Where's the Meat? Exploring Changes in Game Management and Governance that BC Resident Hunters Value

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Summary

- Problem: Management of game species in BC is under resourced.
- Opportunity: Raise more funds from hunters to support management of game species.
- Question: What are some changes to hunting experience and governance of the resource that hunters are willing to pay for?
  - Big question! Focus on limited entry hunt (LEH) for moose.
- Answer: Hunters who participated in a LEH moose hunt are willing to pay for
  - all else equal, increased probability of harvesting an animal,
  - for constant total harvest, being able to hunt more often,
  - shifting governance to a commission of experts,
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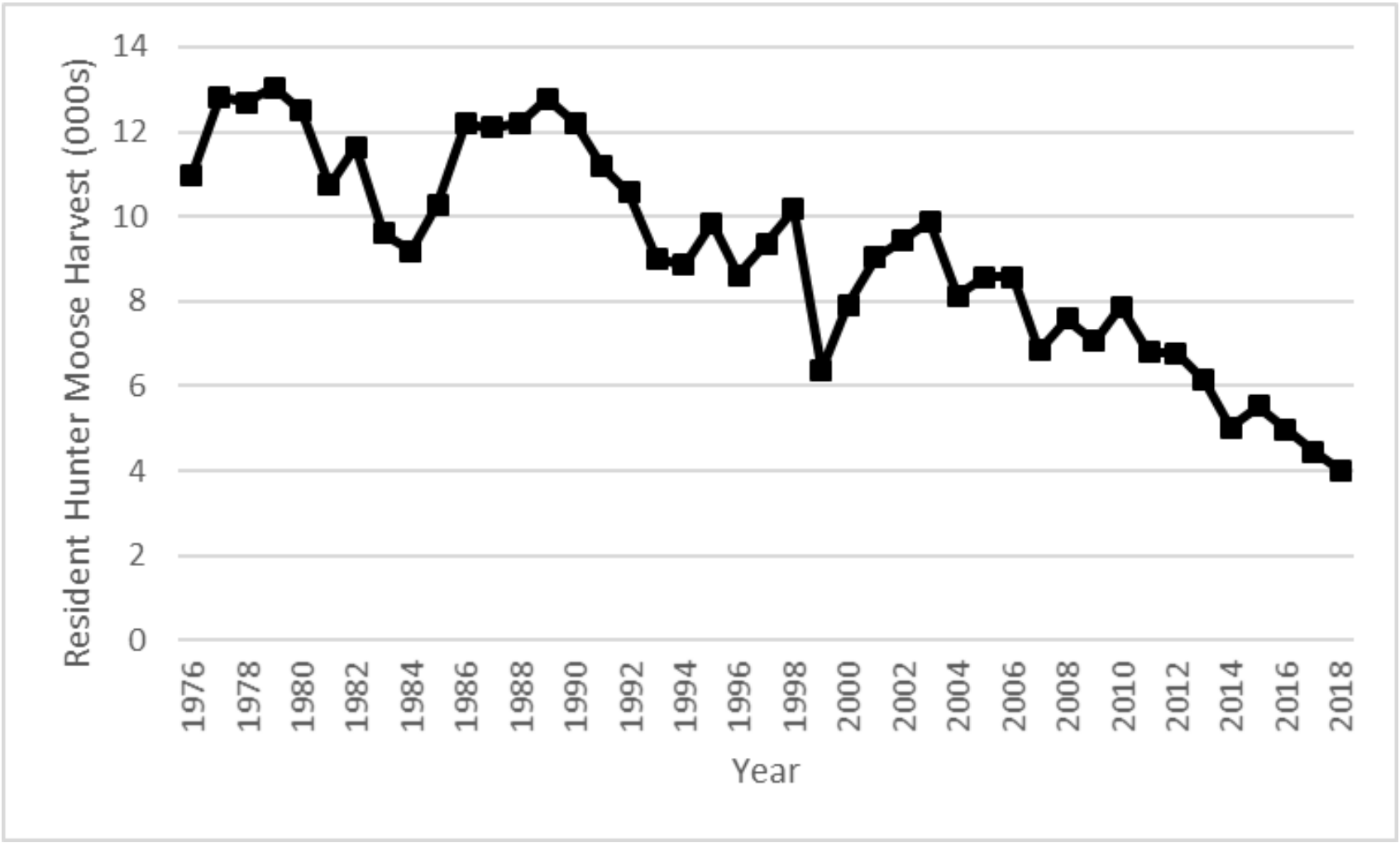
Moose Harvest Trend



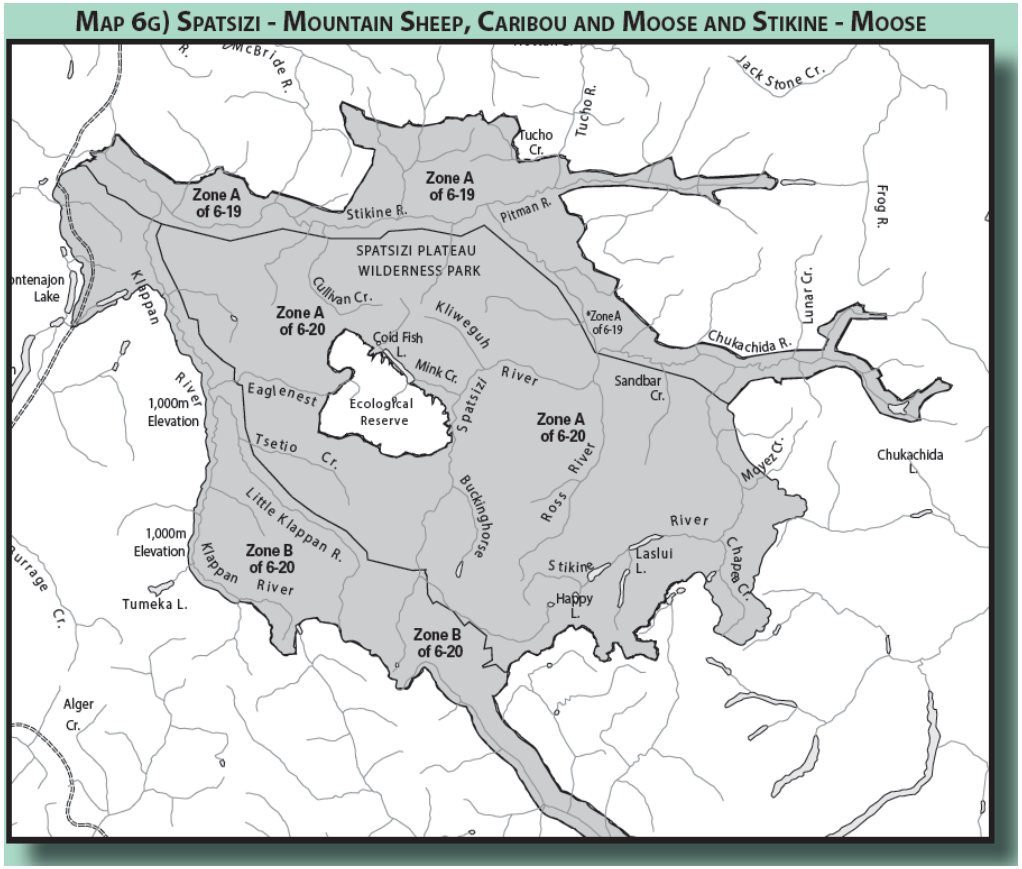
Regional Economics of Hunting

Region	Population	Median Income	Net Inflow Amount	Net Inflow Per Capita
Vancouver Island	773,788	75,843	-4,599,873	-5.94
Lower Mainland	2,846,546	84,451	-13,482,849	-4.74
Thompson Nicola	169,484	67,644	5,076,023	29.95
Kootenay	152,430	78,156	2,951,548	19.36
Cariboo	63,043	67,315	4,193,512	66.52
Skeena	77,040	74,193	998,528	12.96
Omineca	114,332	80,811	1,197,011	10.47
Peace	65,444	90,864	3,253,493	49.71
Okanagan	375,366	74,274	1,128,797	3.01

Geography of Moose Management

- Nine (7 + 2) hunting regions.
- Regions divided into management units.
- Hunts established for zones within management units, defined by time, duration, type of animal that can be taken.
- LEH application for first and second choice hunts.

Geography of Moose Management



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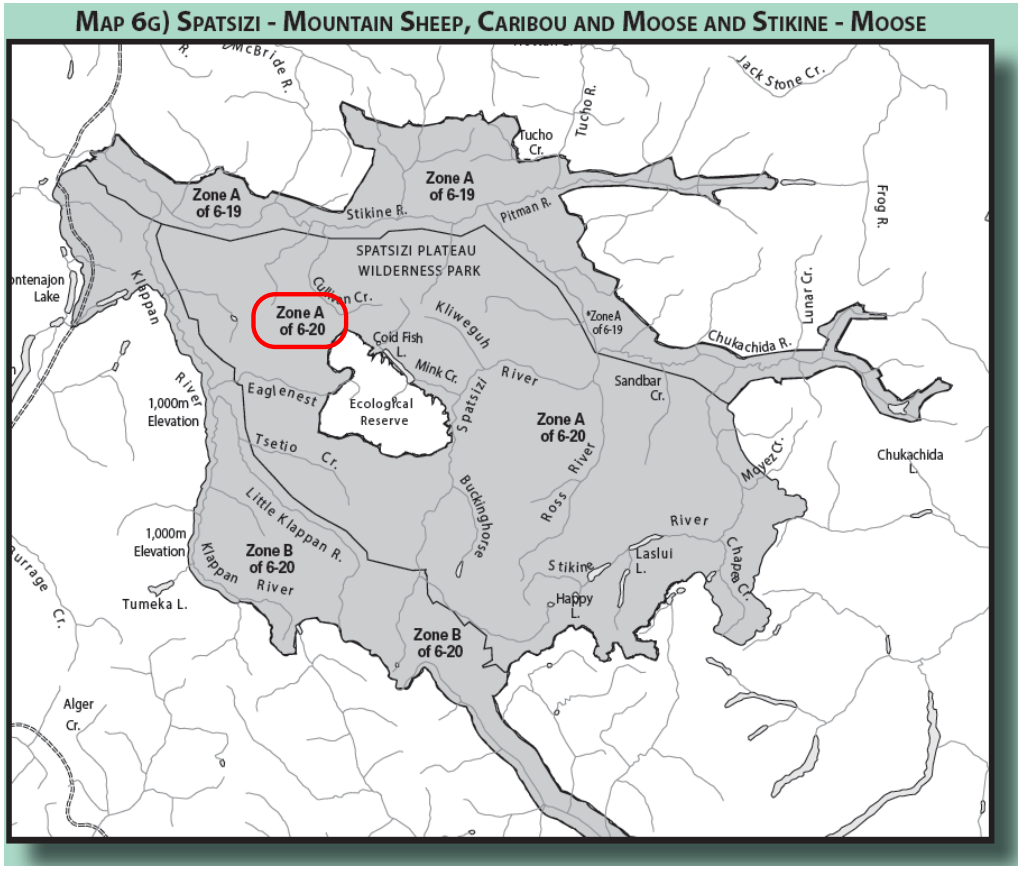

Individual Hunts

LIMITED ENTRY MOOSE SHARED HUNTS

SKEENA REGION 6 (See **Maps 6E, 6G, 6I, 6L & 6M** for boundaries)

Code	Area	M.U.	Zone	Season Dates	Class of Animal	Tentative # of Auth	2021 First Choice Odds
REGULAR HUNTS							
4245	Smithers	6-08		Sept 25-Oct 19	Bull	79	13.3:1
4246	Smithers	6-08		**Oct 20**-Nov 15	Bull	78	**N/A**
4247	Smithers	6-09		Sept 10-Sept 24	Bull	138	2.2:1
4248	Smithers	6-09		Sept 25-Oct 19	Bull	156	7.7:1
4249	Smithers	6-09		**Oct 20**-Nov 15	Bull	187	**N/A**
4250	Smithers	6-10	A*	**Sept 10-Nov 15**	Bull	**141**	**N/A**
4251	Smithers	6-15	A	**Sept 10-Nov 15**	Bull	**36**	**N/A**
4252	Stikine	6-19	A	Sept 1-Sept 14	Bull	9	0.4:1
4253	Stikine	6-19	A	Sept 15-Sept 30	Bull	10	6.3:1
4254	Stikine	6-19	A	Oct 1-Oct 15	Bull	9	5.8:1
4255	Spatsizi	6-20	A	Aug 15-Oct 15	Bull	98	1.1:1
4256	Klappan	6-20	B**	Sept 15-Sept 30	Bull	24	1.3:1
4257	Klappan	6-20	B**	Oct 1-Oct 15	Bull	24	0.9:1
4258	Smithers	6-30	A	**Sept 10-Nov 15**	Bull	**66**	**N/A**

* Includes portions of M.U. 6-03 and 6-11.

** Includes portions of M.U. 6-17 and 6-18. See **Map 6G.**

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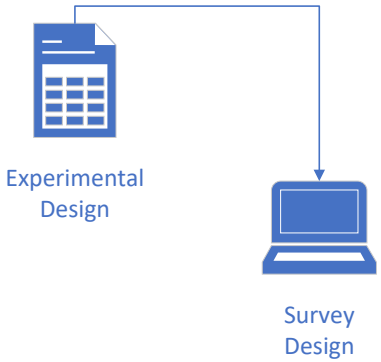
Individual Hunts

- Hunts occur in a specific area, for a specific length of time, targeting a specific species, aiming for a specific number of hunters authorized.
- Hunt parameters chosen based on (limited) information about herds.
- Hunt parameters determine expected harvest, and thereby expected population after hunt.
- Declining moose numbers and increasing hunting demand resulting in greater share of hunts being limited entry.

Choice Experiment

Experimental Design

Choice Experiment



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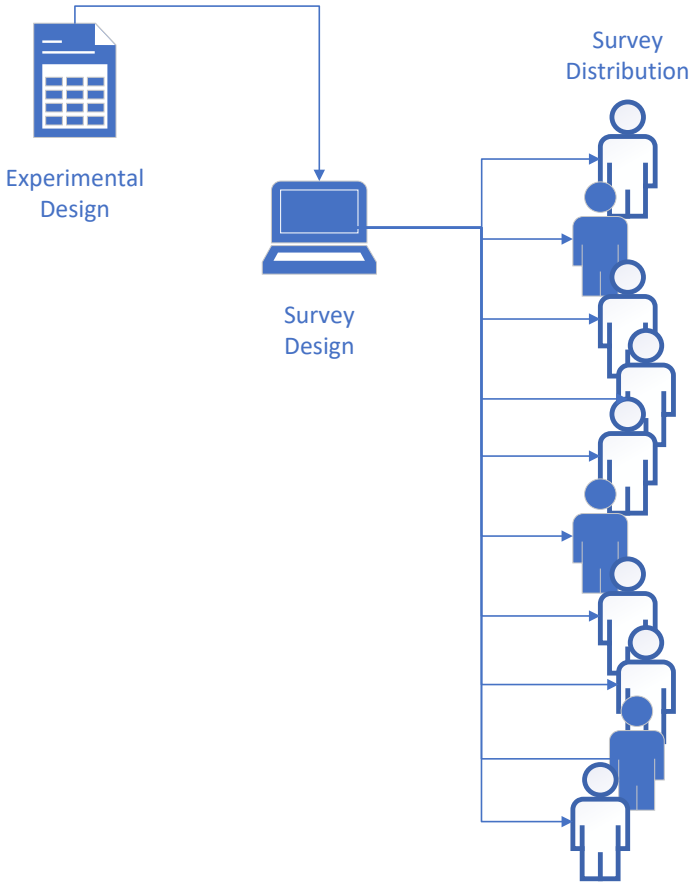

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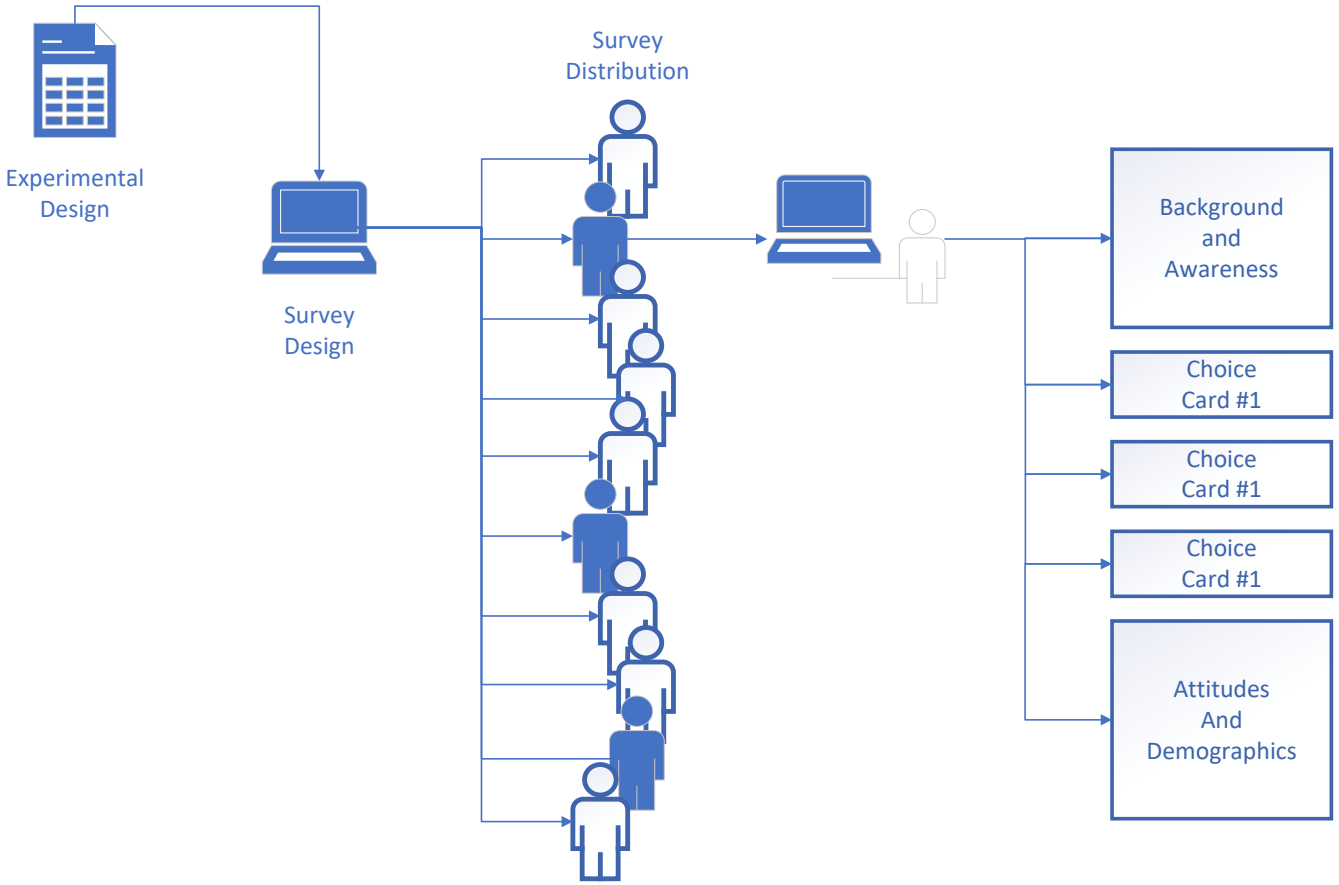

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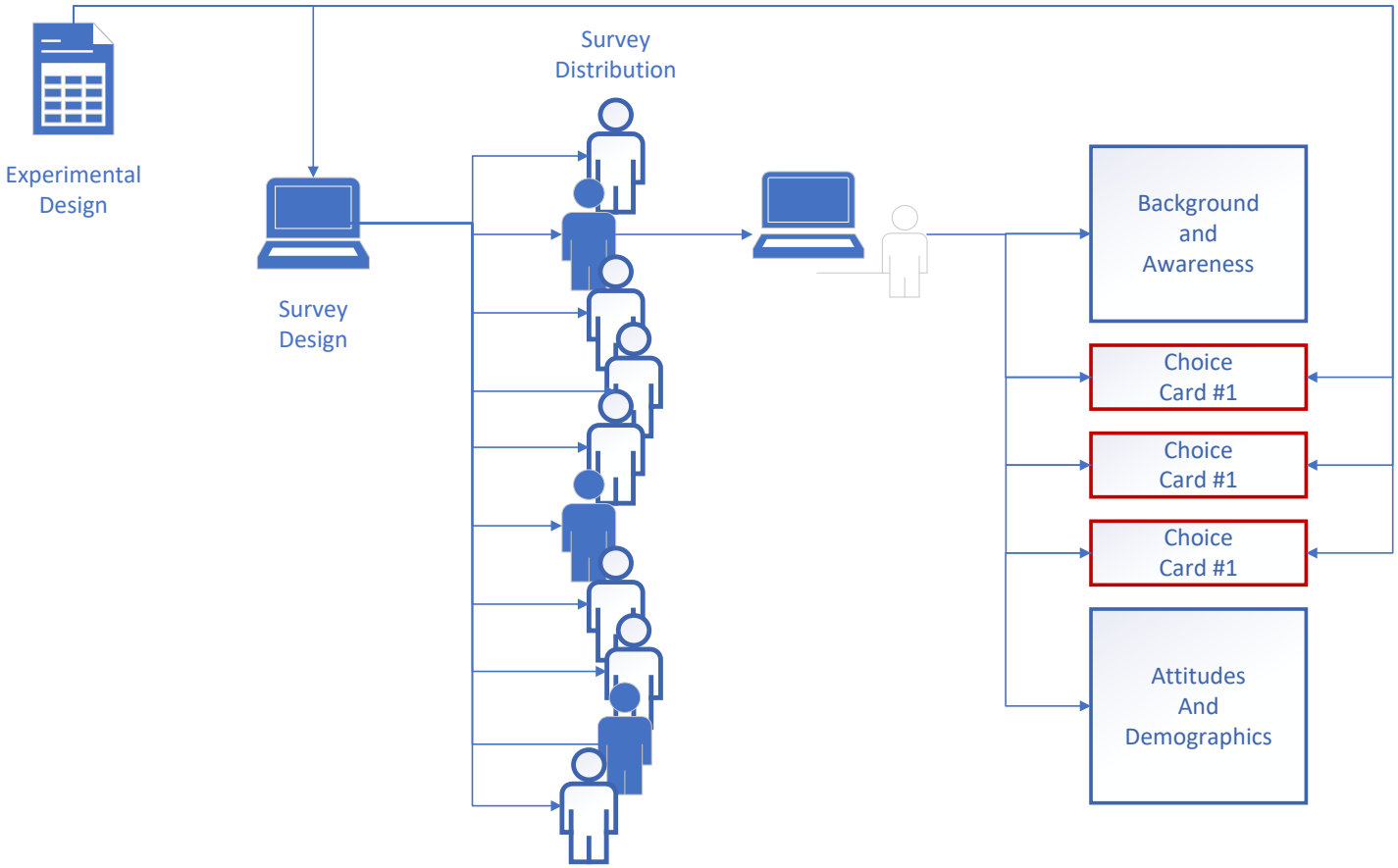

Choice Experiment

Choice Card		
1. Harvestable Surplus of Moose	1. 5,000	1. 12,500
2. How often you receive a moose LEH tag	2. 1 in 7 years	2. 1 in 5 years
3. Share of LEH tag holders that harvest a moose	3. 27 moose for 100 tags	3. 48 moose for 100 tags
4. Governance of wildlife management	4. Elected Officials	4. Elected Officials
5. Share license fee to wildlife management	5. 20%	5. 100%
6. Moose license fee	6. $25	6. $70
	○ Keep status quo	○ Choose this option

- Items 1, 2 and 3 connected

$$\text{Moose harvested} = \left(\text{LEH applied for}\right) \times \left(\text{Prob. drawn}\right) \times \left(\text{Prob. harvest}\right)$$

$$MRTS = \left(\text{Prob. harvest}\right) / \left(\text{Prob. drawn}\right)$$

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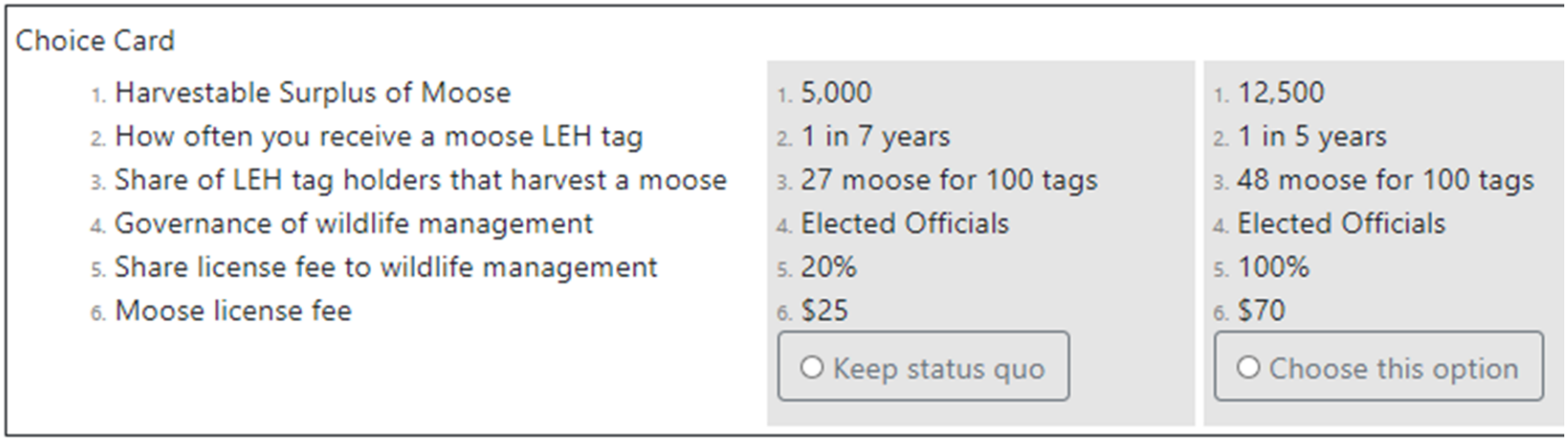

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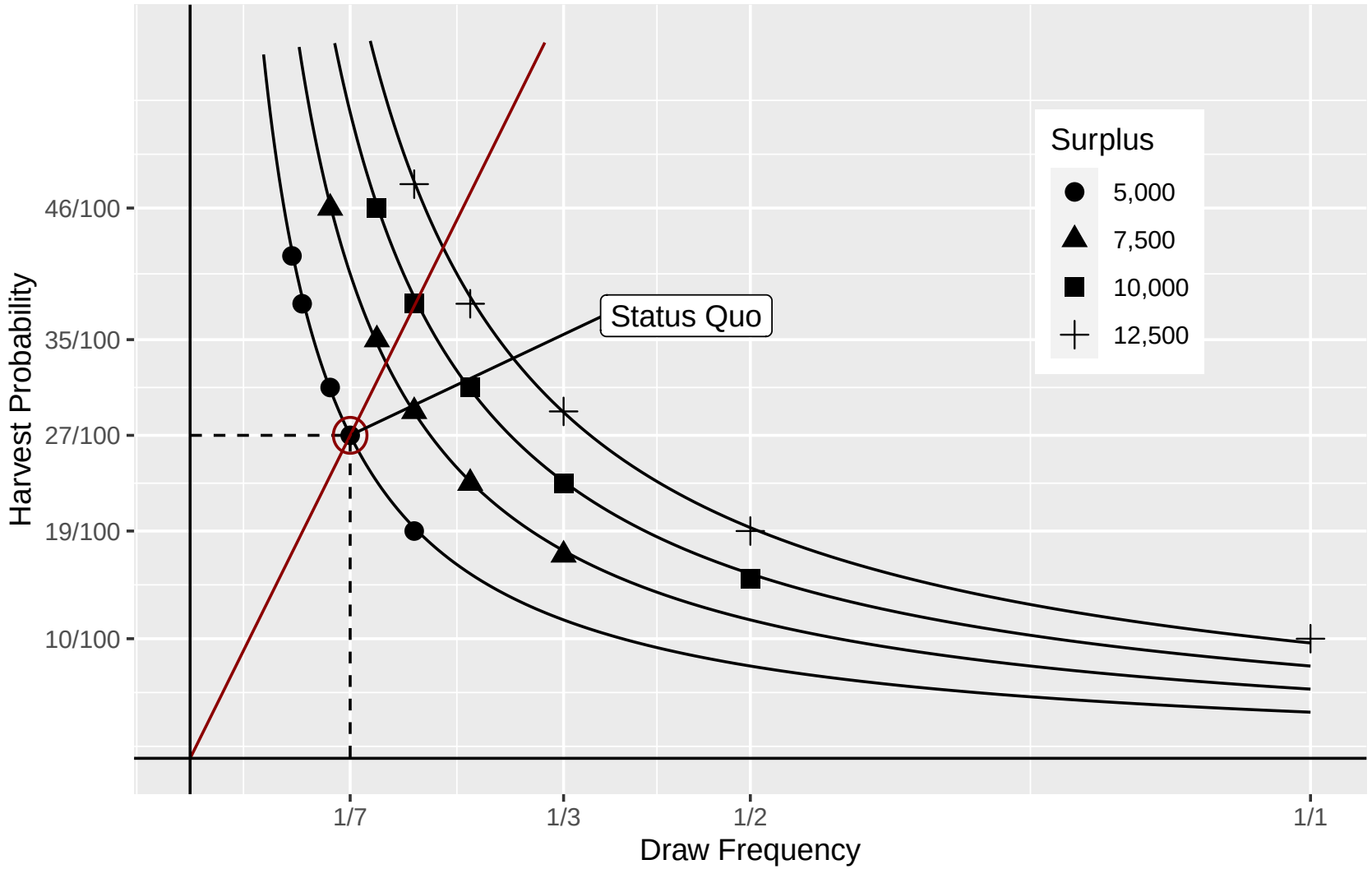
Attribute Levels: Opportunity vs Success



Attribute Levels: Governance

- Who gets to supervise fish and wildlife management; establish regulations; approve budgets, conduct public consultations, and made decisions on wildlife management.
  - *Political - current:*
    Elected officials (Minister and Cabinet).
  - *Game commission:*
    An appointed group of representatives knowledgeable and interested in wildlife conservation, residing across the province.
  - *Multi-government, multi-stakeholder commission:*
    A group of representatives from First Nations, provincial government, conservation organizations, and industry which are knowledgeable and interested in wildlife conservation.

Attribute Levels: Surplus, Share and Licence

- Harvestable surplus of moose: 5,000; 7,500; 10,000, 12,500
  - Current level to historic high.
- Share licence fee to wildlife management: 20%, 50%, 100%
  - Current level to all dedicated.
- Licence fee: $25, $35, $50, $75, $100, $140, $200, $500
  - Current level to almost complete choke (from focus groups).
- Design
  - Binary choice, status quo and one alternative,
  - D-efficient fractional factorial design choosing 75 choice cards from 1,440 member full factorial design, after cards strictly dominated by status quo removed.
  - Blocked as sets of 3 cards, maximum variation within sets.

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Econometrics

- Random utility model (general version)

$$U_{ijt} = \alpha_{ij} + \beta_i \boldsymbol{x}_{ijt} + \varepsilon_{ijt}$$
$$i \in \{1, \ldots, N\}$$
$$j \in \{\mathrm{S}, \mathrm{A}\}$$
$$t \in \{1, 2, 3\}$$
$$\alpha_{i\mathrm{S}} = 0$$
$$\alpha_{i\mathrm{A}} = \alpha_{\mathrm{A}} + \gamma_{\mathrm{A}} \boldsymbol{z}_i + \eta_{i\mathrm{A}}$$
$$\beta_{ik} = \beta_k + \gamma_k \boldsymbol{z}_i + \eta_{ik}$$

  - Choose 'A' if

$$U_{i\mathrm{A}t} - U_{i\mathrm{S}t} > 0$$

  - γ_{A} and γ_k for observable individual specific effects.
  - $\eta_{i\mathrm{A}}$ and η_{ik} for unobservable individual specific effects.

Econometrics

- Individual specific characteristics

$$U_{ijt} = \alpha_{ij} + \beta_i \boldsymbol{x}_{ijt} + \delta_i \boldsymbol{z}_i + \varepsilon_{ijt}$$

  - utility level can vary by $\delta_i \boldsymbol{z}_i$,
  - differencing utility, $U_{iAt} - U_{iSt}$, removes $\delta_i \boldsymbol{z}_i$ effect,
  - cannot estimate utility level effects of $\boldsymbol{z}_i$.
- Interactions
  - With ASC, $\alpha_{iA} = \alpha_A + \gamma_A \boldsymbol{z}_i + \eta_{iA}$,
    - Measures difference in value of having choice across individuals
  - With choice attributes, $\beta_{ik} = \beta_k + \gamma_k \boldsymbol{z}_i + \eta_{ik}$
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  - sample (population) distribution of predicted WTP.

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Econometrics

- If ε_{ijt} follows as type I extreme value distribution (Gumbel), then choice probability follows multinomial logistic distribution

$$\Pr(\text{alt}|i,t) = \frac{\exp(\alpha_{i\text{A}} + \beta_i \boldsymbol{x}_{i\text{A}t})}{\exp(\alpha_{i\text{A}} + \beta_i \boldsymbol{x}_{i\text{A}t}) + \exp(\alpha_{i\text{S}} + \beta_i \boldsymbol{x}_{i\text{S}t})}$$

  - If $\eta_{i\text{A}}$ and η_{ik} have a degenerate distribution, model estimated as multinomial logit.
  - Otherwise, estimated as mixed multinomial logit.
    - Influence of $\eta_{i\text{A}}$ and η_{ik} must be integrated out to solve multinomial logit estimation.
    - Integration approximated by simulated maximum likelihood.

Econometrics

- Utility space

$$U_{ijt} = \alpha_{ij} + \beta_i \boldsymbol{x}_{ijt} - \beta_c c_{ijt} + \varepsilon_{ijt}$$

  - cost as c_{ijt}, β_c marginal utility of income,
  - WTP as β_k/β_c, distribution not well defined.

- WTP space

$$U_{ijt} = \beta_c (\gamma_{ij} + \lambda_i \boldsymbol{x}_{ijt} - c_{ijt}) + \varepsilon_{ijt}$$

  - β_c serves as scaling parameter,
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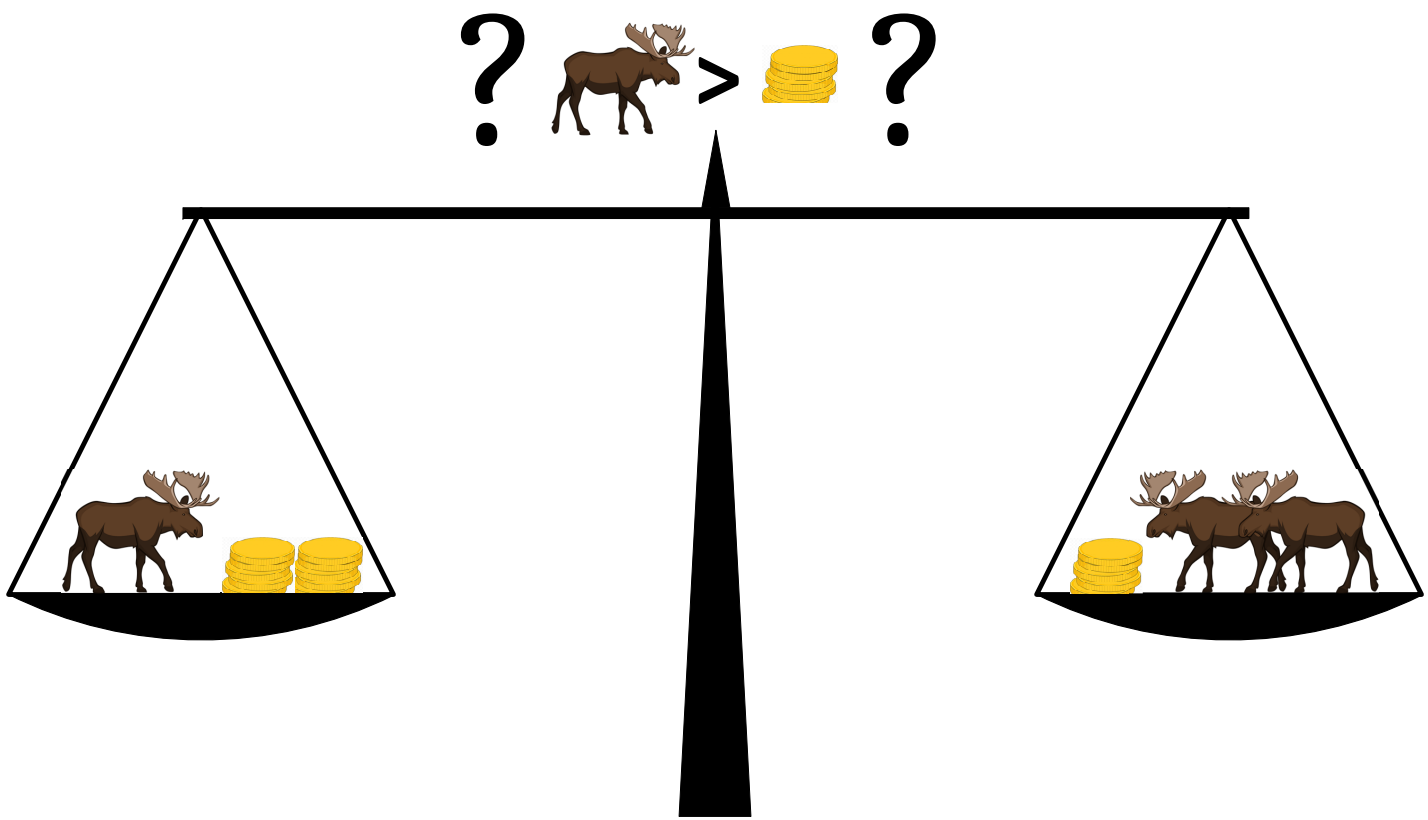

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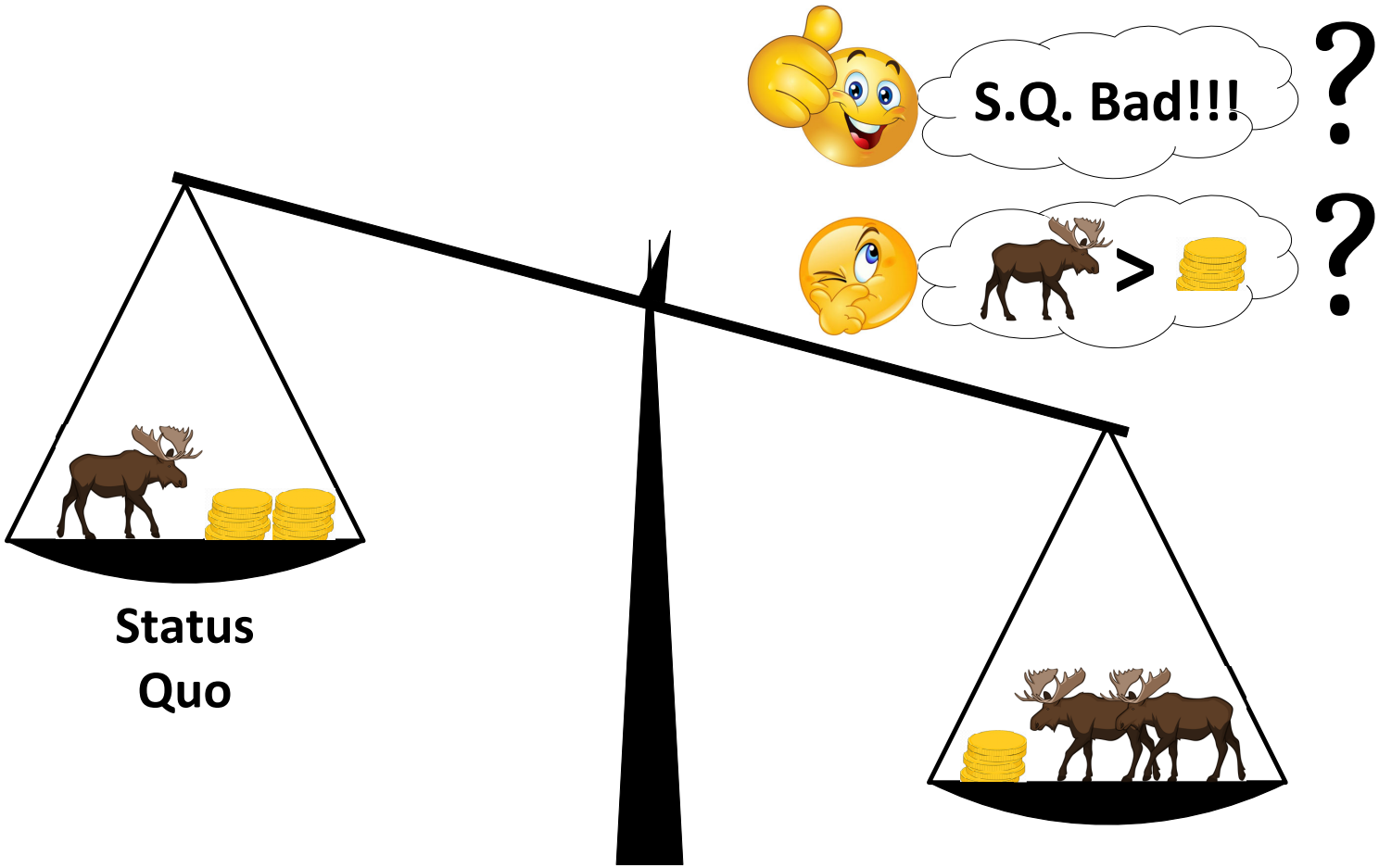

Responses

- Two survey waves
  - Government partner sent invitation email with link to survey to 5,000 applicants to 2018 LEH moose hunts.
  - Link almost immediately shared on social media!
  - Survey adapted to use individualized link, invitation sent to new sample of 5,000.
  - Nested models estimated, with restriction of equality in parameters between samples tested. No significant information loss from pooling data.
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Protest Votes

- Respondents choosing status quo for all three cards asked for level of agreement with statements:
  1. I cannot afford to pay more,
  2. I am satisfied with the current moose population,
  3. I do not believe anything can be done to enhance moose numbers,
  4. The government cannot be trusted to apply any extra revenue to moose enhancement,
  5. I do not believe this research will have any influence on government policy,
  6. I do not believe the researchers understand hunters and hunting.
- Considered protest if agreement with 1. or 2. not stronger than agreement with others.
- Protest responses dropped, 2038 usable responses remain.

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Sample Characteristics

Variable	Group	Count	Percent	Province	Hunters
Income	$<$ 50K	318	14.67	26.94	
	50K - 100K	690	31.84	32.65	
	$>$ 100K	913	42.13	40.42	
	Refuse	246	11.35		
Educ	Elementary	35	1.62	9.60	
	High	742	34.24	26.50	
	Coll/Uni	1390	64.14	63.90	
Age	$<$ 45	589	27.18	43.19	41.97
	45 - 64	1030	47.53	33.22	38.38
	65+	548	25.29	23.58	19.65
Gender	Male	1996	92.11	45.64	92.29
	Female	163	7.52	53.79	7.71
	Other	8	0.37	0.28	

Sample Characteristics

Variable	Group	Count	Percent	Province	Hunters
Urban	Rural	607	28.01	10.47	
	Urban	1560	71.99	89.53	
Home	Vancouver Island	353	16.29	16.69	14.64
	Lower Mainland	436	20.12	61.38	23.71
	Thompson	279	12.87	3.65	9.66
	Kootenay	220	10.15	3.29	12.61
	Cariboo	180	8.31	1.36	6.61
	Skeena	125	5.77	1.66	4.66
	Omineca	238	10.98	2.47	9.01
	Peace	85	3.92	1.41	6.01
	Okanagan	251	11.58	8.09	13.09

Sample Characteristics

Variable	Group	Count	Percent	Province	Hunters
Days	<= 10	420	19.38		
	11 - 20	722	33.32		
	> 20	1025	47.30		
Skill	Beg	78	3.60		
	Int	907	41.86		
	Adv	1182	54.55		

- Days per season spent hunting.
- Self assessed experience.

Sample Characteristics

Variable	Group	Count	Percent	Province	Hunters
Reason	Food	978	45.13		
	Family	288	13.29		
	Nature	884	40.79		
	Trophy	17	0.78		
Region	Home	525	24.23		66.34
	Near	1047	48.32		22.89
	Far	595	27.46		10.78

- Survey asks favorite region, hunter statistic for regions where hunt.

Sample Characteristics

Variable	Group	Count	Percent	Province	Hunters
Leaning	Right	508	23.44		
	Neither	1549	71.48		
	Left	110	5.08		
Awareness	Limited	1140	52.61		
	Somewhat	811	37.43		
	Very	216	9.97		
Pretest	Poor	1337	61.70		
	Fair	616	28.43		
	Good	214	9.88		

- Neither includes weakly right and weakly left.
- Pretest asks all else equal attribute level preference. Good consistent with rational utility maximization.

Sample Characteristics

	Inco	Educ	Age	Gend	Urba	Home	Days	Skil	Reas	Regi	Lean	Awar
Educ	0.143											
Age	0.272	0.127										
Gender	0.113	0.028	0.073									
Urban	0.095	0.093	0.014	0.056								
Home	0.093	0.091	0.116	0.107	0.358							
Days	0.055	0.036	0.115	0.049	0.144	0.184						
Skill	0.058	0.044	0.111	0.168	0.076	0.122	0.275					
Reason	0.077	0.075	0.068	0.105	0.082	0.098	0.050	0.056				
Region	0.051	0.048	0.066	0.081	0.255	0.563	0.118	0.036	0.040			
Leaning	0.053	0.030	0.017	0.044	0.029	0.059	0.054	0.077	0.027	0.039		
Awareness	0.049	0.062	0.034	0.042	0.046	0.077	0.134	0.113	0.060	0.035	0.036	
Pretest	0.034	0.032	0.041	0.040	0.038	0.066	0.085	0.055	0.039	0.036	0.057	0.073

- Cramer's V, $V = \sqrt{(\chi^2/n)/\min(k-1, r-1)}$,
- Gray cells not significant at $\alpha = 0.01$.

Default Individual

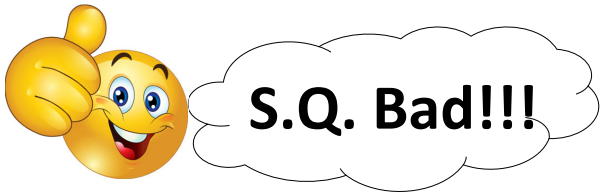
- Characteristics of the default individual:
  - Annual income less than $50,000,
  - No more than high school education,
  - Below 45 years of age,
  - Female (in models with gender),
  - Lives outside urban area (in models with urban or rural),
  - Lives in lower mainland (if models include region),
  - Does not consider their hunting skill advanced,
  - Hunts primarily for food,
  - Home region is favorite hunting region,
  - Politically center or left leaning.
  - Limited awareness.
  - Pretest score not good.

Diagnostics

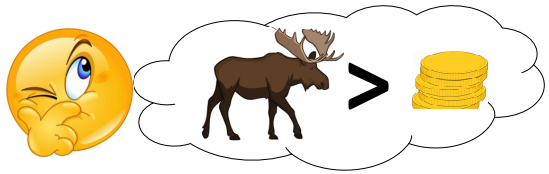
	Model			
Measure	**#1**	**#2**	**#3**	**#4**
Log-Likelihood:	-3296	-3234	-3207	-3186
McFadden R2:	0.222	0.237	0.243	0.248
Adj McFadden R2:	0.219	0.229	0.226	0.227
AIC:	6622	6535	6558	6554
BIC:	6722	6764	7042	7166
Number of Observations:	6114	6114	6114	6114
Number of Clusters:	2038	2038	2038	2038
Number of Parameters:	15	34	72	91
ASC Interactions	No	Yes	No	Yes
Attribute Interactions	No	No	Yes	Yes

Models

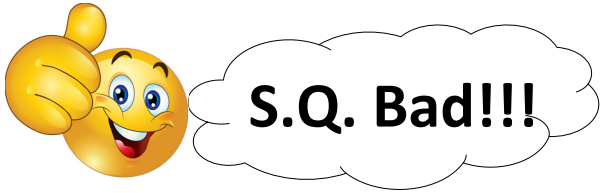
Model #2

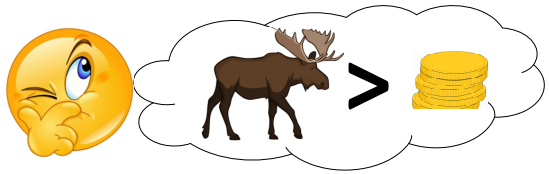


Model #3



Model #4





Alternative Specific Constant

	Model 1		Model 2		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
asc	108.41***	18.48	-17.78	39.75	30.89	59.76
	-205.08***	14.71	199.35***	14.81	-190.36***	16.08
$50K - $100K			72.93**	23.57	55.41	35.03
$100K +			134.27***	25.02	110.15**	36.20
Refuse			10.26	30.06	21.93	43.63
Coll/Uni			32.73*	15.72	26.41	23.75
45 - 64			-13.97	18.26	-18.63	27.49
65+			-32.57	22.91	-40.41	34.04
11 to 20			-19.89	21.40	-32.39	48.46
> 20			36.69+	21.66	27.93	48.94

Alternative Specific Constant

S.Q. Bad!!!

	Model 1					
Variable	**Estimate**	**S.E.**	**[illegible]**			**S.E.**
asc	108.41***	18.48	-17.78		39.75	59.76
	-205.08***	14.71	199.35***	14.81	-190.36***	16.08
$50K - $100K			72.93**	23.57	55.41	35.03
$100K +			134.27***	25.02	110.15**	36.20
Refuse			10.26	30.06	21.93	43.63
Coll/Uni			32.73*	15.72	26.41	23.75
45 - 64			-13.97	18.26	-18.63	27.49
65+			-32.57	22.91	-40.41	34.04
11 to 20			-19.89	21.40	-32.39	48.46
> 20			36.69+	21.66	27.93	48.94

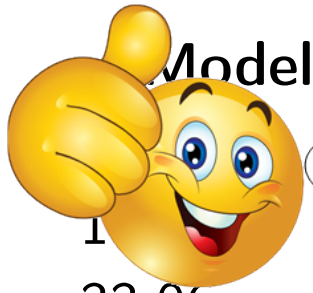
Alternative Specific Constant

	Model 1		Model 2		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
asc	108.41***	18.48	-17.78	39.75	30.89	59.76
	-205.08***	14.71	199.35***	14.81	-190.36***	16.08
$50K - $100K			72.93**	23.57	55.41	35.03
$100K +			134.27***	25.02	110.15**	36.20
Refuse			10.26	30.06	21.93	43.63
Coll/Uni			32.73*	15.72	26.41	23.75
45 - 64			-13.97	18.26	-18.63	27.49
65+			-32.57	22.91	-40.41	34.04
11 to 20			-19.89	21.40	-32.39	48.46
$>$ 20			36.69+	21.66	27.93	48.94

Alternative Specific Constant (continued)

	Model 1		Model 2		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Advanced			14.97	16.02	34.26	32.08
Family			33.06	23.17	26.03	38.36
Nature			51.93**	16.41	37.57	26.59
Trophy			330.73***	91.21	117.61	125.77
Near			-7.10	18.99	-4.83	19.24
Far			-17.39	20.70	-18.78	21.04
Right			29.61+	17.59	20.63	35.65
Somewhat			-20.69	16.15	-17.07	36.58
Very			20.93	27.31	-51.62	62.30
Fair			25.97	17.31	-3.86	40.57
Good			-23.81	24.31	-154.85**	56.88

Alternative Specific Constant (continued)



S.Q. Bad!!!

	Model 1		Model 2			
Variable	**Estimate**	**S.E.**				
Advanced			1			.08
Family			33.06	23.17	20.03	38.36
Nature			51.93**	16.41	37.57	26.59
Trophy			330.73***	91.21	117.61	125.77
Near			-7.10	18.99	-4.83	19.24
Far			-17.39	20.70	-18.78	21.04
Right			29.61+	17.59	20.63	35.65
Somewhat			-20.69	16.15	-17.07	36.58
Very			20.93	27.31	-51.62	62.30
Fair			25.97	17.31	-3.86	40.57
Good			-23.81	24.31	-154.85**	56.88

Alternative Specific Constant (continued)

	Model 1		Model 2		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Advanced			14.97	16.02	34.26	32.08
Family			33.06	23.17	26.03	38.36
Nature			51.93**	16.41	37.57	26.59
Trophy			330.73***	91.21	117.61	125.77
Near			-7.10	18.99	-4.83	19.24
Far			-17.39	20.70	-18.78	21.04
Right			29.61+	17.59	20.63	35.65
Somewhat			-20.69	16.15	-17.07	36.58
Very			20.93	27.31	-51.62	62.30
Fair			25.97	17.31	-3.86	40.57
Good			-23.81	24.31	-154.85**	56.88

Harvestable Surplus

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Surplus	21.55***	2.86	-9.47	7.62	-0.92	9.37
	27.22***	4.29	-28.38***	3.93	-23.08***	5.67
$50K - $100K			12.62**	4.50	4.98	6.73
$100K +			22.81***	4.76	7.20	6.97
Refuse			-0.19	5.61	-2.81	8.12
Coll/Uni			5.49+	3.04	2.08	4.65
45 - 64			-1.25	3.52	1.55	5.29
65+			-3.48	4.31	3.07	6.51

Harvestable Surplus

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Surplus	21.55***	2.86	-9.47	7.62	-0.92	9.37
	27.22***	4.29	-28.38***	3.93	-23.08***	5.67
$50K - $100K			12.62**	4.50	4.98	6.73
$100K +			22.81***	4.76	7.20	6.97
Refuse			-0.19	5.61	-2.81	8.12
Coll/Uni			5.49+	3.04	2.08	4.65
45 - 64			-1.25	3.52	1.55	5.29
65+			-3.48	4.31	3.07	6.51

Harvestable Surplus (continued)

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Family			5.97	4.86	1.49	7.99
Nature			10.26**	3.45	3.10	5.44
Trophy			132.68**	44.92	105.72+	55.72
11 to 20			-0.72	6.39	2.44	7.03
$>$ 20			6.02	6.24	3.42	6.83
Somewhat			3.80	4.00	5.01	4.60
Very			6.68	7.22	12.28	7.77
Fair			12.82*	5.00	13.38*	5.77
Good			18.69*	8.10	30.43***	8.80

Harvestable Surplus (continued)

	Model 1		Model 2			
Variable	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Family			5.97	4.86	1.49	7.99
Nature			10.26**	3.45	3.10	5.44
Trophy			132.68**	44.92	105.72+	55.72
11 to 20			-0.72	6.39	2.44	7.03
$>$ 20			6.02	6.24	3.42	6.83
Somewhat			3.80	4.00	5.01	4.60
Very			6.68	7.22	12.28	7.77
Fair			12.82*	5.00	13.38*	5.77
Good			18.69*	8.10	30.43***	8.80

Success / Opportunity

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Succ,/Opp.	-23.26***	5.94	-55.65**	17.34	-51.20**	17.63
	64.18***	13.31	-69.48***	13.40	68.96***	11.93
Near			26.78*	11.57	27.57*	11.80
Far			11.16	12.90	14.31	13.08
Family			17.58	15.42	7.86	16.21
Nature			22.28*	10.98	10.96	11.81
Trophy			231.92+	132.50	189.54	144.50
11 to 20			6.96	16.35	8.25	16.54
$>$ 20			30.66+	16.49	24.25	16.61
Advanced			-27.81**	10.26	-23.00*	10.62
Fair			-5.97	13.56	-7.97	13.86
Good			7.35	18.89	11.56	18.83

Success / Opportunity

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**		**S.E.**
Succ,/Opp.	-23.26***	5.94	-5			53
	64.18***	13.31	-6	*		11.93
Near			26.78*	11.57	27.57*	11.80
Far			11.16	12.90	14.31	13.08
Family			17.58	15.42	7.86	16.21
Nature			22.28*	10.98	10.96	11.81
Trophy			231.92+	132.50	189.54	144.50
11 to 20			6.96	16.35	8.25	16.54
$>$ 20			30.66+	16.49	24.25	16.61
Advanced			-27.81**	10.26	-23.00*	10.62
Fair			-5.97	13.56	-7.97	13.86
Good			7.35	18.89	11.56	18.83

Success / Opportunity

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Succ,/Opp.	-23.26***	5.94	-55.65**	17.34	-51.20**	17.63
	64.18***	13.31	-69.48***	13.40	68.96***	11.93
Near			26.78*	11.57	27.57*	11.80
Far			11.16	12.90	14.31	13.08
Family			17.58	15.42	7.86	16.21
Nature			22.28*	10.98	10.96	11.81
Trophy			231.92+	132.50	189.54	144.50
11 to 20			6.96	16.35	8.25	16.54
$>$ 20			30.66+	16.49	24.25	16.61
Advanced			-27.81**	10.26	-23.00*	10.62
Fair			-5.97	13.56	-7.97	13.86
Good			7.35	18.89	11.56	18.83

Governance: Game Commission

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Game Comm.	100.11***	19.71	98.54*	40.32	104.10*	43.20
	163.18***	43.14	103.60*	47.95	136.77**	44.43
Right			109.57**	33.95	109.66**	39.20
11 to 20			-26.96	43.99	-16.64	46.94
$>$ 20			-29.42	44.73	-38.76	48.64
Advanced			24.56	30.47	2.16	35.10
Somewhat			-25.24	30.76	-16.15	34.06
Very			73.34	50.64	95.57+	56.20
Fair			-45.49	35.80	-43.31	38.19
Good			-75.87	51.05	-26.81	54.05

Governance: Game Commission

	Model 1					
Variable	**Estimate**	**S.E.**				**S.E.**
Game Comm.	100.11***	19.71	98.54*	40.32	104.10*	43.20
	163.18***	43.14	103.60*	47.95	136.77**	44.43
Right			109.57**	33.95	109.66**	39.20
11 to 20			-26.96	43.99	-16.64	46.94
$>$ 20			-29.42	44.73	-38.76	48.64
Advanced			24.56	30.47	2.16	35.10
Somewhat			-25.24	30.76	-16.15	34.06
Very			73.34	50.64	95.57+	56.20
Fair			-45.49	35.80	-43.31	38.19
Good			-75.87	51.05	-26.81	54.05

Governance: Multi-Government, Multi-Stakeholder

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Multi. Gov.	35.66*	17.64	85.88*	37.07	91.42*	40.85
	209.41***	33.95	-208.55***	31.51	221.20***	30.39
Right			39.81	32.65	29.62	37.49
11 to 20			-42.60	40.29	-29.66	44.41
$>$ 20			-76.24+	40.79	-91.00*	45.93
Advanced			28.26	28.75	8.77	33.55
Somewhat			-16.78	29.11	-10.16	33.30
Very			88.32+	50.57	111.29+	57.50
Fair			-32.69	31.40	-29.07	36.07
Good			-119.70*	49.04	-66.98	53.42

Governance: Multi-Government, Multi-Stakeholder

	Model 1					
Variable	**Estimate**	**S.E.**	**Es[illegible]te**			**S.E.**
Multi. Gov.	35.66*	17.64	85.88*	37.07	91.42*	40.85
	209.41***	33.95	-208.55***	31.51	221.20***	30.39
Right			39.81	32.65	29.62	37.49
11 to 20			-42.60	40.29	-29.66	44.41
$>$ 20			-76.24+	40.79	-91.00*	45.93
Advanced			28.26	28.75	8.77	33.55
Somewhat			-16.78	29.11	-10.16	33.30
Very			88.32+	50.57	111.29+	57.50
Fair			-32.69	31.40	-29.07	36.07
Good			-119.70*	49.04	-66.98	53.42

Governance: Multi-Government, Multi-Stakeholder

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
Multi. Gov.	35.66*	17.64	85.88*	37.07	91.42*	40.85
	209.41***	33.95	-208.55***	31.51	221.20***	30.39
Right			39.81	32.65	29.62	37.49
11 to 20			-42.60	40.29	-29.66	44.41
$>$ 20			-76.24+	40.79	-91.00*	45.93
Advanced			28.26	28.75	8.77	33.55
Somewhat			-16.78	29.11	-10.16	33.30
Very			88.32+	50.57	111.29+	57.50
Fair			-32.69	31.40	-29.07	36.07
Good			-119.70*	49.04	-66.98	53.42

Dedicated Licence Share: 50%

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
50% Ded.	74.07***	17.13	69.32+	36.36	79.19*	39.77
	31.54	62.26	-36.45	28.25	34.02	26.89
Right			-66.36+	33.88	-79.32*	38.54
11 to 20			16.82	40.81	20.06	45.45
$>$ 20			88.76*	42.10	72.74	46.18
Advanced			-25.83	31.10	-34.10	34.49
Somewhat			-18.75	31.06	-17.46	34.27
Very			-83.99	52.03	-80.24	58.98
Fair			19.13	31.91	15.42	35.70
Good			-36.46	52.03	26.25	55.45

Dedicated Licence Share: 50%

	Model 1					
Variable	**Estimate**	**S.E.**	**Es**	**te**		**.E.**
50% Ded.	74.07***	17.13	69.32+	36.36	79.19*	39.77
	31.54	62.26	-36.45	28.25	34.02	26.89
Right			-66.36+	33.88	-79.32*	38.54
11 to 20			16.82	40.81	20.06	45.45
$>$ 20			88.76*	42.10	72.74	46.18
Advanced			-25.83	31.10	-34.10	34.49
Somewhat			-18.75	31.06	-17.46	34.27
Very			-83.99	52.03	-80.24	58.98
Fair			19.13	31.91	15.42	35.70
Good			-36.46	52.03	26.25	55.45

Dedicated Licence Share: 50%

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
50% Ded.	74.07***	17.13	69.32+	36.36	79.19*	39.77
	31.54	62.26	-36.45	28.25	34.02	26.89
Right			-66.36+	33.88	-79.32*	38.54
11 to 20			16.82	40.81	20.06	45.45
$>$ 20			88.76*	42.10	72.74	46.18
Advanced			-25.83	31.10	-34.10	34.49
Somewhat			-18.75	31.06	-17.46	34.27
Very			-83.99	52.03	-80.24	58.98
Fair			19.13	31.91	15.42	35.70
Good			-36.46	52.03	26.25	55.45

Dedicated Licence Share: 100%

	Model 1		Model 3		Model 4	
Variable	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
100% Ded.	60.65***	16.00	61.46+	34.42	82.28+	42.13
	11.40	10.80	-5.62	12.60	-99.32***	24.03
Right			6.14	27.31	-6.53	36.98
11 to 20			11.84	36.50	19.99	44.43
$>$ 20			43.89	36.87	30.67	45.48
Advanced			-22.55	23.99	-39.06	32.57
Somewhat			-23.25	26.53	-22.41	32.31
Very			-42.90	45.02	-27.40	55.75
Fair			-13.85	28.32	-10.89	34.42
Good			21.50	46.22	90.12+	51.08

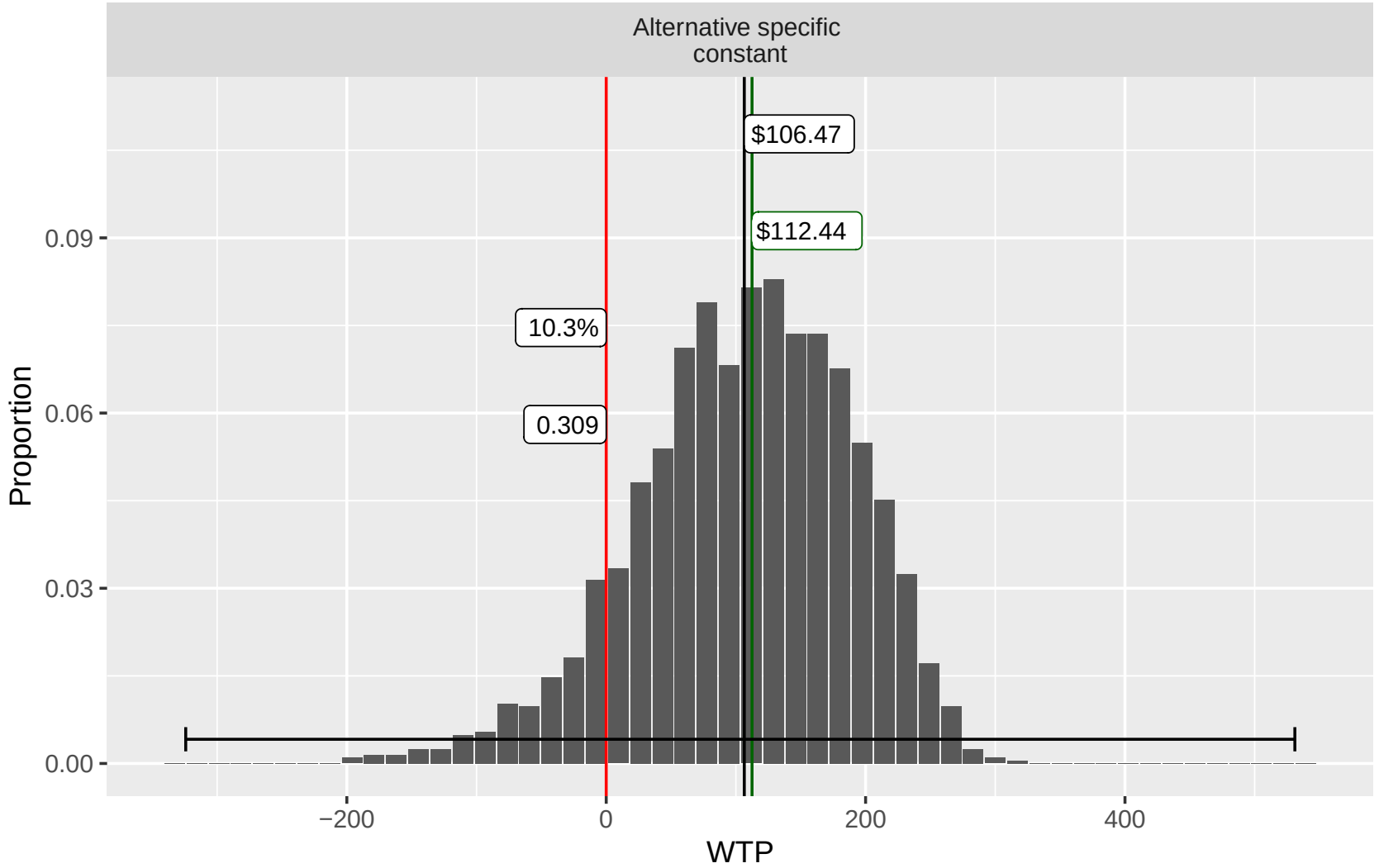
Dedicated Licence Share: 100%

	Model 1					
Variable	**Estimate**	**S.E.**	**Es[illegible]te**		**[illegible].E.**	
100% Ded.	60.65***	16.00	61.46+	34.42	82.28+	42.13
	11.40	10.80	-5.62	12.60	-99.32***	24.03
Right			6.14	27.31	-6.53	36.98
11 to 20			11.84	36.50	19.99	44.43
$>$ 20			43.89	36.87	30.67	45.48
Advanced			-22.55	23.99	-39.06	32.57
Somewhat			-23.25	26.53	-22.41	32.31
Very			-42.90	45.02	-27.40	55.75
Fair			-13.85	28.32	-10.89	34.42
Good			21.50	46.22	90.12+	51.08

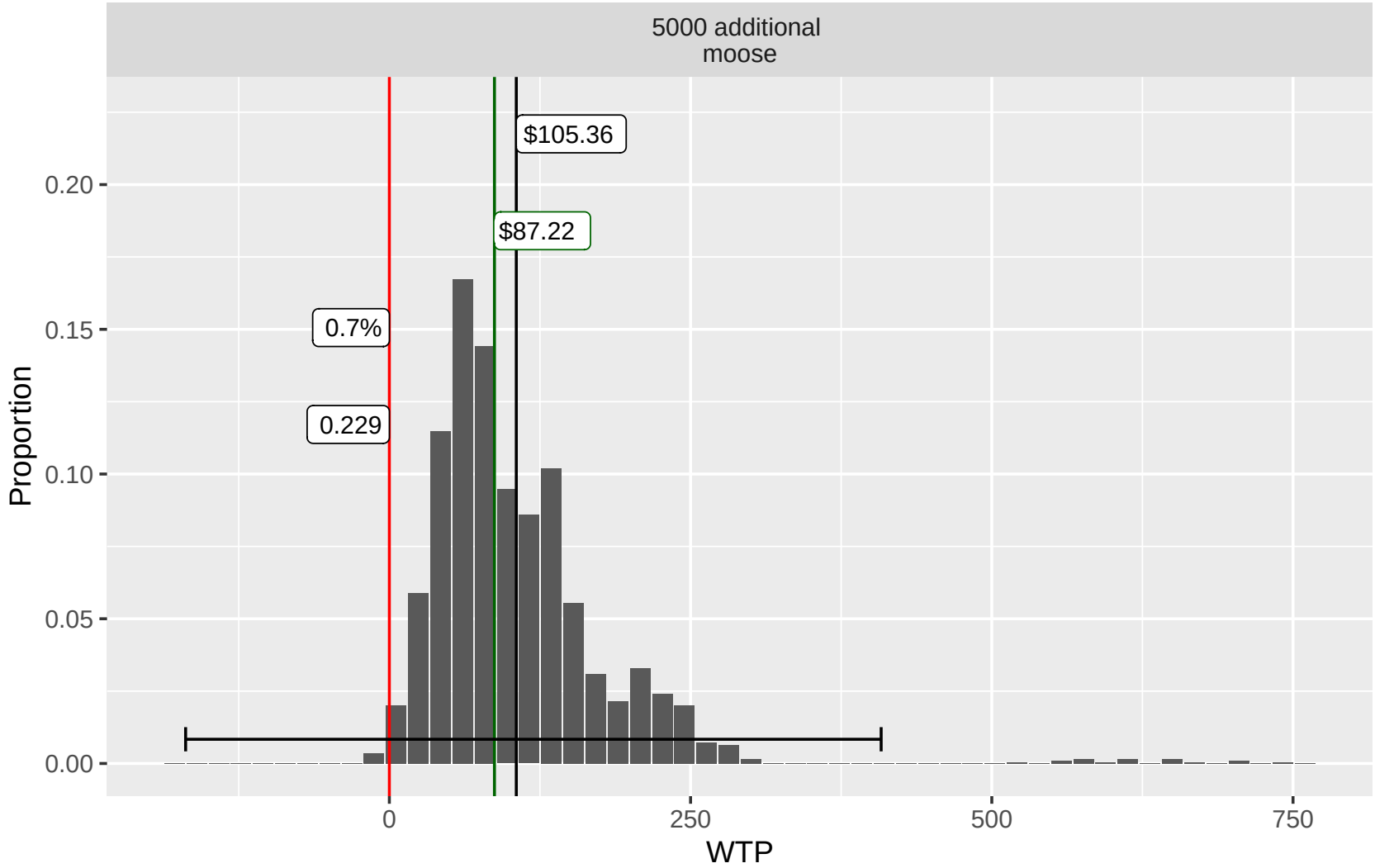
Scenarios

- Interactions between individual specific characteristics and alternative levels enables predicted WTP for each survey participant.
- Variables of interest:
  - Mean WTP,
  - Share made worse off (WTP below zero),
  - Confidence interval for mean WTP (bootstrap)

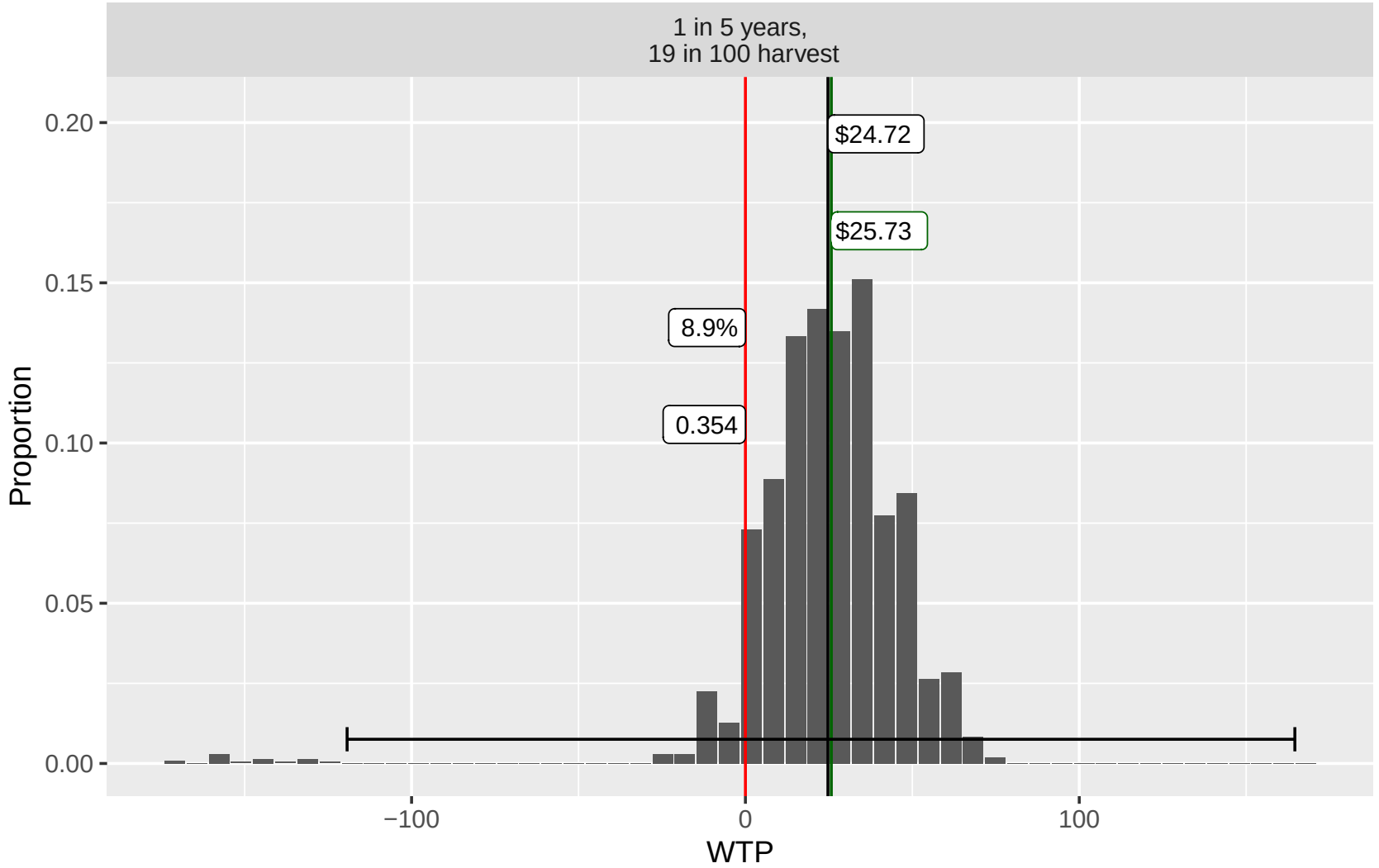
Alternative Specific Constant



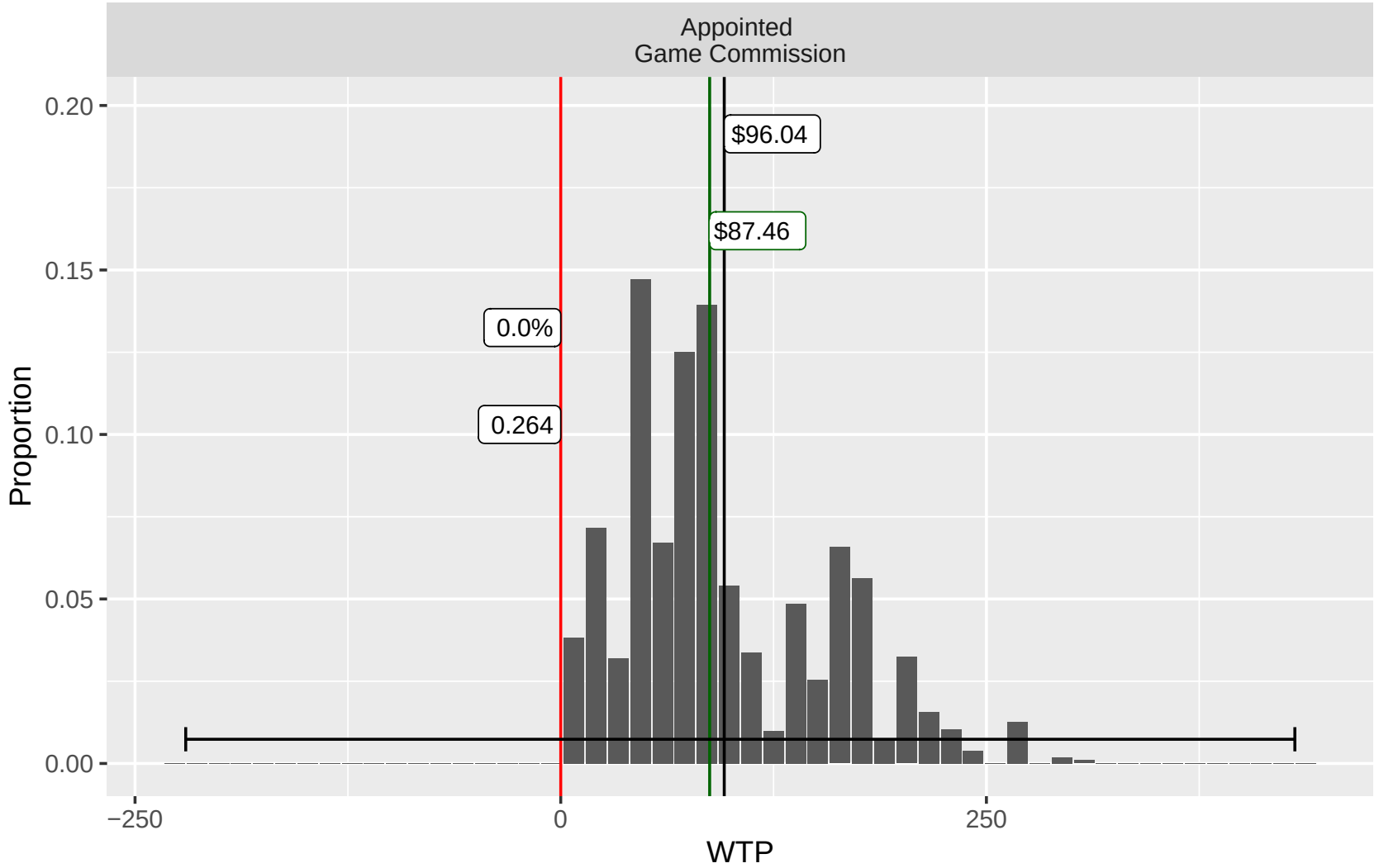
Harvestable Surplus: 10,000



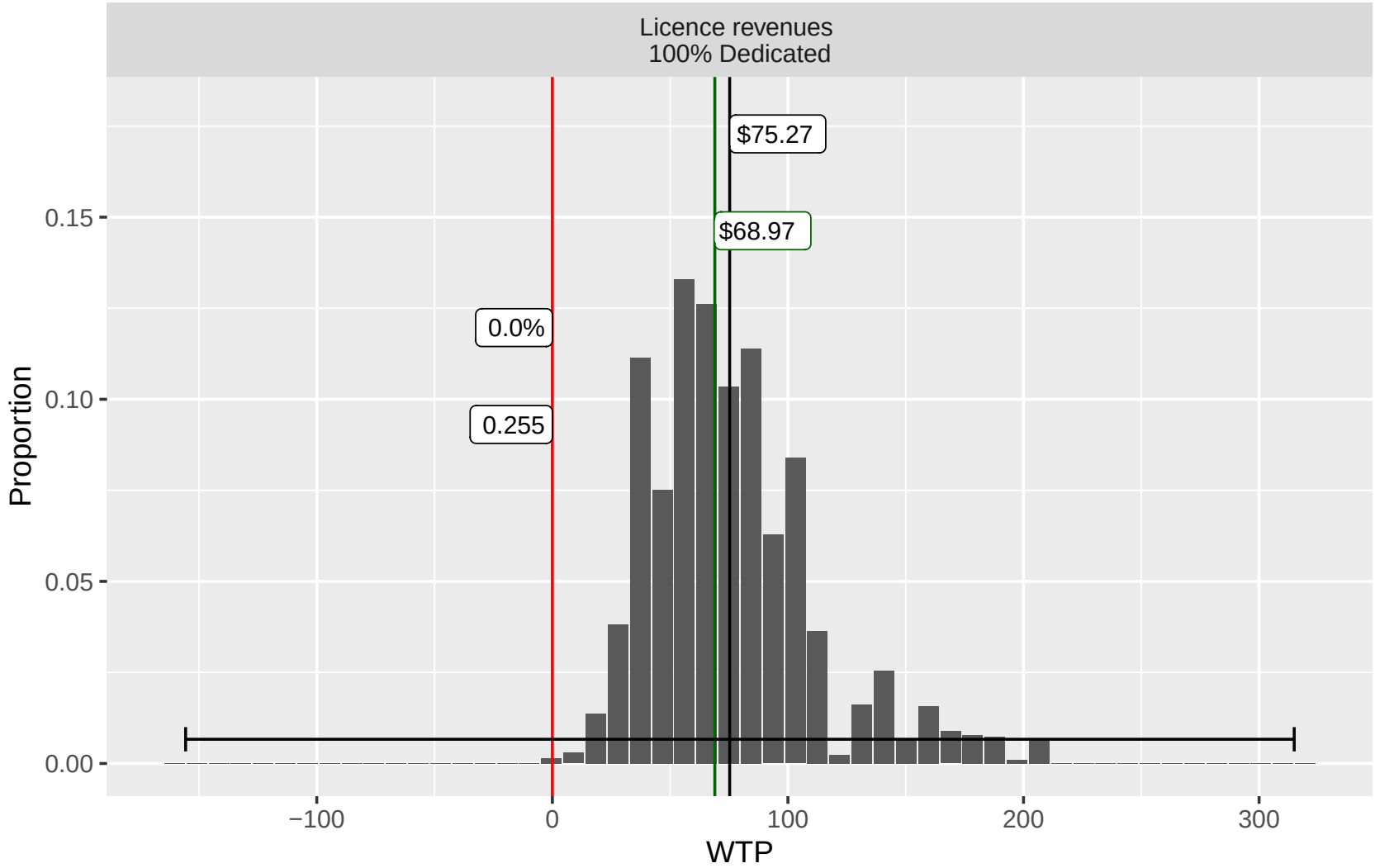
Success / Opportunity: 19/100 and 1/5



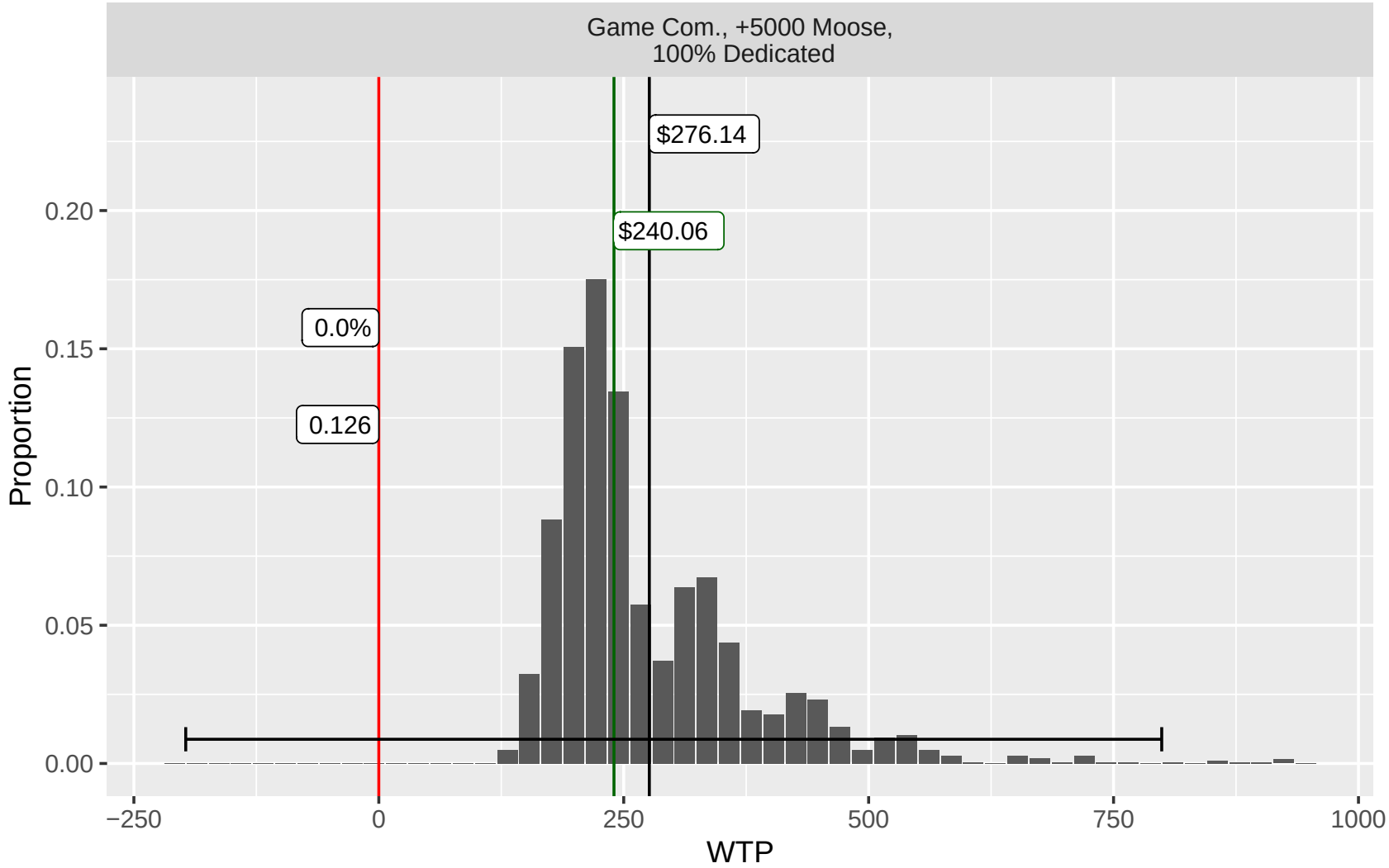
Governance: Game Commission



Dedicated Licence Share: 100%



Combination: +5K surplus, game com., 100%

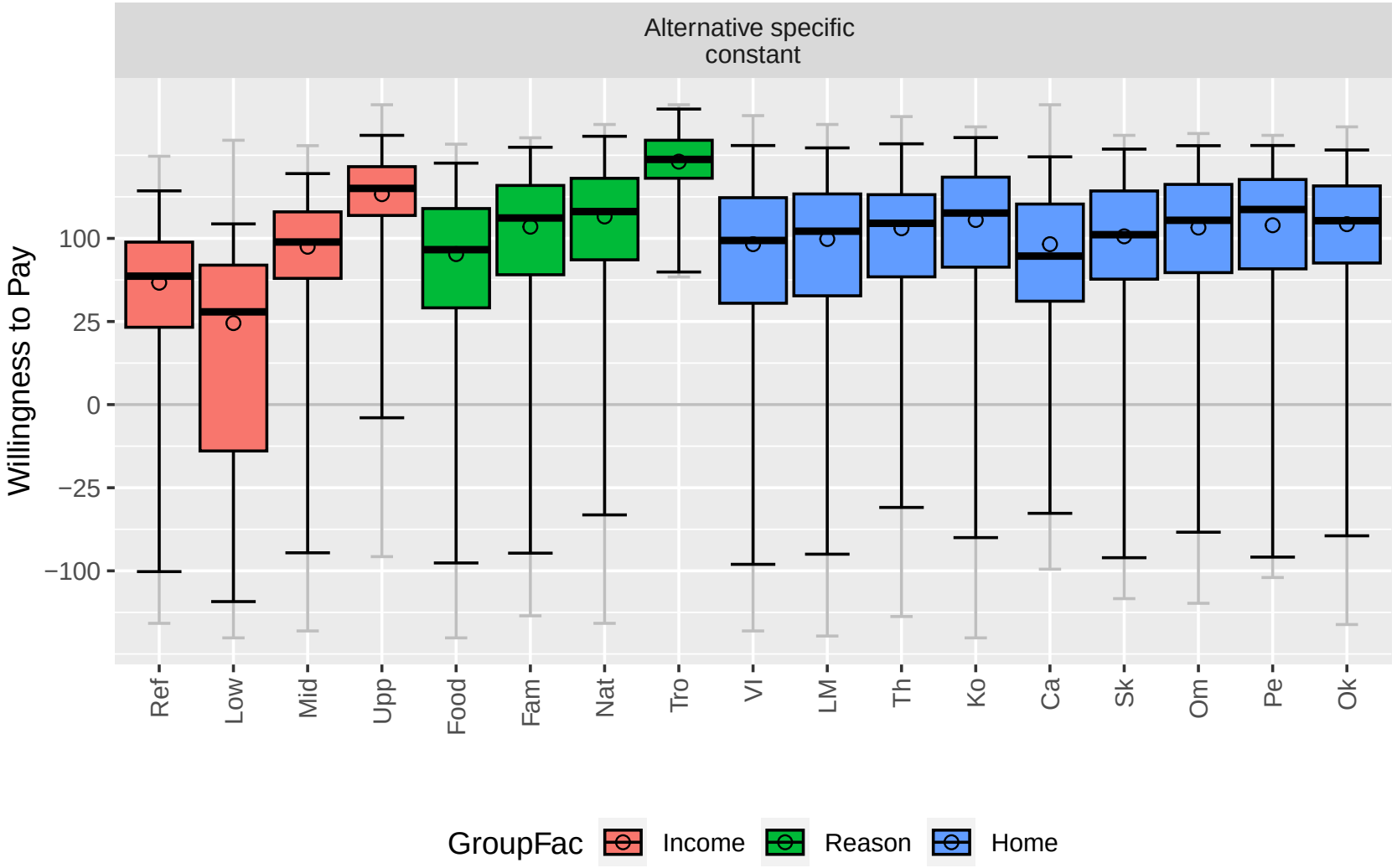


Comparable Licence Fees

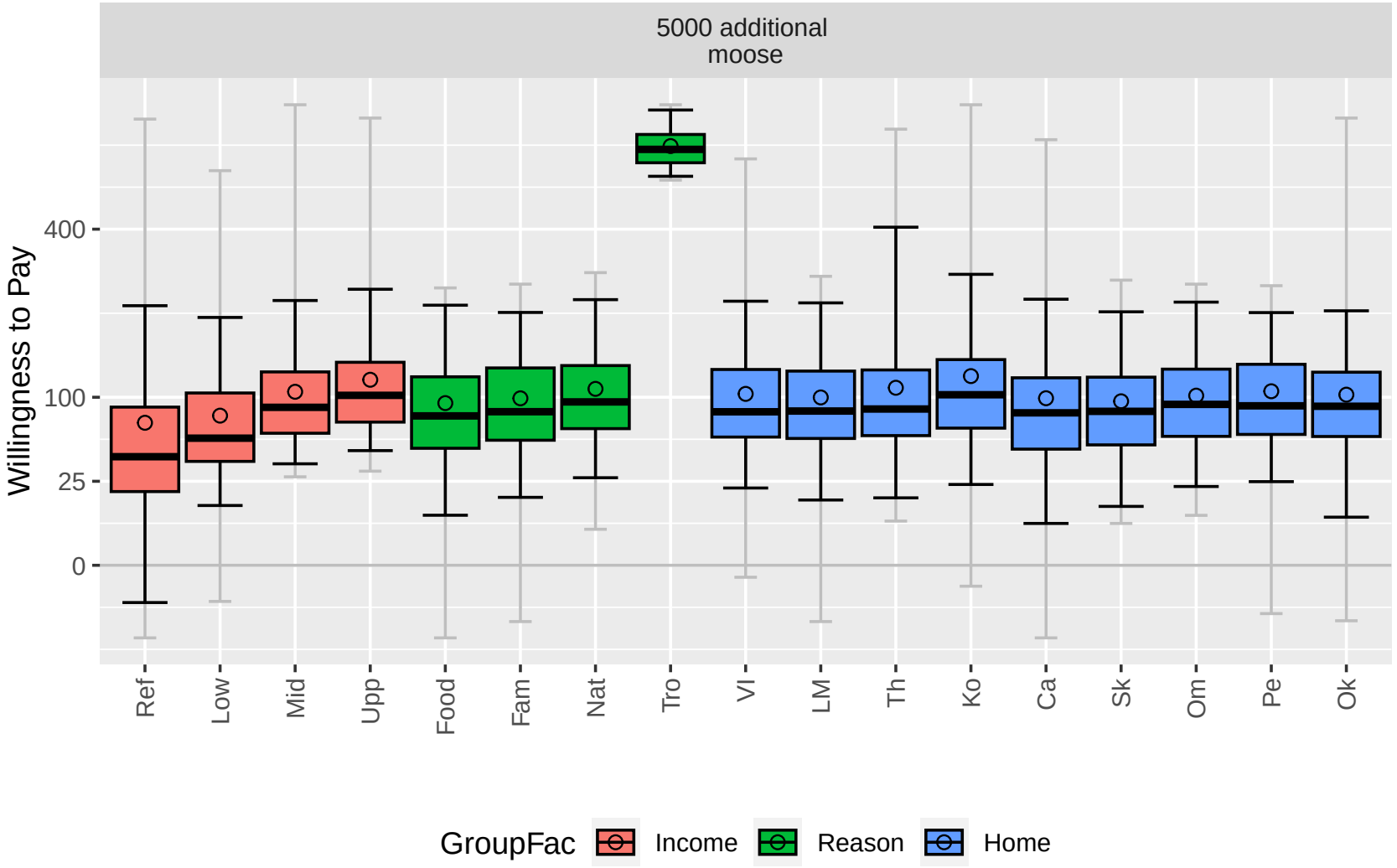
Jurisdiction	Licence (CAD)	Jurisdiction	Licence (CAD)
B.C.	$25	B.C.	$25
N.W.T.	$22	Sask.	$40 / $65
Yukon	$10	Alta	$44.95
Alaska	$0	Man.	$57.25 / $88.25
		Montana	$167.81
		Idaho	$268.16
		Colorado	$336.97
		Wash.	$445.71

- WTP for changes in line with licence fees in nearby Pacific Northwest US states.

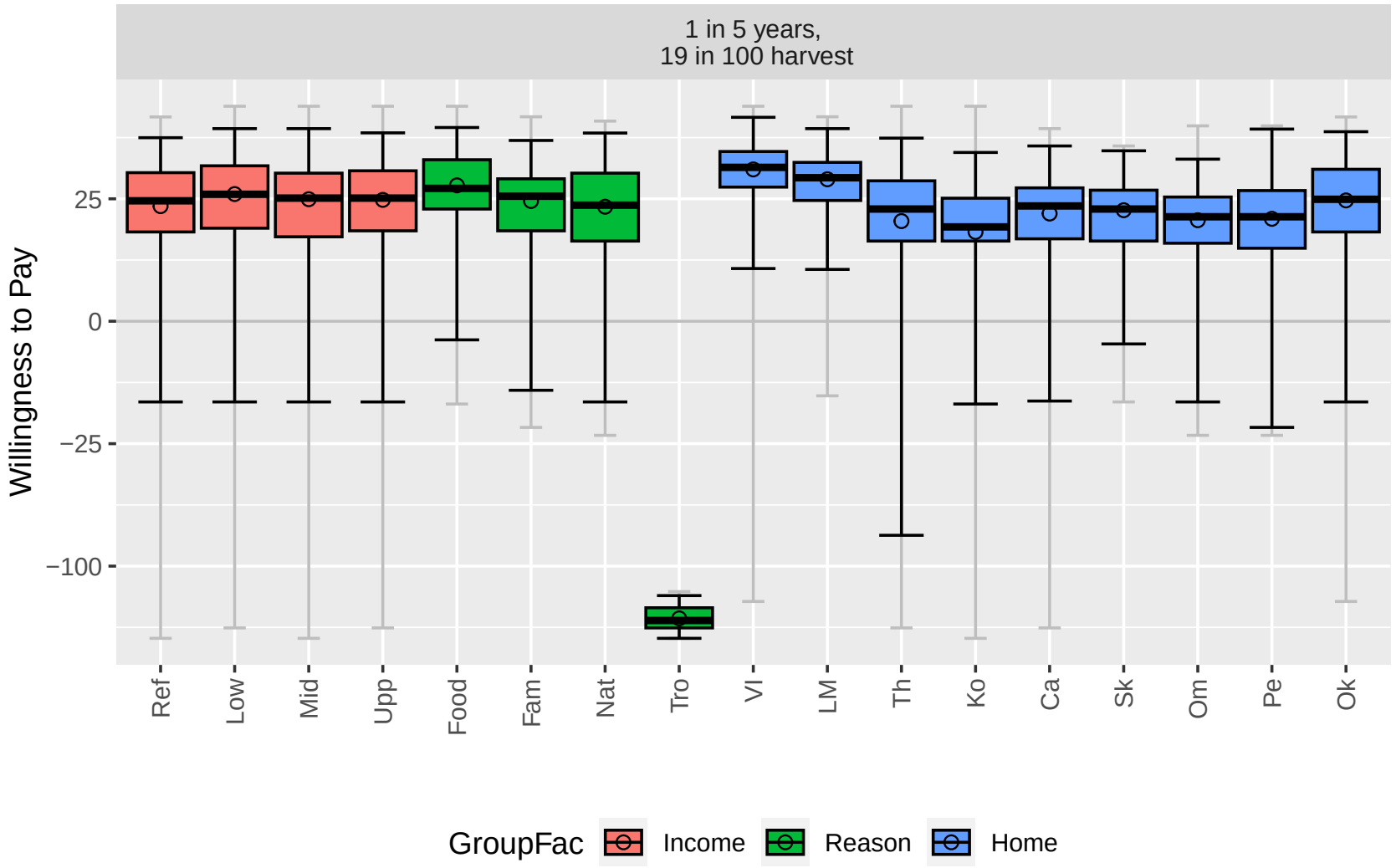
Alternative Specific Constant



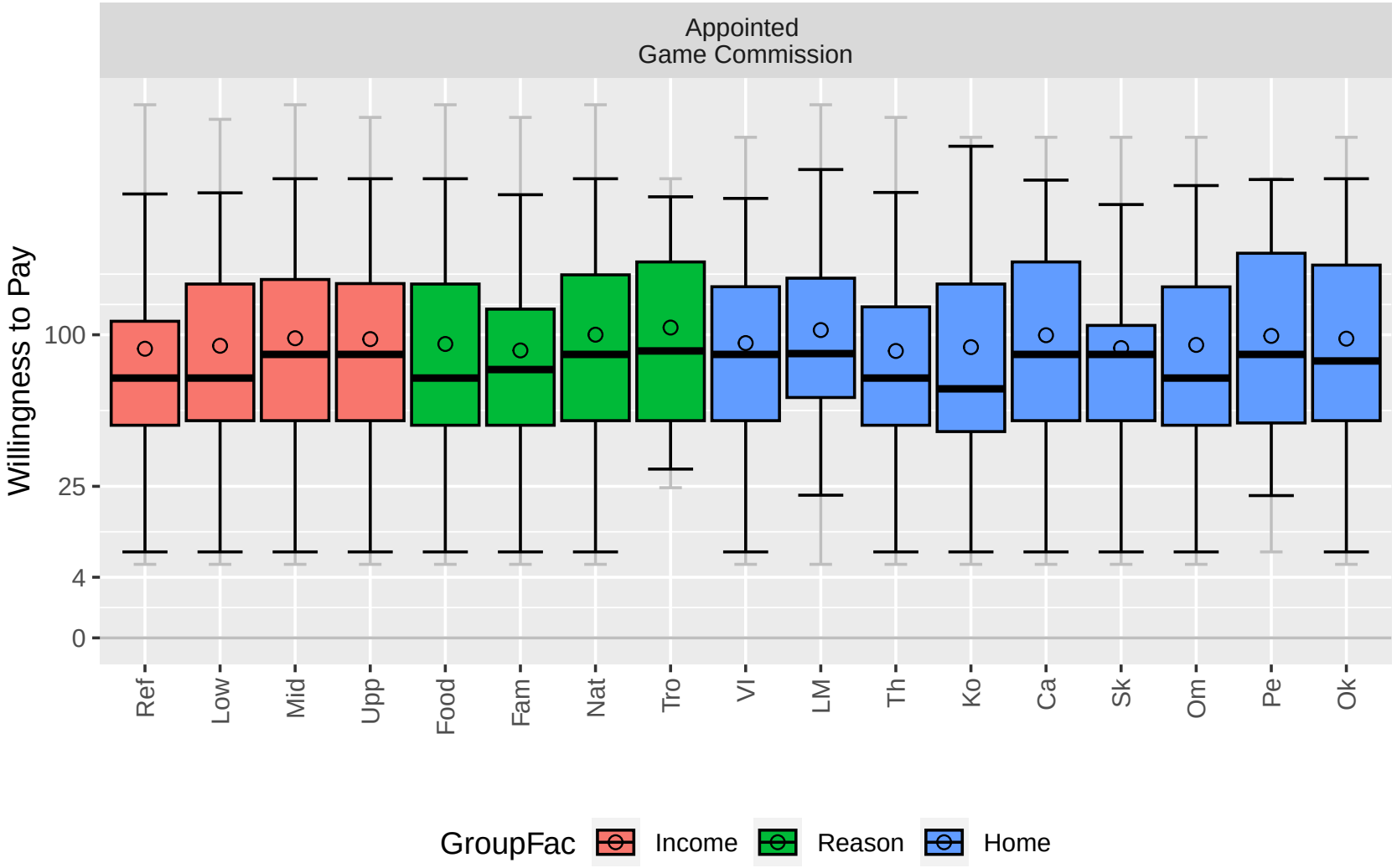
Harvestable Surplus: 10,000



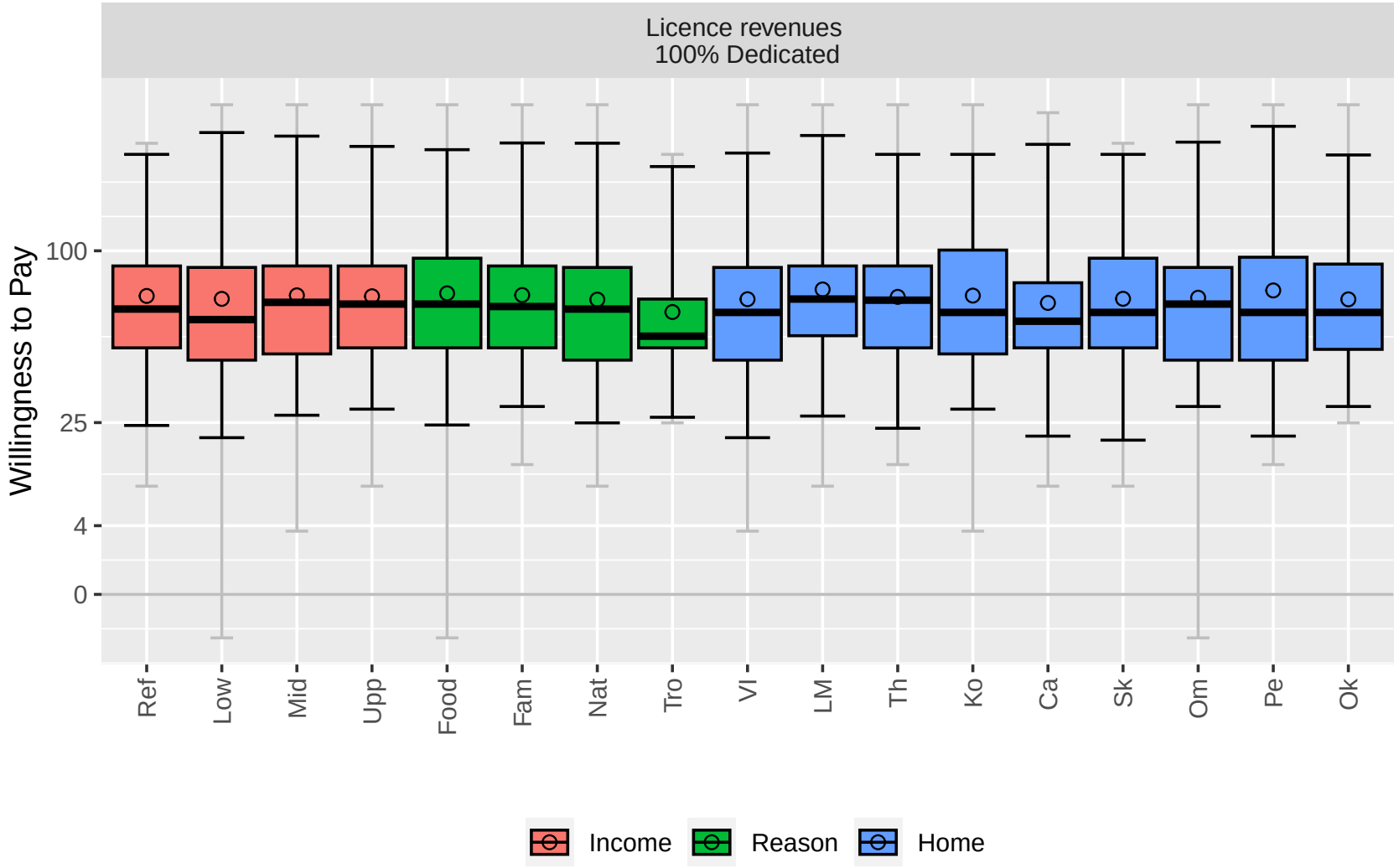
Success / Opportunity: 19/100 and 1/5



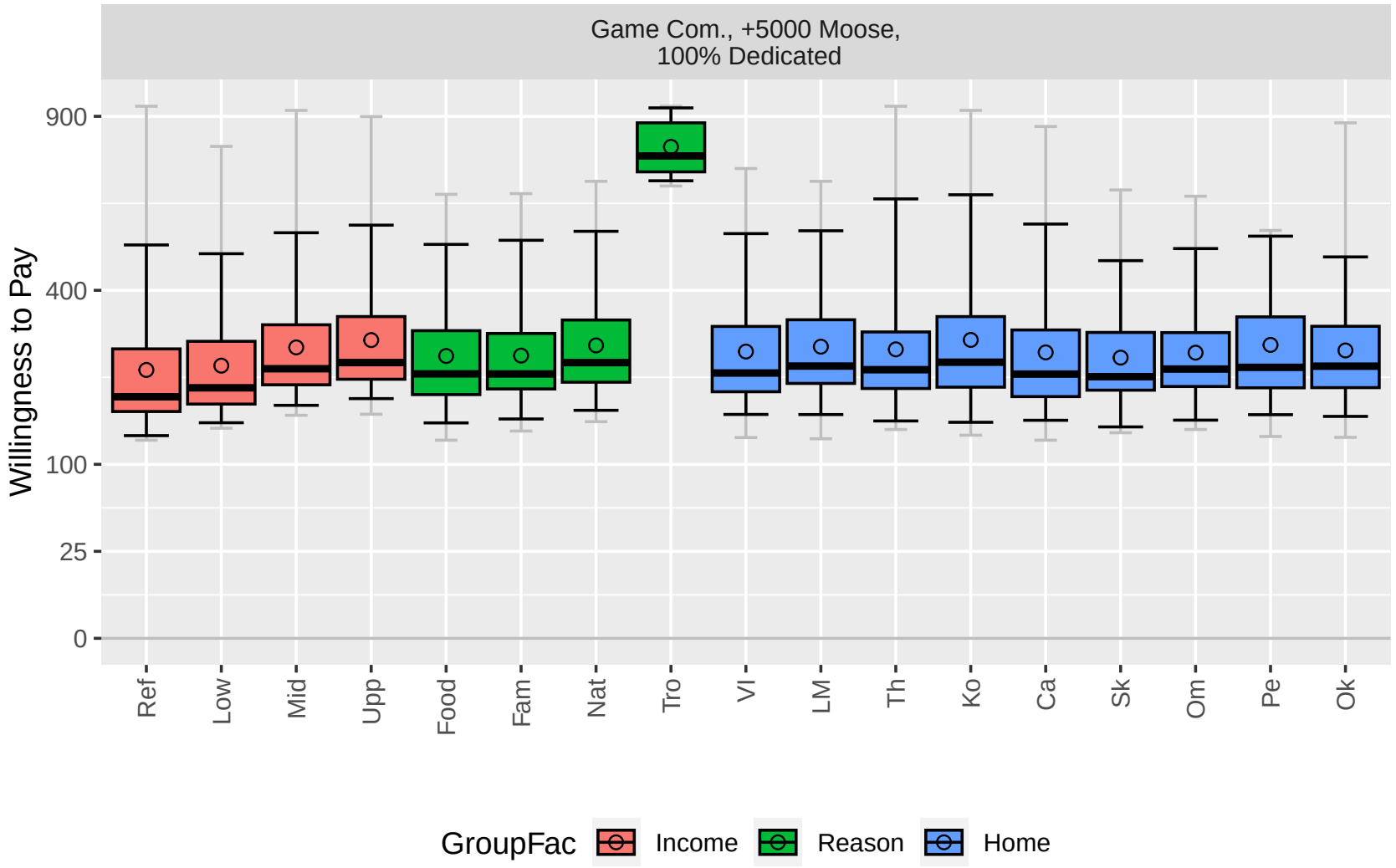
Governance: Game Commission



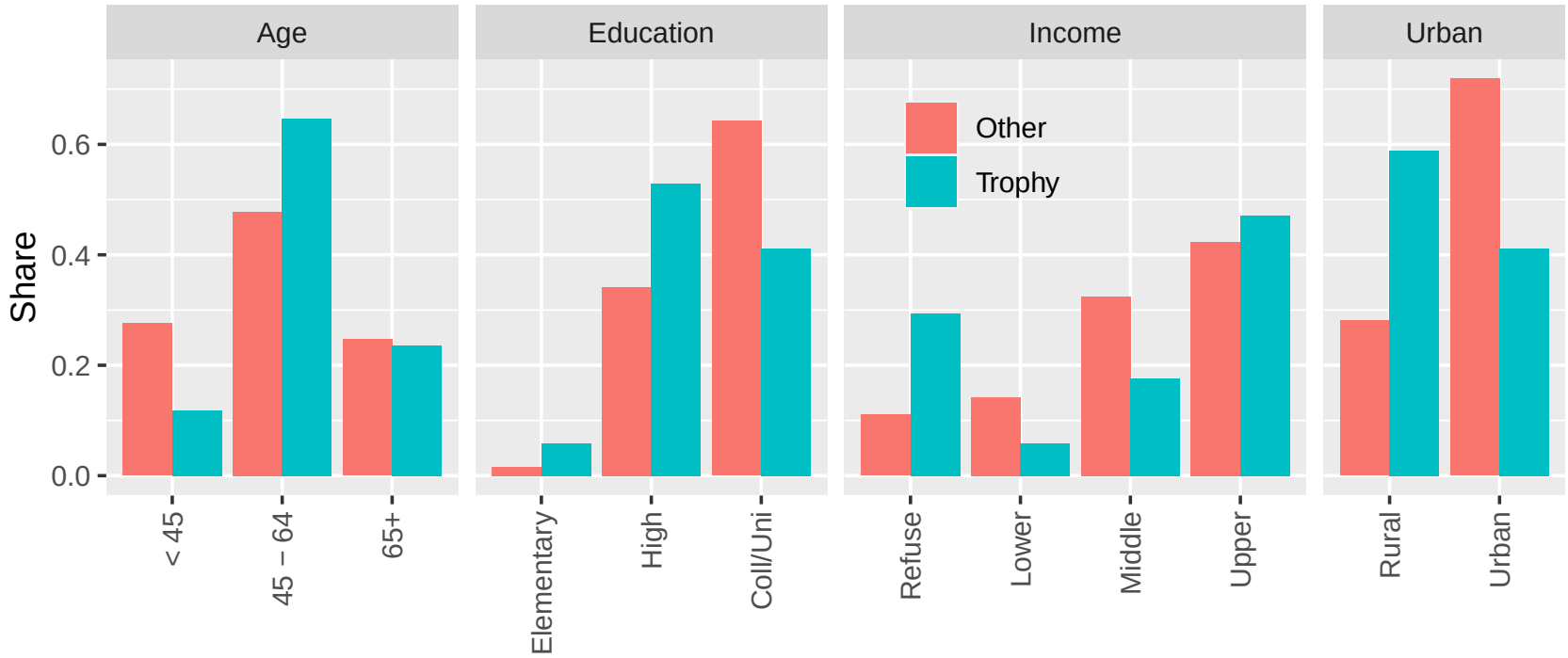
Dedicated Licence Share: 100%



Combination: +5K surplus, game com., 100%



Trophy Hunters



- There are 17 trophy hunters in 2038 respondents (0.83%).
- Statistical difference: Refuse ($P = 0.0807$) and Rural/Urban ($P = 0.0047$).

Conclusions

- BC resident hunters who participated in the moose limited entry hunt have heterogeneous preferences.
  - Strong income effect on WTP for any alternative, weaker for income, age and hunting experience.
  - WTP for larger harvest numbers largely reflected in bias favoring alternative.
  - Those with favorite hunting region as home region WTP to hunt more often, even if less likely to be successful.
    - Even stronger for self assessed advanced hunters.
    - Much weaker for hunters with neigbouring favorite region (travel cost).

Conclusions

- BC resident hunters who participated in the moose limited entry hunt have heterogeneous preferences.
  - Reforming governance to an appointed game commission strongly favored by those leaning right politically, relative to no leaning.
  - Hunters strongly prefer dedicating more funding to game management.
    - Right leaning respondents double WTP with doubling of dedicated share.