# Revisiting the Theory of the Calculus of Voting

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## Outline

- Research Question
- The EITM Framework
- Hypotheses
- Data and Measurement
- Empirical Evidence
- Conclusions

### **Research Question**

- The calculus of voting (Downs 1957; Riker and Ordeshook (1968):
- R = PB C + D
- 1)  $\underline{R}$ : the reward gained by the voter from voting in a given election.
- 2)  $\underline{P}$ : the probability that her marginal contribution to the election is decisive.
- 3) <u>B</u>: the individual's benefits if her preferred candidate actually wins.
- 4) <u>C</u>: the cost of voting (informational, physical, opportunity, etc.).
- <u>D</u>: the sense of citizen duty, goodwill feeling, psychological and civic benefit of voting.
- The voter turns out to vote if R > 0 and abstains if  $R \le 0$ .

#### **Research Question**

- Fiorina (1976): expressive components (**D**)
- 1) Civic duty.
- 2) Psychological support.
- This study attempts to employ an empirical implication of theoretical models (EITM) framework to reexamine the calculus of voting and expect to provide more insight into the *D* term in the model developed by Downs (1957) and Riker and Ordeshook (1968).

### The EITM Framework

• Three-Step EITM Framework (Granato et al. 2010):

**Step 1**: Identify a theoretical concept of human behavior of interest and relate it to a statistical concept.

*Step 2*: *Develop behavioral (formal) and statistical analogues.* 

#### Step 1: Identify a theoretical concept of human behavior of interest and relate it to a statistical concept

- The baseline model: R = PB C + D (1)
- 1)  $\underline{D}$ : civic duty (i.e., *O*) and affinity for candidate (i.e., *A*).
- <u>C</u>: small and constant (Niemi 1976; Aldrich 1993; Tullock 2000; Riker and Ordeshook 1968)
- $U(V) = PB + O + A \tag{2}$
- where U(V) is the utility of voting; PB is the benefit of voting;
  O is civic duty; A is the voter's affinity for candidate.
- 1) If U(V) > 0, then an individual will choose to vote.
- 2) If  $U(V) \leq 0$ , then an individual will abstain from voting.

Step 1: Identify a theoretical concept of human behavior of interest and relate it to a statistical concept

- The EITM relation:
- 1) <u>Theoretical concept</u>: decision making (U(V) = PB + O + A).
- *Applied statistical concept*: discrete choice (turnout a dichotomous action).

- $U(V) = PB + O + A \tag{2}$
- 1) <u>**PB</u>**: party differential (i.e., **Pd**) (Downs 1957).</u>
- <u>A</u>: the difference in affinity for competing candidates (i.e., <u>Ad</u>).
- U(V) = Pd + O + Ad

(3)

- An individual *i* will vote if at least one of the three components is greater than zero:
- 1)  $Pd_i > 0, O_i > 0, \text{ and } Ad_i > 0.$
- 2)  $Pd_i > 0, O_i = 0, \text{ and } Ad_i = 0.$
- 3)  $Pd_i = 0, O_i > 0, \text{ and } Ad_i = 0.$
- 4)  $Pd_i = 0, O_i = 0, \text{ and } Ad_i > 0.$
- 5)  $Pd_i > 0, O_i > 0, \text{ and } Ad_i = 0.$
- 6)  $Pd_i = 0, O_i > 0, \text{ and } Ad_i > 0.$
- 7)  $Pd_i > 0, O_i = 0, \text{ and } Ad_i > 0.$
- An individual *i* will abstain from voting if  $Pd_i = 0$ ,  $O_i = 0$ , and  $Ad_i = 0$ .

- Assume that the true values of an individual's party differential, civic duty and affinity for candidate are conditioned on her observed values,  $\widehat{Pd}_i$ ,  $\widehat{O}_i$  and  $\widehat{Ad}_i$ .
- The probability that an individual vote is:

 $\Pr(y_i = 1 \mid \widehat{Pd}_i, \widehat{O_i}, \widehat{Ad}_i) = 1 - \Pr(Pd_i = 0 \mid \widehat{Pd}_i) \Pr(O_i = 0 \mid \widehat{O_i})$  $\Pr(Ad_i = 0 \mid \widehat{Ad}_i)$ (4)

1) 
$$\Pr(Pd) = \Phi(\alpha_{Pd} + \beta_{Pd}\widehat{Pd}),$$

2)  $Pr(O) = \Phi(\alpha_0 + \beta_0 \hat{O})$ 

3) 
$$\Pr(Ad) = \Phi(\alpha_{Ad} + \beta_{Ad}\widehat{Ad}).$$

• The familiar property of the standard normal cumulative distribution function:  $1 - \Phi(z) = \Phi(-z)$ .

 $\Pr(v_i=1 | \widehat{Pd}_i, \widehat{O}_i, \widehat{Ad}_i)$  $= 1 - \left[1 - \Phi(\alpha_{Pd} + \beta_{Pd}\widehat{Pd})\right] \left[1 - \Phi(\alpha_0 + \beta_0\widehat{O})\right] \left[1 - \Phi(\alpha_{Ad} + \beta_{Ad}\widehat{Ad})\right]$  $= 1 - \Phi(-\alpha_{Pd} - \beta_{Pd}\widehat{Pd}) \Phi(-\alpha_0 - \beta_0\widehat{O}) \Phi(-\alpha_{Ad} - \beta_{Ad}\widehat{Ad})$  $= 1 - \Phi[(-\alpha_{Pd}\alpha_0\alpha_{Ad}) - (\alpha_0\alpha_{Ad}\beta_{Pd})\widehat{Pd} - (\alpha_{Pd}\alpha_{Ad}\beta_0)\widehat{O} - (\alpha_{Pd}\alpha_0\beta_{Ad})\widehat{Ad} (\alpha_{Ad}\beta_{Pd}\beta_{O})\widehat{PdO} - (\alpha_{O}\beta_{Pd}\beta_{Ad})\widehat{PdAd} - (\alpha_{Pd}\beta_{O}\beta_{Ad})\widehat{OAd} - (\beta_{Pd}\beta_{O}\beta_{Ad})\widehat{PdOAd}]$  $=\Phi[(\alpha_{Pd}\alpha_{O}\alpha_{Ad}) + (\alpha_{O}\alpha_{Ad}\beta_{Pd})\widehat{Pd} + (\alpha_{Pd}\alpha_{Ad}\beta_{O})\widehat{O} + (\alpha_{Pd}\alpha_{O}\beta_{Ad})\widehat{Ad} + (\alpha_{Ad}\beta_{Pd}\beta_{O})\widehat{Pd}\widehat{O}$  $+(\alpha_{0}\beta_{Pd}\beta_{Ad})\widehat{Pd}\widehat{Ad} + (\alpha_{Pd}\beta_{0}\beta_{Ad})\widehat{O}\widehat{Ad} + (\beta_{Pd}\beta_{0}\beta_{Ad})\widehat{Pd}\widehat{O}\widehat{Ad}]$  $= \Phi[\gamma_0 + \gamma_1 \widehat{Pd} + \gamma_2 \widehat{O} + \gamma_3 \widehat{Ad} + \gamma_4 (\widehat{Pd}\widehat{O}) + \gamma_5 (\widehat{Pd}\widehat{Ad}) + \gamma_6 (\widehat{O}\widehat{Ad}) + \gamma_7 (\widehat{Pd}\widehat{O}\widehat{Ad})]$ (5)

Equation (5) is simply a conventional probit regression setup with several interaction terms.

- Probit(Turnout) =  $\delta_0 + \delta_1$ (Party differential) +  $\delta_2$ (Civic duty) +  $\delta_3$ (Affinity for candidate) +  $\delta_4$ (Party differential × Civic duty) +  $\delta_5$ (Party differential × Affinity for candidate) +  $\delta_6$ (Civic duty × Affinity for candidate) +  $\delta_7$ (Party differential × Civic duty × Affinity for candidate) (6)
- It is expected to find that  $\delta_1$ ,  $\delta_2$ , and  $\delta_3$  are positive.
- But how are  $\delta_4$ ,  $\delta_5$ ,  $\delta_6$  and  $\delta_7$ ?

- From equation (5) (i.e.,  $\Pr(y_i=1 | \widehat{Pd}_i, \widehat{O}_i, \widehat{Ad}_i) = 1 \Phi(-\alpha_{Pd} \beta_{Pd} \widehat{Pd}) \Phi(-\alpha_0 \beta_0 \widehat{O}) \Phi(-\alpha_{Ad} \beta_{Ad} \widehat{Ad}))$ , it is known that as an individual's civic duty rises,  $\Phi(-\alpha_0 \beta_0 \widehat{O}) \rightarrow \Phi(-\infty) = 0$ .
- Then she will approach 100 percent probability of turnout and the effects of party differential and affinity for candidate will be negligible.
- By contrast, if an individual has low level of civic duty (i.e.,  $\Phi(-\alpha_{O} - \beta_{O}\hat{O}) \rightarrow 1$ ), then equation (5) will reduce to:  $\Pr(y_{i}=1 \mid \widehat{Pd}_{i}, \widehat{Ad}_{i}) = 1 - \Phi(-\alpha_{Pd} - \beta_{Pd}\widehat{Pd})$   $\Phi(-\alpha_{Ad} - \beta_{Ad}\widehat{Ad})$ (7)

- Equation (7) reflects that when an individual does not regard voting as her civic responsibility, her turnout decision is mainly driven by her party differential and affinity for candidate.
- With the increase of civic duty, the effects of party differential and affinity for candidate on turnout will be diminishing.
- By contrast, lack of civic duty will strengthen the impacts of party differential and affinity for candidate on turnout.

- The same logic can also be applied to the situations for party differential and affinity for candidate.
- Our theoretical model suggests that party differential, civic duty and affinity for candidate have their own individual effects on turnout, and more importantly they also interact to affect turnout.
- The interactions are the key to showing the relationship that the effect of one variable on voter participation weakens as another variable becomes important in affecting turnout decisions.
- The four interaction terms in equation (6) (i.e.,  $\delta_4$ ,  $\delta_5$ ,  $\delta_6$  and  $\delta_7$ ) should display *negative* signs.

### Hypotheses

- $H_1$ : Party differential is positively associated with voter turnout (i.e.,  $\delta_1 > 0$ ).
- $H_2$ : Civic duty is positively associated with voter turnout (i.e.,  $\delta_2 > 0$ ).
- $H_3$ : Affinity for candidate is positively associated with voter turnout (i.e.,  $\delta_3 > 0$ ).

### Hypotheses

- $H_4$ : The interaction between party differential and civic duty is negatively associated with voter turnout (i.e.,  $\delta_4 < 0$ ).
- $H_5$ : The interaction between party differential and affinity for candidate is negatively associated with voter turnout (i.e.,  $\delta_5 < 0$ ).
- $H_6$ : The interaction between civic duty and affinity for candidate is negatively associated with voter turnout (i.e.,  $\delta_6 < 0$ ).
- $H_7$ : The interaction among party differential, civic duty and affinity for candidate is negatively associated with voter turnout (i.e.,  $\delta_7 < 0$ ).

- Data: The ANES 2010-2012 Evaluations of Government and Society Study (EGSS1).
- Dependent variable: *Voter Turnout in the Congressional elections*

What is the percent chance that you will vote in the Congressional elections this November? The percent chance can be thought of as the number of chances out of 100.You can use any number between 0 and 100. For example, numbers like 2 and 5 percent may be "almost no chance," 20 percent or so may mean "not much chance," a 45- or 55-percent chance may be a "pretty even chance," 80 percent or so may mean a "very good chance," and a 95- or 98-percent chance may be "almost certain."

- Responses are rescaled to 1 and 0: 1 = 100 percent and 0 otherwise.
- 41 percent of respondents are coded to vote and this number is close to the average turnout rate in midterm elections (39.8 percent over the past 50 years).

- Key independent variables:
- <u>Party differential</u> =  $| I_i I_R | | I_i I_D |$
- where *I<sub>i</sub>* is voter *i*'s ideological position, *I<sub>R</sub>* is voter *i*'s perception about the ideological position of Republican Party, and *I<sub>D</sub>* is voter *i*'s perception about the ideological position of Democratic Party.

• **Party differential**  $\geq 0$ .

#### • <u>Civic duty</u>

- Different people feel differently about voting. For some, voting is a duty – they feel they should vote in every election no matter how they feel about the candidates and parties. For others voting is a choice – they feel free to vote or not to vote, depending on how they feel about the candidates and parties.
   How strongly do you feel that voting is a (choice/duty)?
- Civic duty is coded to range from 0 to 6: 0 = very strongly mainly a choice; 3 = neither a choice nor a duty; 6 = very strongly mainly a duty.

- <u>Affinity for candidate</u> =  $||A_{HRi} A_{HDi}| + ||A_{SRi} A_{SDi}||$
- where  $A_{HRi}$  is voter *i*'s affinity for the House Republican candidate;  $A_{HDi}$  is voter *i*'s affinity for the House Democratic candidate;  $A_{SRi}$  is voter *i*'s affinity for the Senate Republican candidate;  $A_{SDi}$  is voter *i*'s affinity for the the Senate Democratic candidate.
- Affinity for candidate  $\geq 0$ .

Table 1. Correlations between Key Independent Variables					
	Party differential	Civic duty	Affinity for candidate		
Party differential	1.00				
Civic duty	0.15***	1.00			
Affinity for candidate	0.32***	0.21***	1.00		
N		996			

Note: \*\*\* is significant at p < 0.01.

- Control variables:
- 1) Political efficacy.
- 2) Political interest.
- 3) Strength of party ID.
- Demographic variables (ex., income, education, race, gender and age).

Variable	Mean	S.D.	Min.	Max.
Turnout	0.41	0.49	0	1
Party differential	2.25	1.82	0	6
Civic duty	3.11	2.36	0	6
Affinity for candidate	2.76	2.94	0	12
Political efficacy	1.57	1.12	0	4
Political interest	2.17	1.18	0	4
Strength of party ID	1.79	1.05	0	3
Income	9.99	4.52	0	18
College and above degree	0.32	0.47	0	1
Black	0.11	0.32	0	1
Hispanie	0.10	0.30	0	1
Others (Asian and other)	0.05	0.22	0	1
Female	0.50	0.50	0	1
Age	46.64	17.19	18	100
Ν		99	96	

#### Table 2. Descriptive Statistics of All Variables

I able 5. Binary Probit Analysis of	voter 1 u	rnout		
	Model 1 Model 2			
	Coef.		Coef.	
	(S.D.)		(S.D.)	
Party differential $(\delta_I)$	<mark>0.134</mark>	***	<mark>0.259</mark>	***
	(0.025)		(0.059)	
Civic duty (82)	0.157	***	<mark>0.272</mark>	***
	(0.019)		(0.050)	
Affinity for candidate $(\delta_3)$	<mark>0.126</mark>	***	<mark>0.201</mark>	***
	(0.016)		(0.050)	
Party differential $\times$ Civic duty ( $\delta_4$ )			-0.027	*
			(0.016)	
Party differential $\times$ Affinity for candidate $(\delta_5)$			-0.010	
			(0.014)	
Civic duty × Affinity for candidate $(\delta_6)$			-0.010	
			(0.013)	
Party differential × Civic duty × Affinity for candidate $(\delta_7)$			-0.001	
			(0.003)	
Constant	-1.422	***	-1.881	***
	(0.097)		(0.182)	
N	996		996	
Likelihood ratio test	237.15	***	257.92	***
Pseudo R <sup>2</sup>	0.18		0.19	
AIC	1113.23		1100.45	
BIC	1132.84		1139.67	
-2*Log likelihood	1105.23		1084.45	

Table 3. Binary Probit Analysis of Voter Turnout

Note: **\*\*\*** is significant at  $p \le 0.01$ ; **\*\*** is significant at  $p \le 0.05$ ; **\*** is significant at  $p \le 0.10$ .

#### High correlations between interaction terms

	Party differential × Civic duty	Party differential × Affinity for candidate	Civic duty × Affinity for candidate	Party differential × Civic duty × Affinity for candidate
Party differential × Civic duty	1.00			
Party differential × Affinity for candidate	0.48***	1.00		
Civic duty × Affinity for candidate	0.59***	0.63***	1.00	
Party differential $\times$ Civic duty $\times$ Affinity for candidate	0.73***	0.78***	0.87***	1.00
N			996	

Table 4. Correlations between Interaction Terms

Note: \*\*\* is significant at p < 0.01.

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Table 3. Binary Probit Analysis of Voter Turnout					
(S.D.)         (S.D.)         (S.D.)         (S.D.)         (S.D.)           Party differential $(\delta_g)$ 0.184 ***         0.259 ***         0.272 ***         0.128 ***         0.120 ***           Civic duty $(\delta_g)$ 0.157 ***         0.272 ***         0.284 ***         0.220 ***           Affinity for candidate $(\delta_g)$ 0.126 ***         0.201 ***         0.213 ***         0.040           Party differential × Civic duty $(\delta_g)$ 0.016         (0.037)         (0.040)         (0.040)           Party differential × Affinity for         0.016         (0.011)         (0.012)         (0.040)           Party differential × Affinity for candidate $(\delta_g)$ (0.016)         (0.011)         (0.012)           Civic duty × Affinity for candidate $(\delta_g)$ (0.013)         (0.006)         (0.007)           Party differential × Civic duty ×         -0.001         -0.014         **         -0.017           Affinity for candidate $(\delta_g)$ (0.013)         (0.006)         (0.017)         (0.048)           Political interest         -0.010         -0.014         **         0.017         ***           Political interest         0.059         (0.012)         -0.026         (0.012)           Income         -0.026		Model 1	Model 2	Model 3	Model 4	
Party differential $(\delta_{ij})$ 0.134         ****         0.259         ****         0.272         ****         0.159         ****           Civic duty $(\delta_{j})$ 0.157         ***         0.220         ****         0.220         ****         0.220         ****         0.220         ****         0.220         ****         0.221         ****         0.221         ****         0.221         ****         0.221         ****         0.221         ****         0.221         ****         0.221         ****         0.021         ****         0.021         ****         0.021         ****         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.021         ***         0.014         ***         0.014         ***         0.014         ***         0.014         ***         0.014         ***         0.014         ***         0.014         ***         0.014         ***         0.011         ****         0.011<		Coef.	Coef.	Coef.	Coef.	
Civic duty $(\delta_j)$ (0.025)       (0.059)       (0.048)       ***       (0.024)         Affinity for candidate $(\delta_j)$ (0.019)       (0.050)       (0.038)       ***       (0.040)         Affinity for candidate $(\delta_j)$ (0.016)       (0.050)       (0.037)       (0.040)         Party differential × Civic duty $(\delta_q)$ (0.016)       (0.011)       (0.012)         Party differential × Affinity for candidate $(\delta_g)$ (0.014)       (0.008)       (0.009)         Civic duty × Affinity for candidate $(\delta_g)$ (0.014)       (0.008)       (0.009)         Civic duty × Affinity for candidate $(\delta_g)$ (0.014)       (0.008)       (0.007)         Party differential × Civic duty ×       -0.001       -0.014       ***       -0.001         Party differential × Civic duty ×       -0.001       -0.014       ***       -0.001         Political interest       0.037       (0.055)       (0.055)       -0.026         Strength of party ID       0.059       (0.011)       (0.012)       -0.026         Income       (0.012)       -0.026       (0.111)       -0.026         Hispanic       -0.026       (0.170)       -0.026       (0.017)         Others (Asian and other)       -0.044       (0.027)				(S.D.)		
Civic duty $(\delta_2)$ 0.157       ***       0.272       ***       0.284       ***       0.220       ***         Affinity for candidate $(\delta_2)$ 0.019       (0.050)       (0.033)       (0.040)         Party differential × Civic duty $(\delta_2)$ 0.026       ***       0.027       *       0.027       **       0.027       **       0.027       **       0.027       **       0.027       **       0.027       **       0.027       **       0.027       **       0.027       **       0.014       **	Party differential $(\delta_1)$	<mark>0.134</mark> ***	0.259 ***	0.272 ***	0.159 ***	
Affinity for candidate $(\delta_2)$ (0.019)       (0.050)       (0.038)       (0.040)         Party differential × Civic duty $(\delta_2)$ 0.027       **       0.037       (0.040)         Party differential × Affinity for candidate $(\delta_2)$ 0.016       (0.014)       (0.013)       (0.012)         Curie duty × Affinity for candidate $(\delta_2)$ 0.010       0.014       **       0.006         Civic duty × Affinity for candidate $(\delta_2)$ 0.010       0.014       **       0.014         Party differential × Civic duty ×       -0.010       0.014       **       0.014       **         Party differential × Civic duty ×       -0.010       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.014       **       0.017       **       0.015       0.007       **       0.015       0.015       0.015       0.015       0.015       0.015       0			· ·	· ·	· ·	
Affinity for candidate $(6_2)$ 0.126       ****       0.201       ****       0.215       ****       0.124       ****         Party differential × Civic duty $(6_4)$ (0.016)       (0.050)       (0.037)       (0.040)         Party differential × Affinity for candidate $(6_4)$ (0.016)       (0.014)       (0.012)         Civic duty × Affinity for candidate $(6_4)$ -0.010       -0.014       **       -0.006         Civic duty × Affinity for candidate $(6_4)$ -0.010       (0.014)       (0.009)       (0.007)         Party differential × Civic duty ×       -0.010       -0.014       **       -0.016         Affinity for candidate $(6_2)$ 0.003       (0.003)       (0.007)       (0.013)         Party differential × Civic duty ×       -0.001       (0.013)       (0.006)       (0.007)         Party differential × Civic duty ×       -0.001       (0.013)       (0.005)       (0.011)       ***         Political interest       0.037       ***       (0.012)       (0.055)       (0.055)       (0.051)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.012)       (0.017)       (0.021)       (0.017)       (	Civic duty $(\delta_2)$			0.204	0.220	
Party differential × Civic duty ( $\delta_{e}$ )       (0.016)       (0.050)       (0.037)       (0.040)         Party differential × Affinity for candidate ( $\delta_{e}$ )       (0.016)       (0.011)       (0.012)       *** $0.002$ ** $0.002$ *** $0.002$ *** $0.002$ *** $0.001$ (0.012)       *** $0.001$ *** $0.001$ *** $0.014$ (0.013)       (0.009)       *** $0.014$ *** $0.017$ *** $0.017$ *** $0.017$ *** $0.017$ *** $0.055$ (0.012)       (0.012)       (0.012)       (0.012)       (0.017)       (0.017)       (0.017)       (0.017) </td <td></td> <td></td> <td>· ·</td> <td></td> <td>· ·</td>			· ·		· ·	
Party differential × Civic duty ( $\delta_{e}$ )       0.027       *       0.032       ****       0.027       **         Party differential × Affinity for       -0.010       0.014       *       0.009       (0.019)         Civic duty × Affinity for candidate ( $\delta_{e}$ )       0.010       0.014       **       0.017       **       **       0.017       **       **       0.017       **       **       0.017       **       **       0.017       **       **       0.017       **       *       0.017	Affinity for candidate $(\partial_3)$			0.210		
any anticinal $\kappa$ of the any (e)       local       each       each         Party differential $\times$ Affinity for candidate ( $\delta_{2}$ )       (0.016)       (0.011)       (0.009)         Civic duty $\times$ Affinity for candidate ( $\delta_{2}$ )       (0.014)       (0.008)       (0.007)         Party differential $\times$ Civic duty $\times$ -0.010 $\delta_{0.014}$ ** $\delta_{0.014}$ Party differential $\times$ Civic duty $\times$ -0.001       (0.003)       (0.006)       (0.007)         Party differential $\times$ Civic duty $\times$ -0.001       (0.003)       (0.006)       (0.007)         Political efficacy       0.011       ***       0.011       ***         Political interest       0.357       ****       (0.055)         Strength of party ID       0.059       (0.051)       (0.051)         Income       0.037       ****       (0.012)         College and above degree       -0.026       (0.111)         Black       -0.271       (0.023)         Hispanic       -0.047       (0.023)         Query       -1.881 ****       -1.918       ***         Constant       -1.422 ****       -1.881 ****       -1.918       ***         M       996       996       996       996	Parts differential of Civic data (5.)	(0.016)				
Party differential × Affinity for candidate $(\delta_{ij})$ -0.010       0.014       *       -0.006         Civic duty × Affinity for candidate $(\delta_{ij})$ -0.010       0.014       **       0.009         Party differential × Civic duty ×       -0.001       0.014       **       0.014       **         Party differential × Civic duty ×       -0.001       0.014       **       0.014       **       0.014       **         Party differential × Civic duty ×       -0.001       0.006       0.014       **       0.014       **       0.014       **       0.014       **       **       0.014       **       0.014       **       0.014       **       0.014       **       0.001       ***       0.014       **       0.001       ***       0.014       **       0.001       ***       0.014       **       0.001       ***       0.014       ***       0.014       ***       0.014       ***       0.011       ***       0.011       ***       0.011       ***       0.015       0.015       0.015       0.015       0.015       0.015       0.015       0.015       0.011       ***       0.012       0.016       0.0111       0.011       0.011       0.011       0.011       0.011	Party differential $\times$ Civic duty $(o_4)$			0.002		
and date $(\delta_{2})$ (0.014)       (0.008)       (0.009)         Civic duty × Affinity for candidate $(\delta_{2})$ -0.010       0.014       **       -0.014         Party differential × Civic duty ×       -0.001       (0.003)       (0.007)       -0.014       **         Affinity for candidate $(\delta_{2})$ (0.003)       (0.006)       0.011       **       (0.048)         Political efficacy       0.111       **       (0.048)       0.357       ***         Political interest       0.357       ***       (0.055)       0.059         Strength of party ID       0.059       (0.012)       (0.012)         Income       (0.012)       -0.026       (0.111)         Black       -0.271       (0.166)       -0.050       (0.170)         Others (Asian and other)       -0.044       (0.023)       (0.044)       (0.023)         Female       -1.422       ***       -1.881       ***       -1.918       ***       -3.516       ***         N       996       996       996       996       996       996       996       996       996       996       996       996       996       996       996       996       996       996       996	Dente differential of Affaits for			· · · ·		
Civic duty × Affinity for candidate ( $\delta_{el}$ )       -0.010       -0.014       ***       -0.014       ***         Party differential × Civic duty ×       -0.001       (0.006)       (0.007)       -0.011       ***         Affinity for candidate ( $\delta_{el}$ )       (0.003)       (0.006)       (0.007)       -0.011       ***         Political efficacy       0.011       ***       -0.001       (0.008)       ***         Political interest       0.357       ***       (0.055)       ***         Strength of party ID       0.037       ****       (0.012)       (0.012)         Income       0.037       ****       (0.012)       (0.011)         Black       -0.271       (0.166)       (0.111)       (0.166)         Hispanic       -0.044       (0.097)       (0.223)       (0.223)         Female       -0.047       (0.097)       (0.124)       (0.272)         N       996       996       996       996       996         N       996       996       996       996       996         Likelhood ratio test       237.15       ***       257.92       ***       257.77       ***       402.72       ***         N       996 <t< td=""><td></td><td></td><td></td><td></td><td></td></t<>						
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Party differential × Civic duty ×       -0.001         Affinity for candidate ( $\delta_{2}$ )       (0.003)         Political efficacy       0.111 **         Political interest       0.357 ***         Strength of party ID       0.059         Income       (0.012)         College and above degree       -0.026         Black       -0.271         Hispanic       -0.050         Others (Asian and other)       -0.044         Female       -0.047         Constant       -1.422 ***       -1.881 ***       -1.918 ***       -3.516 ***         N       996       996       996       996       996         N       996       996       996       996       996         Likelihood ratio test       237.15 ***       257.92 ***       257.77 ***       402.72 ***         N       996       996       996       996       996         AIC       1113.23       1100.45       1098.60       973.65	· · · · · · · · · · · · · · · · · · ·					
Affinity for candidate (6-)       (0.003)         Political efficacy       0.111       **         Political interest       0.357       ****         Strength of party ID       0.059       (0.051)         Income       0.037       ****         College and above degree       -0.026       (0.111)         Black       -0.271       (0.166)         Hispanic       -0.050       (0.170)         Others (Asian and other)       -0.044       (0.223)         Female       -0.047       (0.097)         Age       0.017       ****         (0.097)       (0.154)       (0.272)         N       996       996       996         N       996       996       996         N       996       996       996         N       996       996       996         NLikelhhood ratio test       237.15       *257.92       ***         Pseudo R <sup>2</sup> 0.18       0.19       0.30         AIC       1113.23       1100.45       1098.60       973.65	Party differential × Civic duty ×					
Political interest $(0.048)$ Strength of party ID $0.357$ Income $0.059$ College and above degree $0.037$ College and above degree $-0.026$ Mispanic $-0.271$ Others (Asian and other) $-0.044$ Female $-0.047$ Konstant $-1.422$ Vertication $-1.881$ N       996       996         N       996       996       996         Likelihood ratio test $237.15$ $27.77$ $27.77$ N       996       996       996       996         AIC       1113.23       1100.45       1098.60       973.65			(0.003)			
Political interest $0.357$ ***         Strength of party ID $0.059$ Income $0.037$ ***         College and above degree $-0.026$ College and above degree $-0.026$ Hispanic $-0.050$ Others (Asian and other) $-0.044$ Female $-0.047$ Konstant $-1.422$ $***$ $(0.097)$ $(0.182)$ $(0.154)$ N       996       996       996         Likelihood ratio test $237.15$ $257.92$ $257.77$ $402.72$ $***$ Pseudo $R^2$ $0.18$ $0.19$ $0.30$ AIC       1113.23 $1100.45$ $1098.60$ $973.65$	Political efficacy				0.111 **	
Strength of party ID       (0.055) 0.059         Income       (0.012)         College and above degree       -0.026         Black       -0.026         Hispanic       -0.050         Others (Asian and other)       -0.044         Female       -0.047         Konstant       -0.047         (0.097)       (0.182)         Voltasi       -0.017         Age       0.017         N       996       996       996         Likelihood ratio test       237.15       257.92       257.77       ***         Pseudo $R^2$ 0.18       0.19       0.30         AIC       1113.23       1100.45       1098.60       973.65					(0.048)	
Strength of party ID $0.059$ Income $0.037$ College and above degree $-0.026$ Black $-0.271$ Hispanic $-0.050$ Others (Asian and other) $-0.044$ Female $-0.047$ (0.097) $0.017$ Age $0.017$ (0.097) $(0.182)$ N       996       996       996         N       996       996       996         Likelihood ratio test $237.15$ $257.92$ $257.77$ $402.72$ $***$ Pseudo $R^2$ $0.18$ $0.19$ $0.30$ $AIC$ $1113.23$ $1100.45$ $1098.60$ $973.65$	Political interest				0.357 ***	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$						
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College and above degree       -0.026         Black       -0.271         Hispanic       -0.050         Others (Asian and other)       -0.044         Female       -0.047         Konstant       -1.422 ***         -1.422 ***       -1.881 ***         (0.097)       (0.170)         N       996         996       996         996       996         996       996         996       996         996       996         1113.23       1100.45         AIC       1113.23	Income					
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Hispanic       (0.166)         Hispanic       -0.050         Others (Asian and other)       -0.044         Female       -0.047         Age       0.017         Constant       -1.422       ***         (0.097)       (0.182)         N       996       996         996       996       996         996       996       996         Stikelihood ratio test       237.15       257.92         Pseudo $R^2$ 0.18       0.19       0.19         AIC       1113.23       1100.45       1098.60       973.65	Black					
Hispanic $-0.050$ Others (Asian and other) $-0.044$ Female $-0.047$ Age $0.017$ Constant $-1.422$ $-1.881$ $(0.097)$ $(0.097)$ N       996       996       996         Likelihood ratio test $237.15$ $257.92$ $257.77$ $402.72$ N       996       996       996       996         Likelihood ratio test $237.15$ $257.92$ $257.77$ $402.72$ AIC       1113.23       1100.45       1098.60       973.65						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Hispanie					
Female       (0.223) -0.047 (0.097)         Age $0.017$ *** (0.003)         Constant $-1.422$ *** (0.097) $-1.918$ *** (0.154) $-3.516$ *** (0.272)         N       996       996       996       996       996       996         Likelihood ratio test       237.15 $257.92$ $257.77$ $402.72$ *** 402.72         N       996       996       996       996       996       996         Likelihood ratio test $237.15$ $88.792$ $257.77$ $402.72$ $88.792$ AIC       1113.23       1100.45       1098.60       973.65	-				(0.170)	
Female       -0.047         Age $0.017$ ***         Constant $-1.422$ *** $-1.881$ *** $-1.918$ *** $-3.516$ ***         Constant $-1.422$ *** $-1.881$ *** $-1.918$ *** $-3.516$ ***         N       996       996       996       996       996         Likelihood ratio test       237.15 ***       257.92 ***       257.77 ***       402.72 ***         Pseudo $R^2$ 0.18       0.19       0.19       0.30         AIC       1113.23       1100.45       1098.60       973.65	Others (Asian and other)				-0.044	
Age $(0.097)$ $(0.017)$ **** $(0.003)$ Constant $-1.422$ *** $-1.881$ *** $-3.516$ ***           N         996         996         996         996         996         996           Likelihood ratio test         237.15         ***         257.92         ***         402.72         ***           Pseudo $R^2$ 0.18         0.19         0.19         0.30         AIC         1113.23         1100.45         1098.60         973.65					(0.223)	
Age $0.017$ ***           Constant $-1.422$ *** $-1.881$ *** $-3.516$ ***           Constant $-0.097$ $(0.182)$ $(0.154)$ $(0.272)$ N         996         996         996         996           Likelihood ratio test         237.15         ***         257.92         ***         402.72         ***           Pseudo $R^2$ 0.18         0.19         0.19         0.30         AIC         1113.23         1100.45         1098.60         973.65	Female				-0.047	
Constant $-1.422$ *** (0.097) $-1.881$ *** (0.182) $-1.918$ *** (0.154) $-3.516$ *** (0.272)           N         996         996         996         996         996           Likelihood ratio test         237.15 ***         257.92 ***         257.77 ***         402.72 ***           Pseudo $R^2$ 0.18         0.19         0.19         0.30           AIC         1113.23         1100.45         1098.60         973.65						
Constant         -1.422 *** (0.097)         -1.881 *** (0.182)         -1.918 *** (0.154)         -3.516 ***           N         996         996         996         996         996           Likelihood ratio test         237.15 ***         257.92 ***         257.77 ***         402.72 ***           Pseudo R <sup>2</sup> 0.18         0.19         0.19         0.30           AIC         1113.23         1100.45         1098.60         973.65	Age					
(0.097)         (0.182)         (0.154)         (0.272)           N         996         996         996         996           Likelihood ratio test         237.15 ***         257.92 ***         257.77 ***         402.72 ***           Pseudo R <sup>2</sup> 0.18         0.19         0.19         0.30           AIC         1113.23         1100.45         1098.60         973.65	<b>C</b>	1 (22 ++++	1 001 000	1 010 444	· · ·	
N         996         996         996         996         996           Likelihood ratio test         237.15         ***         257.92         ***         257.77         ***         402.72         ***           Pseudo R <sup>2</sup> 0.18         0.19         0.19         0.30         0.30           AIC         1113.23         1100.45         1098.60         973.65	Constant					
Likelihood ratio test         237.15         ***         257.92         ***         257.77         ***         402.72         ***           Pseudo R <sup>2</sup> 0.18         0.19         0.19         0.30         0.30         0.10         0.30         0.30         0.10         0.30         0.36						
Pseudo R <sup>2</sup> 0.18         0.19         0.19         0.30           AIC         1113.23         1100.45         1098.60         973.65						
AIC 1113.23 1100.45 1098.60 973.65						
112.01 112.01 112.01 1000.00						
-2*Log likelihood 1105.23 1084.45 1087.619 939.65						
Note: *** is significant at p < 0.01; ** is significant at p < 0.05; * is significant at p < 0.10.						

	Model 1	Model 2	Model 3	Model 4
Party differential	0.051	0.098	0.103	0.059
Civie duty	0.060	0.103	0.108	0.082
Affinity for candidate	0.048	0.076	0.081	0.046
Party differential × Civic duty		-0.010	-0.012	-0.010
Party differential $\times$ Affinity for candidate		-0.004	-0.005	-0.002
Civic duty × Affinity for candidate		-0.004	-0.005	-0.005
Party differential $\times$ Civic duty $\times$ Affinity for candidate		-0.001		
Political efficacy				0.041
Political interest				0.133
Strength of party ID				0.022
Income				0.014
College and above degree				-0.010
Black				-0.096
Hispanie				-0.019
Others (Asian and other)				-0.016
Female				-0.018
Age				0.006

#### Table 5. Marginal Effects of Explanatory Variables on Voter Turnout

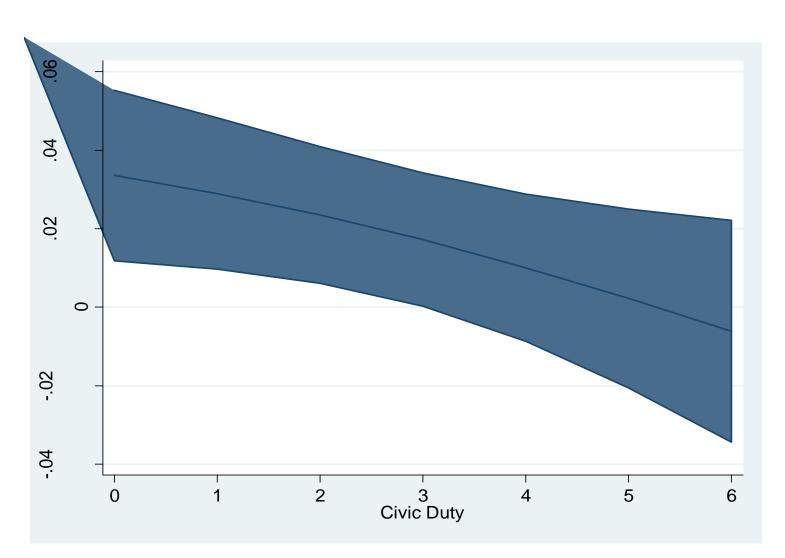


Figure 1. Average Marginal Effects of Party Differential on Voter Turnout with 95 % Confidence Intervals

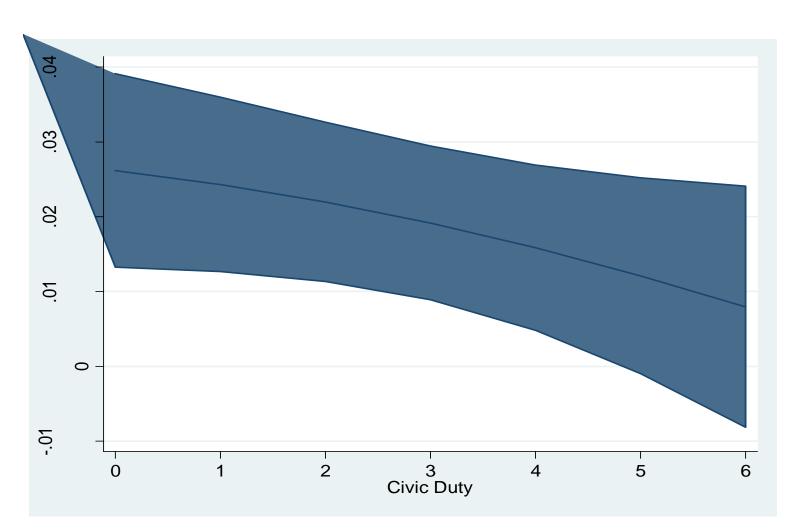


Figure 2. Average Marginal Effects of Affinity for Candidate on Voter Turnout with 95 % Confidence Intervals

Table 6. OLS Regression Analysis of Voter Turnout					
	Model l		Model 2		
-	Coef.		Coef.		
	(S.D.)		(S.D.)		
Party differential ( $\delta_1$ )	7.225	***	2.618	**	
	(1.083)		(1.018)		
Civic duty (8)	<mark>8.068</mark>	***	5.544	***	
	(0.865)		(0.769)		
Affinity for candidate ( $\delta_3$ )	7.473	***	<mark>4.348</mark>	***	
	(0.862)		(0.778)		
Party differential $\times$ Civic duty $(\delta_4)$	-0.608	**	-0.450	*	
	(0.264)		(0.231)		
Party differential $\times$ Affinity for candidate $(\delta_3)$	-0.484	**	-0.189		
	(0.202)		(0.181)		
Civic duty × Affinity for candidate $(\delta_6)$	-0.580	***	-0.583	***	
D 11/1 1 07	(0.156)		(0.136)	***	
Political efficacy			5.062	***	
Delitical interest			(0.983)	***	
Political interest			9.937	***	
Strangth of nasts ID			(1.061) 3.015	***	
Strength of party ID					
Income			(0.999) 1.070	***	
licome			(0.240)		
College and above degree			4.637	**	
conce and acore degree			(2.278)		
Black			-0.026		
			(3.142)		
Hispanie			1.338		
			(3.258)		
Others (Asian and other)			-2.112		
			(4.309)		
Female			-0.081		
			(1.926)		
Age			0.383	***	
			(0.060)		
Constant	20.427	***	-21.185	***	
	(3.004)		(4.560)		
N	996		996		
F statistic	74.13	***	56.62	***	
Adjusted R <sup>2</sup>	0.31		0.47		
Mean VIF	4.65		2.62		

Note: \*\*\* is significant at p < 0.01; \*\* is significant at p < 0.05; \* is significant at p < 0.10.

### **Another Empirical Test**

- Data: Taiwan's Election and Democratization Study: The Survey of the Presidential and Legislative Elections (TEDS2012)
- Dependent variable: *Turnout in the 2012 presidential election*.
- Key independent variables: *party differential*, *civic duty*, and *affinity for candidate*.
- **Control variables**: political efficacy, political interest, electoral concern, strength of party ID, and demographics (i.e., income, education, gender and age).

Variable	Mean	S.D.	Min.	Max.
Turnout	0.88	0.33	0	1
Party differential	4.69	3.06	0	10
Civil duty	1.74	1.17	0	3
Affinity for candidate	3.52	2.85	0	10
Political efficacy	1.45	0.49	0	3
Political interest	1.22	0.86	0	3
Electoral concern	1.97	0.74	0	3
Strength of party ID	1.67	1.04	0	3
Income	5.29	3.04	1	10
College and above degree	0.45	0.50	0	1
Female	0.48	0.50	0	1
Age	2.75	1.29	1	5
Ν		11	.53	

Table 7. Descriptive Statistics of Variables in TEDS0212

Table 8. Binary Probit Analysis of Voter Turnout in Talwan					
	Coef.		(S.E.)	M.F.	
Party differential ( $\delta_1$ )	<mark>-0.061</mark>	**	(0.031)	-0.008	
Civil duty (82)	<mark>0.380</mark>	***	(0.100)	0.048	
Affinity for candidate $(\delta_3)$	<mark>0.160</mark>	***	(0.053)	0.020	
Party differential × Civil duty (δ4)	0.037	**	(0.017)	0.005	
Party differential $\times$ Affinity for candidate ( $\delta_5$ )	-0.008		(0.007)	-0.001	
Civil duty × Affinity for candidate ( $\delta_6$ )	-0.047	**	(0.019)	-0.006	
Political efficacy	-0.107		(0.126)	-0.014	
Political interest	-0.028		(0.074)	-0.004	
Electoral concern	0.279	***	(0.085)	0.035	
Strength of party ID	0.123	**	(0.051)	0.016	
Income	0.000		(0.020)	0.000	
College and above degree	0.096		(0.134)	0.012	
Female	0.190	*	(0.114)	0.024	
Age	0.241	***	(0.055)	0.031	
Constant	-0.616	**	(0.298)		
N	1153				
Likelihood ratio test	233.16	***			
Pseudo R <sup>2</sup>	0.27				
-2×Log likelihood	632.99				

#### Table 8. Binary Probit Analysis of Voter Turnout in Taiwan

Note: 1. \*\*\* is significant at p < 0.01; \*\* is significant at p < 0.05; \* is significant at p < 0.10.

2. M.F. denotes marginal effects.

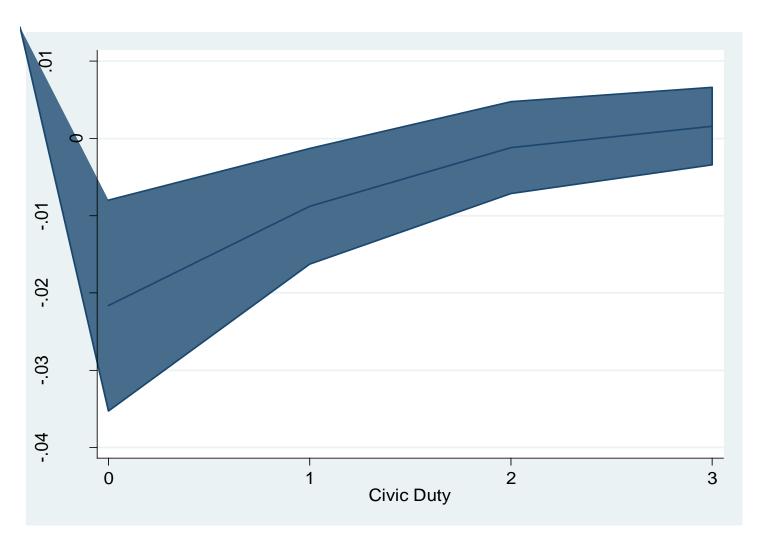


Figure 3. Average Marginal Effects of Party Differential on Voter Turnout with 95 % Confidence Intervals in Taiwan

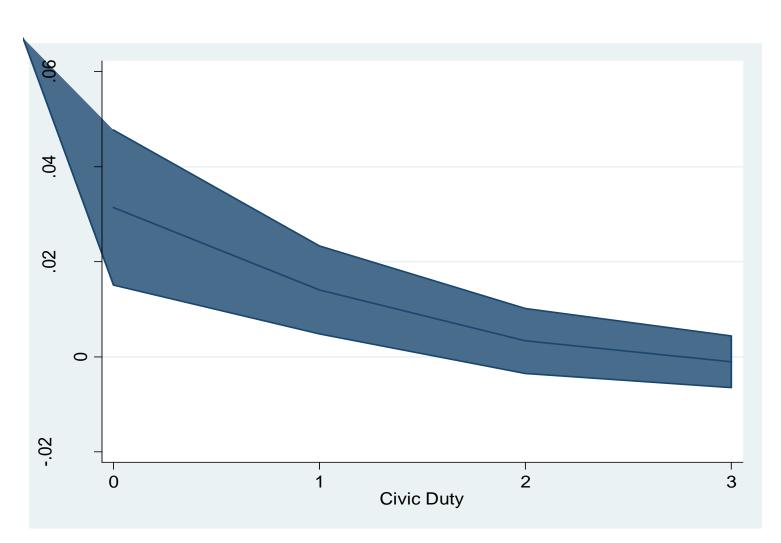


Figure 4. Average Marginal Effects of Affinity for Candidate on Voter Turnout with 95 % Confidence Intervals in Taiwan

### Conclusions

- Party differential, civic duty and affinity for candidate are positively associated with voter turnout.
- The interaction terms between party differential and civic duty and between civic duty and affinity for candidate are negatively related to turnout.
- *Implication*: Citizens with a strong sense of civic duty turn out to vote mainly because they want to fulfill their civil obligation and thus hardly take into consideration parties and candidates.
- **Suggestion**: Analysts should include choice preference, civic duty and their interaction terms in the statistical model of turnout and it is required to take the *D* term seriously.

Thanks for your listening. Any comments are welcome!

## Supplement 1 – U.S.A

#### • Party differential:

When it comes to politics, how would you describe each person or group – as (liberal, conservative, or neither liberal nor conservative / conservative, liberal, or neither conservative nor liberal)?

- 1) Yourself?
- 2) Democrats?
- 3) Republicans?

• 7-point scale: from "Very liberal" to "Very conservative."

## Supplement 2 – U.S.A

- Affinity for candidate:
  - How much do you like or dislike each person?
- 1) House Republican Candidate?
- 2) House Democratic Candidate?
- 3) Senate Republican Candidate?
- 4) Senate Democratic Candidate?
- 7-point scale: from "Like a great deal" to "dislike a great deal."

### Supplement 3 - Taiwan

#### • Party differential:

Sometimes people will talk about the question of Taiwan independence or the unification with China. Some people say that Taiwan should declare independence immediately. Others say that Taiwan and China should unify immediately. Still others have opinions between these two positions. This card lists eleven positions from independence (0) to unification (10).

- 1) What position do you think KMT occupies?
- 2) What position do you think DPP occupies?

#### Supplement 4 - Taiwan

#### • Affinity for candidate:

We'd like to get your feeling toward presidential candidates. I'll read the name of a candidate and I'd like you to rate that candidate using a 0 to 10 scale, while rating 0 means that you dislike him or her very much and rating 10 means that you like him very much.

- 1) How would you rate TSAI Ing-wen using 0 to 10 scale?
- 2) How would you rate MAYing-jeou?

### Supplement 5 - Taiwan

#### • Civic duty:

- 1) Different people have different opinions about voting. Some people think that voting is a responsibility, and you should vote even if you don't like any of the candidates or parties. Other people think that it is all right to vote or not to vote, and the decision depends on how you feel about the candidates or parties. Do you think that voting is a responsibility, or do you think that it is all right either to vote or not to vote?
- 2) Do you believe very strongly, somewhat strongly, or only a little that voting is a responsibility?