vary in terms of whether the subjects receive rumors and government rebuttals. After the treatments, the participants are asked to rate their trust in the Chinese political system in general and to share their evaluations of how the government is handling several policy issues related to the specific rumors that they have read (public safety, equal treatment, citizen protection and/or

[1] also known as, and referred to sporadically herein, as the "ordered probit"

officials' families). To examine whether stronger rebuttals— evidenced either with vivid details or via credible sources— are more effective in recovering people's trust in government, Huang varies the types of rebuttals provided to respondents. The two strong rebuttals used in Experiment 2 include either photographic proof or a guarantee from a source perceived to be independent of the government. The two weak rebuttals used in Experiment 1 are relatively simple and quasi-official.

Given that Huang used randomization to assign treatment, his findings are generally unbiased and robust. One caveat regarding the research design, however, lies in the balance of socio-demographic variables among his four treatment groups and his control group. While randomization is expected to ensure the absence of baseline differences between the treatment groups, imbalances in baseline covariates can arise by chance and lead to an imprecise evaluation of treatment effect if covariates with significant effects on outcomes of interest are imbalanced [14]. As we can see from the comparison between the treated and untreated groups before and after the genetic matching process below, although covariate balance is achieved through randomization for most covariates, certain variables, such as subjects' gender, are still poorly balanced.

Table 1: Balance in Covariate Distributions: before matching

	Means Treated	Means Control	SD Control	Mean Diff	eQQ Med	eQQ Mean	eQQ Max
distance	0.23	0.21	0.07	0.03	0.03	0.03	0.05
life	2.41	2.32	0.73	0.09	0.00	0.10	1.00
news	3.79	3.92	1.28	-0.13	0.00	0.16	1.00
politicalinterest	2.61	2.71	0.83	-0.09	0.00	0.10	1.00
age	23.51	25.11	5.41	-1.60	1.00	1.66	15.00
education	4.35	4.38	0.90	-0.03	0.00	0.13	1.00
income	2.78	2.78	0.64	-0.00	0.00	0.04	1.00
partymember	0.12	0.14	0.35	-0.02	0.00	0.02	1.00
prowest	3.05	2.90	1.41	0.15	0.00	0.19	1.00
male	0.49	0.58	0.49	-0.10	0.00	0.10	1.00

Note: The treatment for matching is "rebuta" in Experiment 1; namely, whether the subjects are exposed to the rumor on children safety.

For researchers estimating the treatment effects with randomized controlled trails, better balance in covariates is desirable for the sake of estimation precision. Given Huang's sample size, it is impractical to seek better balance in his current sample through statistical adjustment: methods such as genetic matching are quite costly, discarding 370 out of 631 observations in the original dataset. The shrunken sample size due to matching would cause us to lose valuable information. Thus, a more practical solution for survey experiment researchers is to have pre-randomization control over the demographic covariates, such as stratified or blocked randomization based on the extant knowledge about the experiment

Table 2: Balance in Covariate Distributions: after matching

	Means Treated	Means Control	SD Control	Mean Diff	eQQ Med	eQQ Mean	eQQ Max
distance	0.23	0.23	0.06	0.00	0.01	0.01	0.02
life	2.41	2.41	0.74	0.00	0.00	0.03	1.00
news	3.79	3.78	1.25	0.01	0.00	0.05	1.00
politicalinterest	2.61	2.62	0.74	-0.01	0.00	0.06	1.00
age	23.51	23.49	3.85	0.02	0.00	0.21	3.00
education	4.35	4.34	0.78	0.01	0.00	0.16	1.00
income	2.78	2.77	0.57	0.01	0.00	0.12	1.00
partymember	0.12	0.12	0.33	0.00	0.00	0.00	0.00
prowest	3.05	3.06	1.17	-0.01	0.00	0.23	1.00
male	0.49	0.49	0.50	0.00	0.00	0.04	1.00

Note: The treatment for matching is "rebuta" in Experiment 1; namely, whether the subjects are exposed to the rumor on children safety.

sample. Nevertheless, we will proceed using Huang's original dataset, so as to avoid limiting the power of Huang's calculations.

To discern treatment effects, Huang runs ordered probit regressions on subjects' belief in the specific rumors and then on various aspects of their political trust. Our replication of his results can be found in Appendix A, and the basic findings are as follows: citizens are generally susceptible to online anti-government rumors; furthermore, rebuttals generally reduce people's belief in the specific content of rumors, but can only be effective when solidly evidenced or when drawn from independent sources. In Tables 3 and 4 on the next pages, we run both ordered probit regressions and ordered logistic regressions on subjects' political trust and the regressions yield similar results to Huang's.

Table 3: Replication of Table 3 (Huang 2015, p. 18) Using Ordered Probit and Ordered Logit Regressions

	safetytrust		equalitytrust		polisystem	
	ordered probit	*ordered logistic*	*ordered probit*	*ordered logistic*	*ordered probit*	*ordered logistic*
rumor	−0.235*	−0.358	−0.402***	−0.688***	−0.260**	−0.452*
	(0.131)	(0.227)	(0.132)	(0.229)	(0.132)	(0.232)
rebuta	−0.367***	−0.601***	−0.541***	−0.923***	−0.267**	−0.451**
	(0.129)	(0.225)	(0.131)	(0.226)	(0.130)	(0.226)
rebutb	−0.284**	−0.461**	−0.279**	−0.448**	−0.153	−0.258
	(0.130)	(0.224)	(0.131)	(0.224)	(0.132)	(0.230)
rebut2	−0.217	−0.371	−0.401***	−0.663***	−0.133	−0.215
	(0.133)	(0.227)	(0.133)	(0.225)	(0.134)	(0.234)
news	0.075**	0.124**	−0.001	−0.016	−0.019	−0.033
	(0.037)	(0.062)	(0.037)	(0.063)	(0.037)	(0.063)
politicalinterest	0.002	0.011	−0.034	−0.057	0.138**	0.220**
	(0.055)	(0.095)	(0.056)	(0.094)	(0.056)	(0.099)
life	0.298***	0.508***	0.289***	0.479***	0.126**	0.223**
	(0.059)	(0.103)	(0.059)	(0.102)	(0.059)	(0.103)
prowest	−0.031	−0.062	−0.032	−0.055	−0.153***	−0.258***
	(0.030)	(0.052)	(0.030)	(0.051)	(0.030)	(0.054)
age	−0.003	−0.010	−0.006	−0.010	−0.009	−0.014
	(0.008)	(0.014)	(0.008)	(0.014)	(0.009)	(0.015)
male	−0.032	−0.032	−0.150*	−0.287*	−0.027	−0.030
	(0.088)	(0.151)	(0.089)	(0.151)	(0.089)	(0.153)
education	−0.080	−0.164*	−0.119**	−0.184**	0.059	0.100
	(0.049)	(0.086)	(0.049)	(0.086)	(0.049)	(0.086)
income	0.139**	0.257**	0.020	0.037	0.159**	0.278**
	(0.066)	(0.117)	(0.066)	(0.114)	(0.066)	(0.119)
partymember	0.047	0.120	0.159	0.244	0.028	0.095
	(0.127)	(0.214)	(0.127)	(0.216)	(0.128)	(0.221)
Observations	631	631	631	631	631	631

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4: Replication of Table 6 (Huang 2015, p. 24) Using Ordered Probit and Ordered Logit Regressions

	protectiontrust		officialstrust		polisystem	
	ordered probit	*ordered logistic*	*ordered probit*	*ordered logistic*	*ordered probit*	*ordered logistic*
rumor	−0.205*	−0.362*	−0.001	−0.074	−0.221**	−0.452*
	(0.112)	(0.195)	(0.117)	(0.199)	(0.112)	(0.232)
rebuta	0.047	0.067	0.136	0.211	−0.045	−0.451**
	(0.110)	(0.190)	(0.115)	(0.193)	(0.111)	(0.226)
rebutb	0.008	0.021	0.294**	0.510**	−0.125	−0.258
	(0.118)	(0.202)	(0.122)	(0.204)	(0.119)	(0.230)
rebut2	−0.041	−0.095	0.060	0.131	0.036	−0.215
	(0.114)	(0.196)	(0.119)	(0.197)	(0.115)	(0.234)
news	−0.019	−0.033	0.052	0.075	0.007	−0.033
	(0.032)	(0.055)	(0.033)	(0.056)	(0.032)	(0.063)
politicalinterest	0.086*	0.160*	−0.043	−0.073	0.040	0.220**
	(0.048)	(0.083)	(0.050)	(0.085)	(0.048)	(0.099)
life	0.192***	0.330***	0.216***	0.364***	0.117***	0.223**
	(0.045)	(0.080)	(0.046)	(0.079)	(0.045)	(0.103)
prowest	−0.071**	−0.126***	−0.065**	−0.112**	−0.132***	−0.258***
	(0.028)	(0.048)	(0.029)	(0.050)	(0.028)	(0.054)
age	0.008	0.016	−0.022***	−0.040***	−0.013*	−0.014
	(0.008)	(0.014)	(0.008)	(0.015)	(0.008)	(0.015)
male	0.021	0.055	−0.018	−0.060	0.040	−0.030
	(0.076)	(0.130)	(0.079)	(0.134)	(0.077)	(0.153)
education	−0.050	−0.077	0.035	0.076	−0.009	0.100
	(0.042)	(0.075)	(0.044)	(0.074)	(0.042)	(0.086)
income	0.124**	0.232**	0.195***	0.368***	0.204***	0.278**
	(0.057)	(0.100)	(0.061)	(0.105)	(0.057)	(0.119)
partymember	0.261**	0.437**	0.130	0.215	0.290***	0.095
	(0.110)	(0.186)	(0.112)	(0.188)	(0.110)	(0.221)
Observations	799	799	799	799	799	631

Note: *p<0.1; **p<0.05; ***p<0.01

A Focus on Demographics

In this paper, we will focus primarily upon how demographic features of the Chinese population impact levels of trust in the government and perspectives on policy issues in China. To do so, we will exploit the set of socio-demographic covariates that Huang features in his dataset. Included in this set of covariates are age, gender, level of education, level of income, political affiliation (CCP membership), news consumption[2], political interest[3], life satisfaction[4] and pro-Western orientation.[5]

It appears that Huang includes socioeconomic and political covariates in his dataset for two main reasons. First, Huang references the coefficients on these covariates in Table 2 (p. 17) and Table 5 (p. 23) to determine whether they either increase or decrease respondents' level of belief in rumors. For the most part, these covariates are not associated with changes in rumor belief. As a result, Huang concludes that "citizens of diverse socio-economic, political and demographic backgrounds are similarly susceptible to anti-government rumors" (p. 17).

Second, Huang includes socio-demographic variables in the regressions in Table 3 (p. 18) and Table 6 (p. 24) to make estimates of trust more accurate. However, he hardly references the coefficients on the socio-demographic variables in discussion of the trust-related regressions. Beyond a comment about the positive effect of news consumption in one of three equations in Table 3, Huang quickly mentions that the results of the demographic variables are "generally as expected" (see pgs. 18 and 23) and moves on quite perfunctorily.

Let us take a second to enumerate the effects of demographics upon Chinese survey respondents' levels of trust in the government as indicated in Huang's original ordered probit model. Levels of life satisfaction are positively associated with levels of trust in all six of the ordinal probit results in Tables 3 and 6. Income is positively associated with levels of trust in five of the six regressions. Political interest and Chinese Communist Party (CCP) membership are each positively associated with levels of trust in two of the regressions. As

[2]Survey asked: 'How often do you follow news in the media?'. The choices were: 'almost everyday', 'several times per week', 'once or twice per week', 'less than once a week' and 'rarely'.

[3]Survey asked: 'How interested are you in political affairs?' The choices were 'interested' ,'somewhat interested', 'not very interested' and 'not interested at all'.

[4]Survey asked: 'All things considered, how do you feel about your life, work, and study these days?' The choices were 'satisfied', 'somewhat satisfied', 'somewhat dissatisfied' and 'dissatisfied'.

[5]"Pro-Western orientation was measured as the sum of a respondent's degree of agreement with the following two statements, with responses to the second statement reversely coded: (1) 'We must strive to learn from the West in terms of institutions, culture, and ideas' and (2) 'We must strive to maintain our own institutions, culture, and way of life'." (p. 17)

mentioned by Huang, four of the regressions reveal that being more pro-Western is associated with higher levels of trust in the government.

In Huang's ordered probit regressions, education and gender, respectively, each have (negative) effects in only one of the six regressions related to trust in government. It is understandable that Huang would not "expect" many very interesting effects of gender upon levels of trust; however, it seems curious that education only has a significant effect in one of Huang's six trust regressions. While one could make a valid argument for education pushing levels of trust in either direction, most would probably guess that education plays a role *somehow* in how much a country's citizens trust its government.

In fact, there is more to the story. In the following section, by altering the model used to analyze these covariates, we will demonstrate that both education and gender have interesting and informative effects on levels of trust in the Chinese government.

The Proportional Odds Assumption

Huang uses an ordered probit regression to analyze his results.[6] This model, first estimated by McKelvey and Zavoina, "assumes that the ordinal nature of the observed dependent variable is due to methodological limitations in collecting the data, which force the researcher to lump together and identify various portions of an (otherwise) interval level variable" [11]. In Huang's paper, the dependent variable trust indicators range from 1 to 7, and these numbers are purely ordinal— one cannot expect that the difference between a 3 and 4 and the difference between 4 and 5 will be equal. Becker and Kennedy (1992) explain that the probability of observing an outcome variable at any given ordinal level in an ordered probit depends on a normal distribution of error terms, centered at the coefficient estimate for the covariate in question. [1]

The ordered probit model operates on the premise that each individual has a latent preference y_i*, which cannot be observed, except through a censoring mechanism dividing the outcome variable into $J + 1$ categories. Thus,

$$\begin{aligned} y_i &= 0 \text{ if } y_i* \leq \delta_0 \\ &= 1 \text{ if } \delta_0 < y_i* \leq \delta_1 \end{aligned}$$

[6]He notes that the results are similar in OLS regressions.

$$= 2 \text{ if } \delta_1 < y_i* \leq \delta_2$$

$$...$$

$$= J \text{ if } \delta_{J-1} < y_i*$$

The regression model employing y_i* is:

$$y_i* = \beta' x_i + \epsilon_i, i = 1, ..., n. \text{ [6]}$$

Moreover, the probability that individual i picks alternative j is:

$$p_{ij} = p(y_i = j) = p(\delta_{J-1} < y_i* \leq \delta_J) = F(\delta_J - \beta' x_i) - F(\delta_{J-1} - \beta' x_i),$$

where F is the standard normal cdf.[7]

The ordered probit (along with its sister-function, the ordered logit) depends on the proportional odds assumption.[8] This assumption states that "the relationship between any two levels in the dependent variable group are the same and therefore the slope coefficients do not vary over different alternatives except the cut-off points" [15]. In other words, for all levels of the outcome variable y_i, the effect of each independent variable x_i is constant.

Let us focus on the coefficient on education in Huang's "equal treatment"[9] regression, which is negative and significant at the $p < 0.05$ level. According to the proportional odds assumption, education should have the same effect for respondents at each level of equal treatment trust, regardless of whether trust is high ($y_i > 4$) or low ($y_i < 4$). (Likewise, the effects of news, political interest, life, age, and so on, should remain the same for those with favorable opinions of the government and those with unfavorable opinions.)

The distribution of the data hints at the potential violation of the proportional odds assumption for education. In fact, as can be seen from Figure 1, the proportional odds assumption appears to be violated for education in Huang's "equal trust" regression (top left) *and* a number of Huang's other probit regressions. In these regressions, the distributions of y's at different levels of education vary erratically.

[7] For a visualization of the ordered probit, see: Becker and Kennedy 1992.

[8] The proportional odds assumption is also known as the parallel lines assumption.

[9] The survey read: 'On a scale from 1 to 7, with 1 being "strongly disagree" and 7 being "strongly agree," indicate the extent to which you agree with the following statement: 'in general, we can trust that our government will provide equal treatment to Chinese citizens and foreign citizens, rather than giving foreign citizens preferential treatment.'

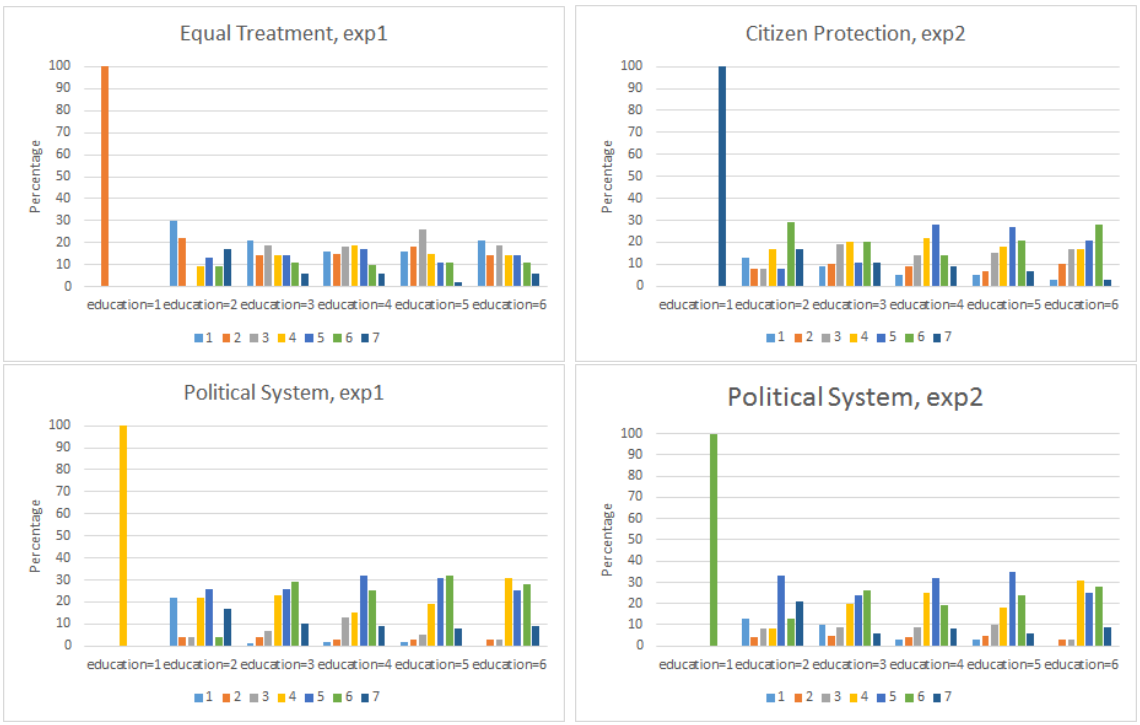

Figure 1: Distributions of Levels of Trust, Grouped by Levels of Education

To investigate these red flags further, Figure 2 features a visual representation of differences in effect at every level of y. Note that because this representation is based on the ordered logit equation, the term "effect" used in the figure does not have an easily interpretable meaning (as it would in OLS). Instead, "effect" is measured in log-odds, and must be converted to predicted probabilities in order to have more substantive meaning. Nevertheless, in Figure 2, we are concerned with the differences between covariate effects as y-levels increase from y_i to y_{i+1}. The difference in effects when $y = 1$ versus when $y = 2$ is normalized to 0. If the proportional odds assumption holds, then for differences between each level of y (where each level is represented by a different symbol), effects should remain constant (and thus, points should line up perfectly vertically). As can be seen in the second figure, this is not the case. Instead, wide horizontal differences between the points for several covariates indicate violations of the proportional odds assumption. In the top left plot of Figure 1, recall that the distributions for "equal treatment" trust ratings varied significantly according to levels of education. Likewise, the education effects appear to be particularly spread apart in Figure 2.

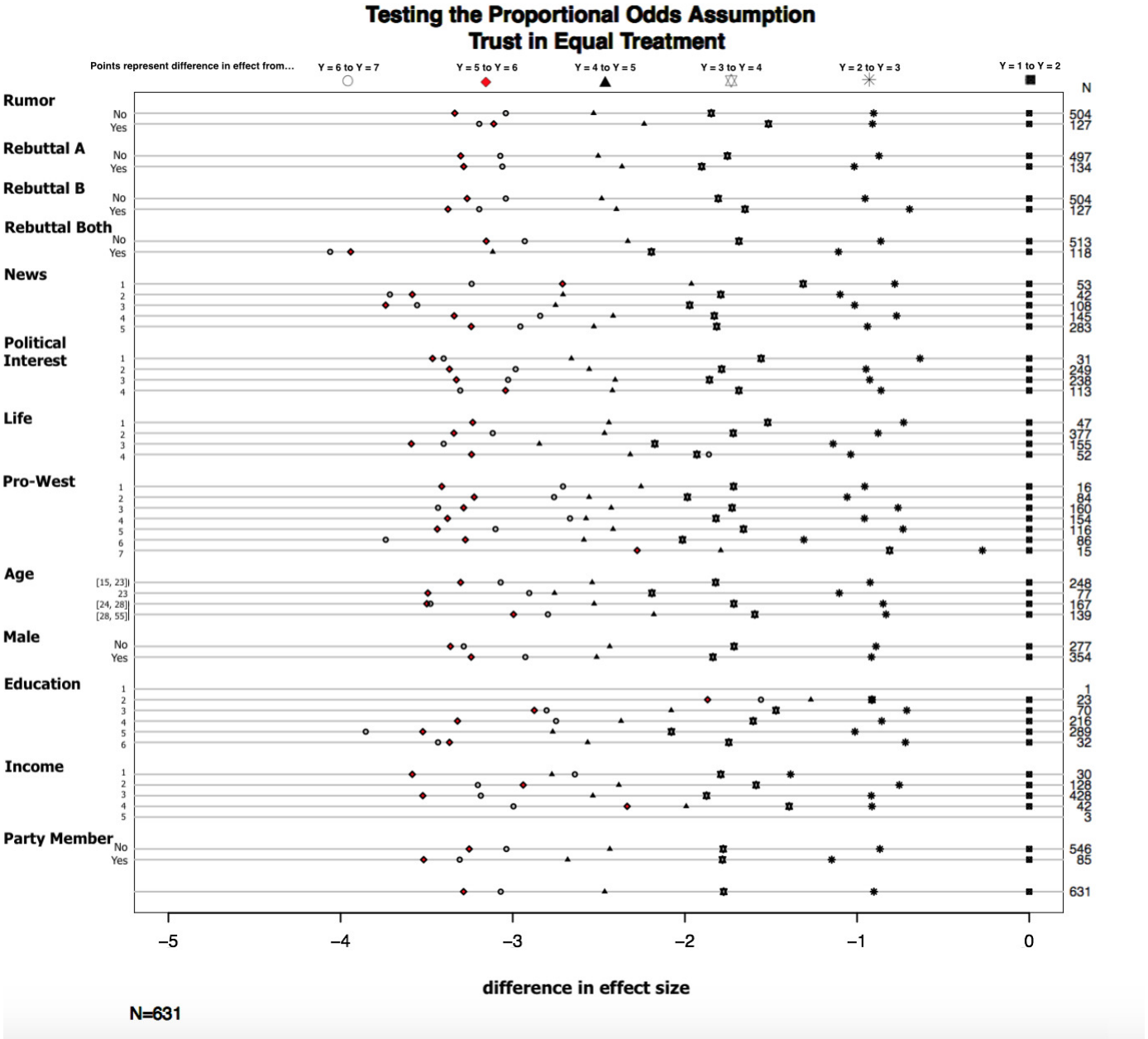

Figure 2: Proportional Odds Visualization Plot (Experiment 1)

Switching from the Ordered Probit to the Ordered Logit Model

The visualizations above may alert us to the fact that the proportional odds assumption is violated, but an empirical test is needed to confirm which covariates most severely violate the assumption. The Brant test, discussed below, allows for exactly this type of adjudication. However, it applies only to the ordered logit model. It is much more complicated (and unnecessary) to empirically test the proportional odds assumption using the ordered probit.

From this point onwards, we will shift from Huang's chosen model, the ordered probit, to the ordered logit. The ordered logit relies on the same latent preference model as the ordered logit with the only difference being that F (see the equation for the ordered probit on pages 8 and 9) represents the logistic cdf.[10] Hence, this switch has few costs and many benefits. The results of Huang's regressions in Tables 3 and 6 of his paper do not change when switching from the ordered probit to the ordered logit. For the vast majority of variables, significant values remain significant, and coefficients always have the same sign. Tables 3 and 4 above demonstrated the robustness of Huang's results when switching to an ordered logit. Changing the model primarily changes the interpretation of the results. For example, the ordered probit on political trust in Experiment 2 (the last set of regressions in Table 4 of this paper) indicates that rating life satisfaction one level higher increases the z-score of level of political trust by .117; meanwhile, the ordered logit says that this same increase in life satisfaction raises the log-odds of level of political trust by .211. Moreover, using the ordered logit will allow us to diagnose and fix non-proportionality. Ultimately, these changes will yield greater information about the effects of demographic variables upon trust in the government in China.

Because we are primarily concerned with the effects of socio-demographic indicators on trust in the government, we will run the regressions in this replication paper without treatments 1 through 4 (rumor, rebuta, rebutb, and rebut2).[11] It should be noted that removing the treatment covariates from Huang's regressions regarding trust does not change results because: 1) treatment is assigned via randomization and 2) each treatment is in-

[10]The equation for the logistic cdf is:

$$F(z) = \frac{e^z}{1 + e^z}$$

[11]Many thanks to Anton Strezhnev for this suggestion.

Table 5: Table Comparing Coefficients with and without Treatments

	(1) Political System, Exp 2 with treatment coefficients	(2) Political System, Exp 2 without treatment coefficients
Rumor	-0.384*	
	(-1.99)	
RebutA	-0.151	
	(-0.78)	
RebutB	-0.184	
	(-0.91)	
Rebut2	0.0377	
	(0.19)	
News	0.0180	0.0186
	(0.32)	(0.33)
Political Interest	0.100	0.109
	(1.18)	(1.28)
Life	0.211**	0.203*
	(2.67)	(2.57)
Pro-West	-0.246***	-0.245***
	(-4.95)	(-4.93)
Age	-0.0201	-0.0205
	(-1.48)	(-1.51)
Male	0.0432	0.0232
	(0.33)	(0.18)
Education	-0.0382	-0.0441
	(-0.51)	(-0.59)
Income	0.392***	0.394***
	(3.88)	(3.91)
Party Member	0.483*	0.486**
	(2.57)	(2.60)
Observations	799	799

t statistics in parentheses, cut values removed from table for brevity

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

dependent from other covariates in the regressions. Table 5 demonstrates that the results of the ordered logit regression excluding treatment effects remain largely the same. It uses regression 3, trust in the political system, from Table 6 of Huang's paper to exemplify the same point for all regressions in Huang's Tables 3 and 6.

Diagnosing Proportional Odds Violations Empirically

The Brant Test determines whether individual covariates in an ordered logit meet the proportional odds assumption. The test operates by comparing separate measures of fit to each of the binary logit models underlying the overall ordered logit model. [3] [10] Figure 3 shows the Brant test results for the political system trust ordered logit in Experiment 1 (Huang's original Table 3, Regression 3).[12]

It is immediately clear that the proportional odds assumption is not met for the model, as the Chi-squared p-value for all variables is zero. Moreover, the test reveals that

[12]There is no simple command to perform a Brant test in R, but the **brant** function in Stata is easy to use and works quite well.

Brant Test of Parallel Regression Assumption

Variable	chi2	p>chi2	df
All	**94.85**	**0.000**	**45**
news	**7.64**	**0.177**	**5**
politicali~t	**4.21**	**0.519**	**5**
life	**2.59**	**0.763**	**5**
prowest	**7.61**	**0.179**	**5**
age	**7.54**	**0.184**	**5**
male	**1.15**	**0.950**	**5**
education	**11.74**	**0.039**	**5**
income	**3.49**	**0.626**	**5**
partymember	**20.18**	**0.001**	**5**

A significant test statistic provides evidence that the parallel regression assumption has been violated.

Figure 3: Brant Test for Political Trust (Experiment 1) Regression

a $p < 0.05$ level of significance, we can reject the hypothesis that the education and party member variables satisfy the parallel odds assumption.

Performing a Brant test on each of the ordered logits in Huang's Tables 3 and 6, we found that at a significance level of $p < 0.10$, several variables violated the parallel odds assumption. A summary of the variables violating the assumption can be found in Figure 4.

	Experiment 1			**Experiment 2**		
Type of Trust	Public Safety	Equal Treatment	Political System	Citizen Protection	Officials' Families	Political System
Variables that do not satisfy PO assumption	partymember	education	partymember education	male education	age income	education

Figure 4: Proportional Odds Assumption Violations

The Generalized Ordered Logistic Regression Model

The generalized ordered logit operates very much in the same way as the ordered logit. However, with this model, it is possible to relax the proportional odds assumption for some or all covariates. [5] [16] [15] [12] By relaxing the parallel odds assumption for a variable, the model yields different coefficients for each level of y in the regression. Variables

for which the parallel odds assumption is not relaxed maintain the same coefficient across every level of y outcomes.

The model follows the following form:

$$p(y_i > J) = g(\beta' x_i) = \frac{exp(\delta_J + \beta' x_i)}{1+(\delta_J + \beta' x_i)},\ j = 1, 2, ..., M-1$$

where M equals the number of categories in the ordinal dependent variable, y. [16]

The **gologit2** function in Stata quickly evaluates the generalized ordered logit, an its npl() function allows users to specify the variables for which the parallel odds assumption does not hold.[13]

Table 6 shows the output of the generalized ordered logit for the trust in political system regression (Experiment 1) whose Brant test is featured in Figure 3. Table 7 shows the original results of the ordered logit for this same set of data for comparison. Notice that the coefficients for party system and education change across levels of y because the parallel odds assumption has been relaxed. The coefficients on the other variables do not change across levels of y in the generalized ordered logit, and they maintain very similar magnitudes and exactly the same significance levels as compared to the results from the ordered logit.

As can be seen from Figure 4, the proportional odds assumption does not hold for education in four of the six regressions on trust. Party membership, age, income, and gender also appear to have varying effects across different levels of trust. The next section will be dedicated to exploring what new information we can glean from the results of the generalized ordered logit.

The Effect of Demographics on Government Trust

The impact of demographics upon levels of citizen trust in the Chinese government is a burgeoning research topic in comparative politics. Results from the generalized logit model shed new light on the how demographic features affect groups with low vs. high trust in the Chinese government. This new information not only confirms the usefulness of the generalized ordered logistic method, but it also has implications for future study of

[13] Running this model sometimes triggers a warning that some of the " in-sample cases have an outcome with a predicted probability that is less than 0." Williams indicates that a high proportion of cases with negative predicted probabilities likely means the model does not fit the data [16]. The Equal Treatment, Exp 1, Political System, Exp 1, and Officials' Families, Exp 2, **gologit2** regressions yield 1, 19, and 13 cases with negative predicted probabilities, respectively. Given the large sample sizes for this data, these small numbers of cases should not be problematic.

Table 6: Results for Trust in the Political System (Experiment 1) from the Generalized Ordered Logit

(generalized ordered logit) Political System, Exp 1					
Y=1 to Y=2			Y=4 to Y=5		
News	-0.0346	(-0.55)	News	-0.0346	(-0.55)
PoliticalInterest	0.211*	(2.14)	PoliticalInterest	0.211*	(2.14)
Life	0.197	(1.93)	Life	0.197	(1.93)
Pro-West	-0.263***	(-4.87)	Pro-West	-0.263***	(-4.87)
Age	-0.0143	(-0.94)	Age	-0.0143	(-0.94)
male	-0.00404	(-0.03)	male	-0.00404	(-0.03)
Education	0.709**	(2.89)	Education	0.129	(1.30)
Income	0.287*	(2.42)	Income	0.287*	(2.42)
PartyMember	-0.297	(-0.37)	PartyMember	0.275	(1.00)
Constant	0.276	(0.26)	Constant	-0.425	(-0.64)
Y=2 to Y=3			Y=5 to Y=6		
News	-0.0346	(-0.55)	News	-0.0346	(-0.55)
PoliticalInterest	0.211*	(2.14)	PoliticalInterest	0.211*	(2.14)
Life	0.197	(1.93)	Life	0.197	(1.93)
Pro-West	-0.263***	(-4.87)	Pro-West	-0.263***	(-4.87)
Age	-0.0143	(-0.94)	Age	-0.0143	(-0.94)
male	-0.00404	(-0.03)	male	-0.00404	(-0.03)
Education	0.510*	(2.56)	Education	0.104	(1.01)
Income	0.287*	(2.42)	Income	0.287*	(2.42)
PartyMember	-1.078*	(-2.38)	PartyMember	-0.0450	(-0.17)
Constant	0.288	(0.31)	Constant	-1.583*	(-2.27)
Y=3 to Y=4			Y=6 to Y=7		
News	-0.0346	(-0.55)	News	-0.0346	(-0.55)
PoliticalInterest	0.211*	(2.14)	PoliticalInterest	0.211*	(2.14)
Life	0.197	(1.93)	Life	0.197	(1.93)
Pro-West	-0.263***	(-4.87)	Pro-West	-0.263***	(-4.87)
Age	-0.0143	(-0.94)	Age	-0.0143	(-0.94)
male	-0.00404	(-0.03)	male	-0.00404	(-0.03)
Education	0.238*	(1.99)	Education	-0.309	(-1.89)
Income	0.287*	(2.42)	Income	0.287*	(2.42)
PartyMember	0.183	(0.49)	PartyMember	0.390	(0.93)
Constant	0.262	(0.37)	Constant	-1.688	(-1.91)

631 observations; t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Results for Trust in the Political System (Experiment 1) from the Ordered Logit

	(ordered logit) Political System, Exp 1
News	-0.0325
	(-0.52)
PoliticalInterest	0.216*
	(2.19)
Life	0.207*
	(2.04)
Pro-West	-0.257***
	(-4.80)
Age	-0.0139
	(-0.92)
male	-0.00863
	(-0.06)
Education	0.114
	(1.33)
Income	0.301*
	(2.54)
PartyMember	0.0817
	(0.37)
cut1	
Constant	-2.518***
	(-3.74)
cut2	
Constant	-1.627*
	(-2.51)
cut3	
Constant	-0.685
	(-1.07)
cut4	
Constant	0.451
	(0.71)
cut5	
Constant	1.759**
	(2.74)
cut6	
Constant	3.605***
	(5.50)
Observations	631

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Comparison of Coefficients on Education Across Levels of y when the Proportional Odds Assumption is Violated

	(1) Equal Treatment, Exp 1	(2) Political System, Exp 1	(3) Citizen Protection, Exp 2	(4) Political System, Exp 2
Ordered Logit Coefficients				
	-0.175*	0.114	-0.0744	-0.0441
	(-2.02)	(1.33)	(-1.00)	(-0.59)
Generalized Ordered Logit Coefficients				
Y=1 to Y=2	0.0406	0.709***	0.164	0.464***
	(0.36)	(2.89)	(1.02)	(2.76)
Y=2 to Y=3				
	0.00665	0.510**	0.0693	0.236*
	(0.07)	(2.56)	(0.61)	(1.78)
Y=3 to Y=4				
	-0.286***	0.238**	-0.00530	0.0419
	(-2.89)	(1.99)	(-0.06)	(0.39)
Y=4 to Y=5				
	-0.350***	0.129	0.0576	-0.00240
	(-3.25)	(1.30)	(0.68)	(-0.03)
Y=5 to Y=6				
	-0.330**	0.104	-0.220**	-0.144
	(-2.51)	(1.01)	(-2.46)	(-1.60)
Y=6 to Y=7				
	-0.699***	-0.309*	-0.423***	-0.212
	(-3.64)	(-1.89)	(-3.39)	(-1.46)
Observations	631	631	799	799

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chinese politics. In this section, we will review some of the most interesting results from the generalized ordered logit regressions. For a full review of coefficient values for covariates that violate the proportional odds assumption, see Appendix B.

As noted in the previous section, the distribution of the education responses does not satisfy the proportional odds assumption for several of Huang's regressions addressing trust in government. Table 8 displays the coefficients on education across all levels of y for the four regressions where the proportional odds assumption is violated. It also displays the original coefficient on education found in the ordered logit to allow for comparison.[14]

As demonstrated in Table 8, people with more education in China tend to have less extreme views of the Chinese government (in terms of trust in equal treatment, citizen protection, and the political system on the whole). At lower values of y, education has a positive effect on trust while at higher values of y, education has a negative effect on trust. In all four of the six trust-related regressions run by Huang where the proportional odds assumption does not hold, coefficients follow the same pattern across levels of y. This effect is also interesting because in the original paper, education is only found to be significant in one equation (equal treatment), and it was found to have a negative effect on trust across

[14]Note: Reporting the full results of a generalized ordered logit takes up quite a lot of space. This table reports only coefficients on education. However, the full list of covariates used in the regressions remains unchanged: news, politicalinterest, life, prowest, age, male, education, income, and partymember.

the board. We should note that the distributions of levels of trust in government are even in all four trust questions featured in Table 8.

This trend in the effects of education is substantiated by the literature on the Chinese education system and Chinese politics. First, we can confirm through current scholarship that people with higher levels of education in China tend to have less extreme views of the Chinese government. Previous research on the relationship between demographic factors and people's general trust in government suggests that better-educated people tend to trust the government more, in that they have a better understanding about the political-administrative system [2] [4]. However, better-educated people in China are not likely to have extremely positive views of government. This fact can be explained partly by the nature of the authoritarian Chinese regime, as people with a higher level of "intelligence" are more likely to have liberal policy preferences, and therefore develop a critical attitude towards the regime. [8] In addition, people with higher education levels may be less susceptible to the the effect of "top-down" socialization (for example, the Chinese Communist Party propaganda on the legitimacy of government), and thus have less trust in the political system. [13] In sum, the well-educated group's moderate level of trust in China's government can be explained by the mixed effects of higher level education, which can generate cognitive advantages that promote citizens' trust but can also produce normative attitudes against the authoritarian regime.

On the other hand, the mobilizing effect of the Chinese education system is well documented. Richard Callahan writes that the Patriotic Education campaign since the 1980's has sought to teach China's youth how to be patriots. [9] Our results show a unique trend that for those who have the least trust in China's government, more education is associated with more trust. Such results indicate that the patriotic campaign may be working.

Another interesting outcome of the generalized ordered logit model using Huang's data is the trend in coefficient values and magnitudes for gender across levels of trust in the Chinese government to protect its citizens abroad (see Table 9). In Huang's original model, gender did not appear to have a significant effect on any of the trust indicators. Using the generalized ordered logit, it appears that within the group of respondents whose assessments of citizen protection trust are low, men have lower trust levels in the government's ability to protect its citizens abroad than women. Yet when assessments of citizen protection trust are high, this effect switches direction— men are more likely than women to believe that the Chinese government does a good job of protecting citizens abroad. In other words, in both directions, men's viewpoints are more extreme than women's.

Table 9: Coefficients on Male Using the Generalized Ordered Logit Model

	(1) Citizen Protection
Ordered Logit Coefficient	
	0.0409
	(0.31)
Generalized Ordered Logit Coefficients	
Y=1 to Y=2	
	-0.495
	(-1.56)
Y=2 to Y=3	
	-0.388*
	(-1.82)
Y=3 to Y=4	
	-0.255**
	(-1.56)
Y=4 to Y=5	
	0.144
	(0.97)
Y=5 to Y=6	
	0.295*
	(1.79)
Y=6 to Y=7	
	0.362
	(1.38)
Observations	799

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We can not find a systematic reason for this gender effect in current literature, but this result is could lead research on the role of gender in Chinese political trust in a new direction. There is some current work that says that women are more likely to support the public sector, on which they are more dependent for their employment. [4] This may explain our observation in the regression that women's level of trust in the government is higher than men's when trust levels are generally low. Since a government's ability to protect its citizens is an important part of its public sector responsibilities, the gender difference in citizens' trust in the government's ability to protect them might be attributed to women's past experience of benefiting from the public sector. Nevertheless, the full rationale for why gender might follow this trend is still unclear and it should be further explored.

Conclusion

By relaxing the proportional odds assumption for some or all covariates, the generalized ordered logistic regression model allows for greater flexibility and greater information in analyzing ordinal outcome data. In this paper, we have used the model to gain insights about the nature of those who trust in the Chinese government. In particular, we find that education in China has a moderating effect upon political views while masculinity may heighten extreme views on the Chinese government's ability to protect its citizens abroad. One caveat to the findings presented in this paper is that Chinese internet users may not be fully representative of the Chinese population more broadly. Nevertheless, the initial trends explored in the paper would serve as worthy bases for further work. Future research on the impact of sociodemographic features on political trust is warranted.

Appendix A: Data Replication

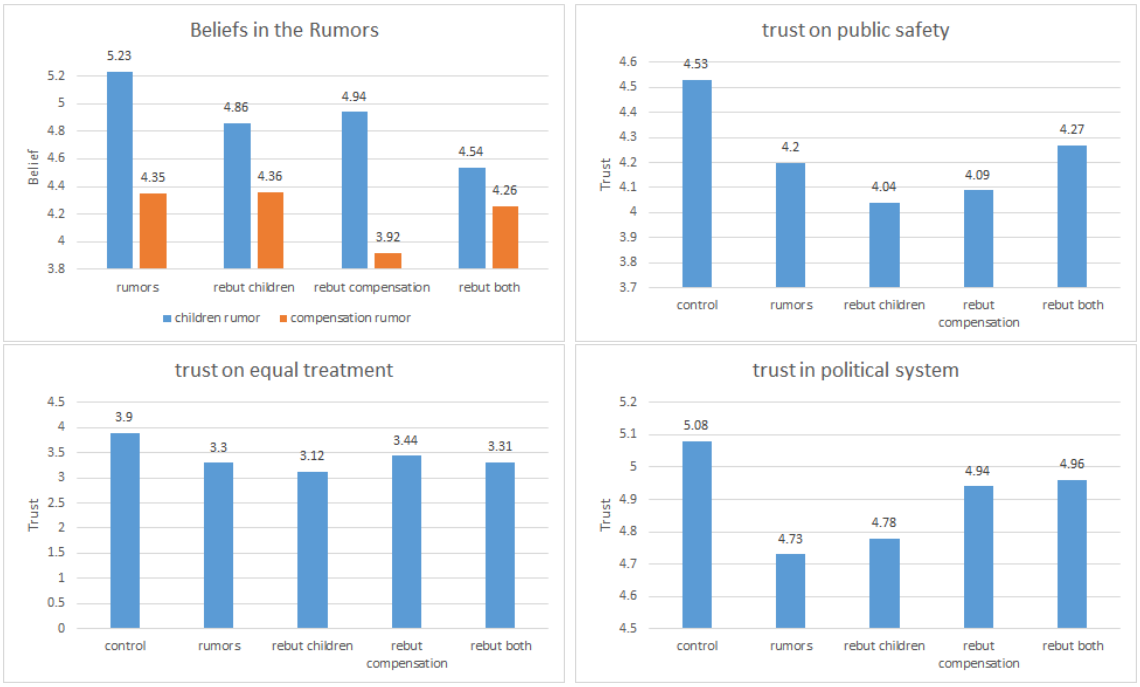

Figure 5: Replication of figure 2: group means of rumor belief and political trust (exp1)

Table 10: Replication table 1: Group Mean Differences in Rumor Belief and Political Trust (Experiment 1)

	children rumor belief	compensation rumor belief	public safety	equal treatment	political system
	(1)	(2)	(3)	(4)	(5)
Rumors−control			−0.323**	−0.605***	−0.348**
			(0.187)	(0.228)	(0.177)
Rebut children−Rumors	−0.370**	0.034	−0.167	−0.180	0.051
	(0.179)	(0.200)	(0.195)	(0.221)	(0.172)
Rebut compensation−Rumors	−0.291*	−0.425**	−0.110	−0.142	0.213
	(0.188)	(0.199)	(0.189)	(0.221)	(0.176)
Rebut both−Rumors	−0.686***	−0.067	0.066	0.006	0.225
	(0.199)	(0.206)	(0.191)	(0.215)	(0.180)
Rebut children−control			−491***	−0.785***	−0.296**
			(0.190)	(0.223)	(0.167)
Rebut compensation−control			−0.434***	−0.463**	−0.135
			(0.184)	(0.223)	(0.171)
Rebut both−control			−0.257*	−0.599***	−0.122
			(0.187)	(0.216)	(0.174)
Note:		*p<0.1; **p<0.05; ***p<0.01			

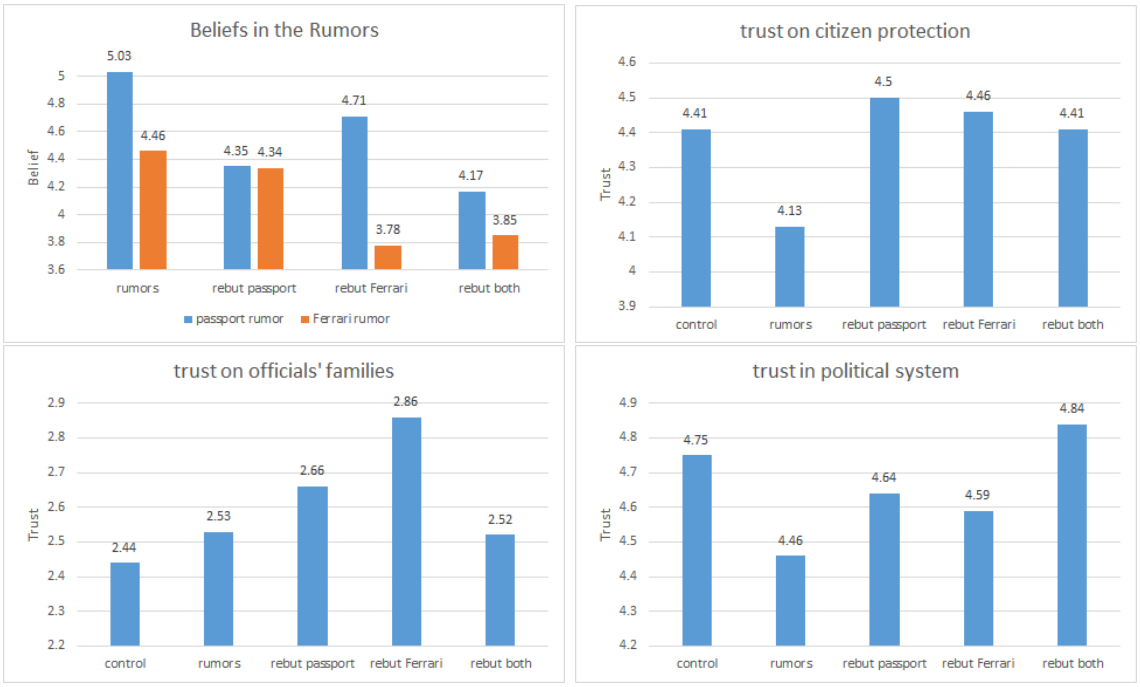

Figure 6: Replication of figure 3: group means of rumor belief and political trust (exp2)

Table 11: Replication table 2: ordered probit analysis of rumor belief (experiment 1)

	Dependent variable:	
	rumorabelief	rumorbbelief
	(1)	(2)
rebuta	−0.318**	0.001
	(0.131)	(0.130)
rebutb	−0.215	−0.304**
	(0.132)	(0.130)
rebut2	−0.497***	−0.055
	(0.134)	(0.132)
news	0.005	−0.057
	(0.041)	(0.041)
politicalinterest	−0.118*	−0.027
	(0.062)	(0.061)
life	−0.018	−0.028
	(0.065)	(0.064)
prowest	0.056*	0.001
	(0.034)	(0.033)
age	−0.010	−0.007
	(0.009)	(0.009)
male	0.200**	0.054
	(0.098)	(0.097)
education	0.045	0.074
	(0.054)	(0.054)
income	0.098	−0.006
	(0.073)	(0.072)
partymember	−0.067	0.020
	(0.145)	(0.144)
Observations	506	506
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 12: Replication table 4: Group Mean Differences in Rumor Belief and Political Trust (Experiment 2)

	passport rumor belief	Ferrari rumor belief	citizen protection	officials' family	political system
Rumors−control			−0.275*	−0.092	−0.290**
			(0.185)	(0.170)	(0.158)
Rebut passport−Rumors	−0.675***	−0.118	0.368**	0.136	0.178
	(0.193)	(0.185)	(0.185)	(0.179)	(0.169)
Rebut Ferrari−Rumors	−0.316*	−0.679***	0.327	0.338**	0.133
	(0.199)	(0.191)	(0.191)	(0.185)	(0.172)
Rebut both−Rumors	−0.857***	−0.068***	0.275*	−0.007	0.379**
	(0.195)	(0.188)	(0.187)	(0.173)	(0.164)
Rebut passport −control			0.093	−0.228*	−0.112
			(0.174)	(0.164)	(0.157)
Rebut Ferrari −control			−0.052	−0.430***	−0.157
			(0.181)	(0.170)	(0.161)
Rebut both−control			−0.000	−0.085	−0.089
			(0.177)	(0.157)	(0.152)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 13: Replication table 5: ordered probit analysis of rumor belief (experiment 2)

	Dependent variable:	
	rumorabelief	rumorbbelief
	(1)	(2)
rebuta	-0.423^{***}	-0.093
	(0.114)	(0.112)
rebutb	-0.219^{*}	-0.414^{***}
	(0.121)	(0.120)
rebut2	-0.513^{***}	-0.363^{***}
	(0.118)	(0.116)
news	0.018	0.011
	(0.037)	(0.036)
politicalinterest	0.081	0.045
	(0.055)	(0.055)
life	-0.082	-0.011
	(0.052)	(0.052)
prowest	0.063^{**}	0.060^{*}
	(0.032)	(0.031)
age	0.011	-0.016^{*}
	(0.009)	(0.009)
male	-0.067	0.054
	(0.086)	(0.086)
education	0.053	0.068
	(0.048)	(0.048)
income	-0.041	-0.042
	(0.064)	(0.063)
partymember	-0.126	-0.158
	(0.123)	(0.122)
Observations	622	622
Note:	*p<0.1; **p<0.05; ***p<0.01	

Appendix B: Trends Found By Relaxing the Proportional Odds Assumption for Select Variables

In addition to education and gender, the proportional odds assumption can be relaxed for three other covariates in Huang's government trust regressions. First, in Huang's original paper, CCP membership was not found to be a significant factor affecting trust in the CCP government. However, in the world of Experiment 1, where harmful rumors about the government are extant and some people have received rebuttals but they are thinly evidenced, CCP membership does appear to make a difference. CCP membership has a positive effect on views of public safety if views were boderline-low before. It has a negative effect on views of the political system if views were low before.

Table 14: Coefficients on CCP Membership Using the Generalized Ordered Logit Model

	(1) Public Safety, Exp 1	(2) Political System, Exp 1
Ordered Logit Coefficients		
	0.120	0.0817
	(0.56)	(0.37)
Generalized Ordered Logit Coefficients		
Y=1 to Y=2		
	0.439	-0.297
	(0.70)	(-0.37)
Y=2 to Y=3		
	0.344	-1.078**
	(0.89)	(-2.38)
Y=3 to Y=4		
	0.739**	0.183
	(2.47)	(0.49)
Y=4 to Y=5		
	-0.0566	0.275
	(-0.23)	(1.00)
Y=5 to Y=6		
	-0.302	-0.0450
	(-0.93)	(-0.17)
Y=6 to Y=7		
	-0.507	0.390
	(-0.82)	(0.93)
Observations	631	631

t statistics in parentheses

In Huang's original model, age had a consistently negative and significant effect on citizens' trust in government officials' ability and/or willingness to discipline their family members. Using the generalized ordered logit model, we see that an increase age only appears to have a significantly negative effect on citizen trust in the government when assessments of the government are low. (In other words, in the group of citizens whose level of trust in government officials disciplining their family members is low, older citizens judge these officials even more harshly.) When assessments of the government are high, age does not have an effect on citizen's trust in government officials disciplining their family members.

While these results are interesting, they must be tempered by the fact that the ratings for Officials' Families Trust have the most skewed distribution in this dataset. The vast majority of respondents rated trust in government officials' ability to discipline their family members at $Y \leq 4$. In fact, only 96 of 799 respondents gave ratings of 5 or higher in response to this question. Thus, while it is clear that Chinese citizens perceive a high level of corruption in the government, it appears that the generalized ordered logit in this case is more likely just capturing the skewed distribution of the data.

Table 15: Coefficients on Age Using the Generalized Ordered Logit Model

	(1) Officials' Families
Ordered Logit Coefficient	
	-0.0392**
	(-2.67)
Generalized Ordered Logit Coefficients	
Y=1 to Y=2	
	-0.0594***
	(-3.53)
Y=2 to Y=3	
	-0.0403**
	(-2.37)
Y=3 to Y=4	
	-0.0132
	(-0.72)
Y=4 to Y=5	
	0.00391
	(0.18)
Y=5 to Y=6	
	0.00649
	(0.21)
Y=6 to Y=7	
	0.0614
	(0.82)
Observations	799

t statistics in parentheses

In Huang's original paper, income had a consistently positive effect on citizen trust in government officials disciplining their families. (The richer a person was, the more likely they were to have trust in the government on this factor.) This model shows that income is only significant for this type of trust when assessments are low. When assessments of the government's ability in disciplining their families are high, income does not significantly affect level of trust.

Once again, while these results are interesting, they must be tempered by the fact that the ratings for Officials' Families Trust have the most skewed distribution in this dataset. Thus, while it is clear that Chinese citizens perceive a high level of corruption in the government, it appears that the generalized ordered logit in this case is more likely just capturing the skewed distribution of the data.

Table 16: Coefficients on Income Using the Generalized Ordered Logit Model

	(1) Officials' Families
Ordered Logit Coefficient	
	0.367***
	(3.52)
Generalized Ordered Logit Coefficients	
Y=1 to Y=2	
	0.417***
	(3.48)
Y=2 to Y=3	
	0.460***
	(3.64)
Y=3 to Y=4	
	0.282**
	(1.97)
Y=4 to Y=5	
	0.0591
	(0.31)
Y= 5 to Y=6	
	-0.221
	(-0.87)
Y= 6 to Y=7	
	0.183
	(0.43)
Observations	799

t statistics in parentheses

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