

A Continuing Analysis of Chinese and American Public Willingness-to-Pay for Climate Change Mitigation Policy Action

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Introduction

The importance of global climate change in society cannot be overstated. As the world's two largest greenhouse gas (GHG) polluters and two largest economies, China and the United States share prominent roles in the development of international climate change mitigation strategies.

Efforts to address climate change through international cooperation have largely taken place through the United Nations Framework Convention on Climate Change (UNFCCC). These negotiations have been highlighted by tensions between developed and developing countries regarding what actions to take and who should bear the costs.

Addressing climate change will require reducing GHG emissions through policies such as cap and trade or taxes which will impact households and businesses. Because meaningful climate change action will require the cooperation and participation of both China and the U.S., a better understanding of public willingness to incur the costs of climate policy action in these two important countries is paramount.

Surveys were conducted of Chinese and American citizens from May – October 2015 (N=7,556). We investigated willingness-to-pay (WTP) for an increased cost of living arising from policies putting a price on GHG emissions to mitigate climate change. We also examined what factors influence WTP for climate action in each country.

We use a double-bounded dichotomous choice (DBDC) contingent valuation method (CVM) framework with five randomized initial bid values, followed up with second bid values based on the initial bid value response. All monetary values are converted to international dollars using purchasing power parity (PPP).

Table 1 presents summary statistics for a variety of variables generated from our survey responses.



Table 1: Descriptive Statistics

Variable \ Description	United States			China		
	N	Mean	SD	N	Mean	SD
<i>Demographic Variables</i>						
Adult \ Indicator for adult 0 = College, 1 = Adult	4927	0.406	0.491	2629	0.458	0.498
Age \ Respondent's age (in years)	4893	29.6	14.1	2572	28.6	12.3
Male \ Indicator for gender 0 = Female, 1 = Male	4894	0.491	0.500	2572	0.464	0.499
Minority \ Indicator for minority race/ethnicity 0 = Not minority, 1 = Minority	4890	0.217	0.412	2563	0.055	0.227
Income \ Annual Household Income (US Thousands \$, and Chinese Thousands ¥)	4861	82.8	53.3	2556	78.0	60.2
Degree \ Indicator for college degree 0 = Else, 1 = At least bachelor's degree	4890	0.543	0.498	2561	0.228	0.419
<i>Environmental \ Policy variables</i>						
HapYes \ Do you think climate change is happening? 0 = Not happening or not sure, 1 = Happening	4927	0.807	0.395	2629	0.947	0.225
CausHum \ Which comes closest to your understanding about the cause of CC? 0 = Else, 1 = Primarily human caused	4927	0.586	0.493	2629	0.813	0.390
ConcHi \ How concerned are you about climate change? 0 = Else, 1 = Concerned or very concerned	4927	0.429	0.495	2629	0.351	0.478
ObStrAgr \ Every person has the obligation to act to prevent climate change 0 = Else, 1 = Strongly agree	4927	0.316	0.465	2629	0.567	0.496
Sci90 \ What percent of climate scientists agree human-caused climate change is happening? 0 = Else, 1 = 90% or more	4927	0.369	0.483	2629	0.285	0.452
TrtyA \ Should your country sign an international climate change treaty? (unconditional) 0 = Else, 1 = Somewhat or strongly support	1649	0.657	0.475	870	0.836	0.371
TrtyB \ Should your country sign an international climate change treaty? (known participant) 0 = Else, 1 = Somewhat or strongly support	1671	0.688	0.463	894	0.789	0.409
TrtyC \ Should your country sign an international climate change treaty? (known non-participant) 0 = Else, 1 = Somewhat or strongly support	1576	0.516	0.500	797	0.681	0.466
<i>Political Affiliation</i>						
Lib \ Liberal political ideology 0 = Not liberal, 1 = Liberal	4888	0.297	0.457			
Mod \ Moderate political ideology 0 = Not moderate, 1 = Moderate	4888	0.396	0.489			
Cons \ Conservative political ideology 0 = Not conservative, 1 = Conservative	4888	0.306	0.461			

Method

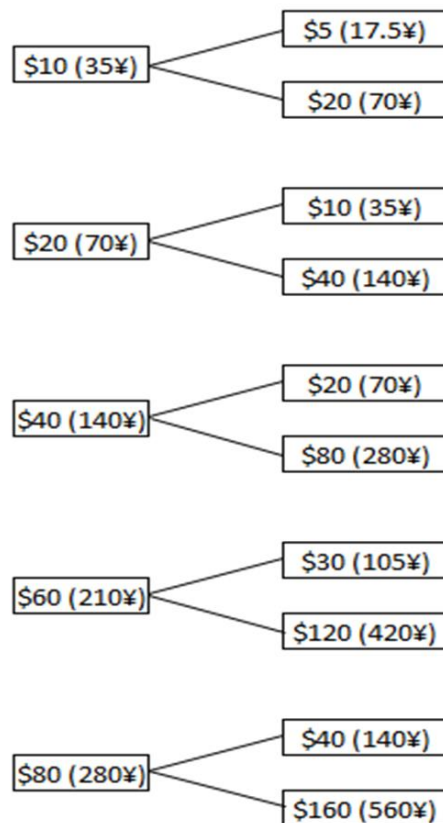
WTP estimates for respondents were derived using a DBDC CVM framework. The DBDC model consists of two WTP questions both of which can be answered yes or no. Respondents were faced with an initial bid amount representing an increased cost of living arising from climate policy action.

Responses of no to the initial bid amount were followed up with a lower amount (half), while yes responses were followed up with a higher amount (double). As such, each respondent's answers to this pair of questions will take one of the following forms: {no, no}, {no, yes}, {yes, no}, or {yes, yes}.

- Randomly assigned starting values (\$10, \$20, \$40, \$60, \$80)
- All values are in International Dollars, Purchasing Power Parity (PPP)
- PPP conversion = 3.5 (¥ / \$)
- Exchange rate conversion = 6.1 (¥ / \$)

Figure 1 presents all of the possible WTP values faced by respondents from this set up.

Figure 1



Willingness-to-Pay Questions

Most policies to address climate change are designed to reduce greenhouse gas emissions which will likely increase your household expenditures on heating, electricity, transportation, food and other goods and services.

多数应对气候变化的政策包括对二氧化碳排放加价，这将会增加您在取暖，用电·交通出行，食物与其他商品以及服务费用方面的家庭开支。

Would you support a policy to address climate change that increased your average monthly household expenditures by \$X?

如果实施应对气候变化的政策将会使您每月平均家庭开支增加X元，您是否会支持该政策？

- No 否
- Yes 是

Table 2 provides a preliminary look at the raw WTP data as well as a validity check illustrating the law of demand across the five initial bid values in both countries.

- Higher acceptance rate for Chinese respondents compared to Americans.
- Consistent with economic theory, there is a declining acceptance rate for higher initial bid amounts in both countries.

Table 2

Initial bid (\$ or ¥)		US	China
\$10	N	988	520
(35¥)	% Accept	65.4%	79.8%
\$20	N	985	505
(70¥)	% Accept	62.9%	75.4%
\$40	N	969	498
(140¥)	% Accept	54.2%	60.6%
\$60	N	1004	501
(210¥)	% Accept	46.2%	59.3%
\$80	N	956	509
(280¥)	% Accept	44.7%	56.0%
Total	N	4,902	2,533
	% Accept	54.7%	66.3%



Regression Analysis Model

The purpose of the DBDC regression analysis is to estimate the mean WTP and also to better understand what factors influence public WTP for climate change mitigation policy in each country.

- The parameters β are estimated by maximum likelihood
- Probability for a response being in each range
- See Lopez-Feldman, *doubleb* command in Stata (2012)

$$WTP = \beta X + \varepsilon$$

Each respondent will fall into one of four categories.

1. Responses = {yes, yes} where $bid2 < WTP < \infty$
2. Responses = {yes, no} where $bid1 < WTP < bid2$
3. Responses = {no, yes} where $bid2 < WTP < bid1$
4. Responses = {no, no} where $0 \leq WTP < bid2$



Regression Results

Table 3 presents regression analysis results with no covariates yielding the estimated mean WTP for respondents in each country.

- On average U.S. respondents are WTP \$48.98 per month compared to \$69.72 among Chinese respondents (international dollars, PPP).
- Average annual WTP of \$588 and \$837 in the U.S and China respectively (international dollars, PPP).
- Chinese annual WTP is approximately \$481 (U.S. dollars, e-r = 6.1 ¥ / \$).

Tables : Mean Willingness-to-Pay

Variable	US	CH
Constant (Std Error)	48.98** (1.00)	69.72** (1.63)
N	4,902	2,533

Table 4: Determinants of Willingness-to-Pay

Variable	US	CH
HapYes	20.42** (2.65)	17.89* (7.60)
CausHum	16.34** (2.19)	8.93* (4.55)
ConcHi	26.86** (2.31)	8.61* (3.51)
ObStrAgr	19.83** (2.35)	17.24** (3.34)
Sci90	5.52** (2.04)	-0.346 (3.60)
Adult	6.27 (3.81)	-11.25* (4.94)
Age	-0.751** (0.133)	-0.560** (0.20)
Male	7.89** (1.85)	-2.73 (3.16)
IncPPP	0.065** (0.020)	0.723** (0.107)
Degree	4.70* (2.07)	1.71 (4.08)
Minority	-3.48 (2.22)	0.46 (6.84)
Lib	21.40** (2.56)	
Mod	9.13** (2.24)	
Constant	1.95 (4.38)	39.98** (8.55)
Log Likelihood	-6,483	-3,432
N	4,855	2,517

Table 4 presents regression analysis results including covariates to examine what factors influence WTP for climate change policy for respondents in each country.

- Climate change awareness variables are positively correlated with WTP in both countries.
- Adults in China are WTP less than college students, while all else equal, age is negatively correlated with WTP in both countries.
- WTP is lower among males compared to females in the U.S, while having a college degree is positively correlated with WTP among American respondents.
- Higher income is associated with higher WTP in both countries, but the impact is small.

Among U.S. respondents, those with liberal and moderate political affiliations exhibit greater WTP compared to conservatives



Conclusion & Discussion

Global climate change is perhaps the most important issue facing the world today. Amid the current discussions surrounding international climate change negotiations and policy cooperation, more research is needed to assess the public support for and perceived value of taking action. This is particularly true in the case of the U.S. and China as the world's leading GHG polluters and largest economies, as well as the two countries most entangled in controversies in past international climate policy negotiations.

It is particularly important to understand the degree to which citizens in these two important countries are willing to incur the significant costs that will arise from putting a price on GHG emissions, which will be a necessary component of taking action to address climate change.

In this study we employed a DBDC model applying the CVM to estimate Chinese and American WTP for climate stabilization policy. We also examined what factors influence public WTP in both countries.

The results show WTP among Chinese respondents is about 1.4 times greater than for Americans in purchasing power parity terms. However, when Chinese WTP is translated into U.S. dollars using the exchange rate, Chinese WTP is reduced to 82% of what U.S. respondents are WTP on average.

Further analysis reveals that variables associated with an acceptance and understanding of climate change realities have a strong positive correlation with WTP in both countries. Additionally, political ideology for U.S. respondents is found to have a significant influence on WTP with liberals and moderates exhibiting a higher WTP compared to conservatives.

These results suggest there is significant support among citizens in both China and the U.S. to pay for policies to address climate change. These findings are a promising indicator that public support to incur substantial costs to prevent or address climate change does in fact exist, which in turn increases the likelihood of success of future climate change policies.

In combination with the outcome from the November 2015 UNFCCC COP-21 meeting in Paris, France where both China the U.S. committed to obligations to reduce GHG emissions, there is reason for hope and optimism. However, because of the significant results found indicating partisan political differences regarding views on climate change and climate policy in the U.S., there is also reason for worry and concern.

Please see our further related research report titled *Climate Change Denial and Skepticism: A Topic Prevalence Analysis from Open-Ended Survey Questions in China and the United States* for a presentation on the presence and absence of a politically charged debate over climate change revolving around science, skepticism and denial in the U.S. and China respectively.