Valuing crop conservation in the Czech Republic using a discrete choice experiment

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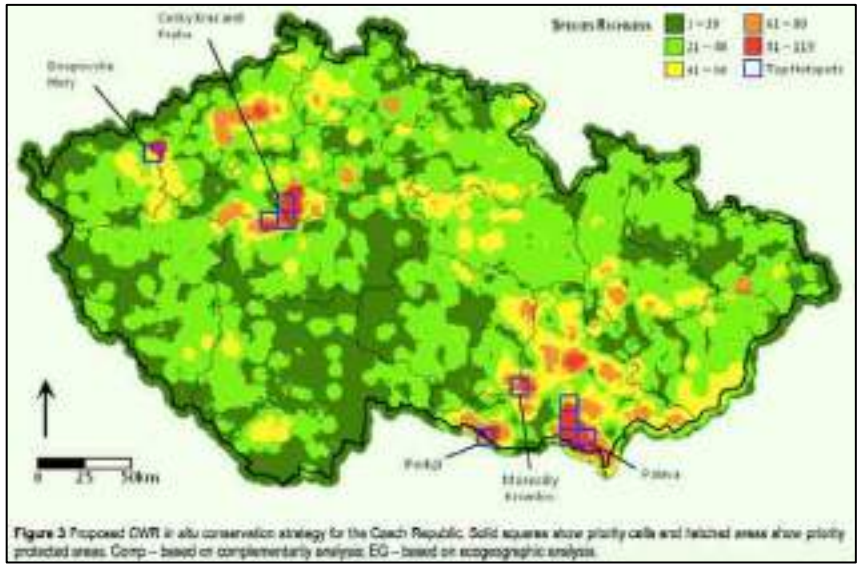
Introduction

- **This study was undertaken as part of my GAUK-funded Master's thesis research, which focused on the valuation of crop diversity in the Czech Republic.**

- More specifically, I utilize a discrete choice experiment to elicit preferences for the conservation of specific types of crop diversity in the Czech Republic.



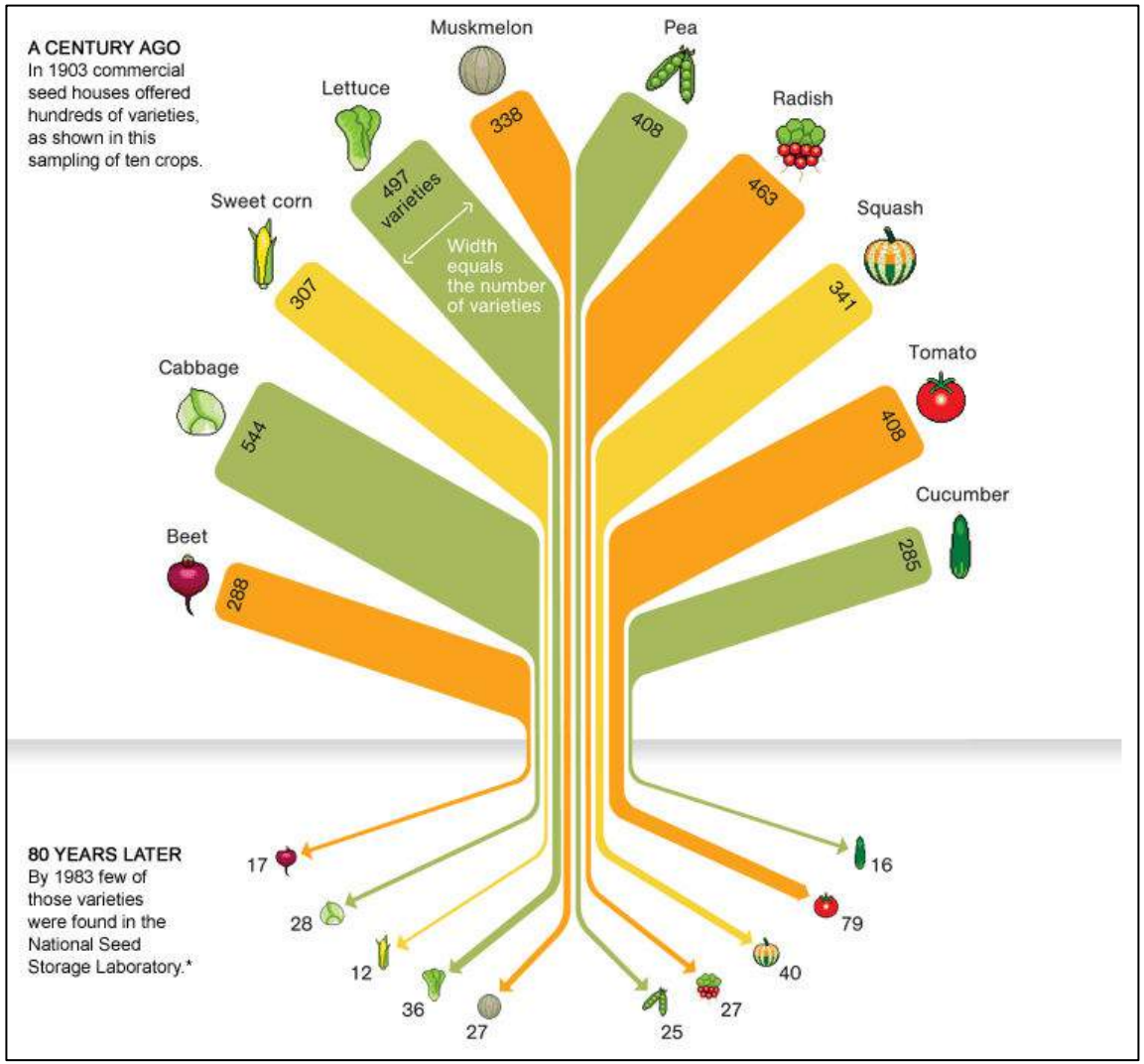
The Value of Crop Diversity

- Crop diversity is economically valuable and essential for food security. It is important for two major reasons:

  - The genetic diversity of crops is **valuable for breeding new, improved crop varieties** that are more productive and resilient

  - Crop varieties also **provide value through direct use**, to the farmers who grow them and those who consume them

Global PGR Crisis



http://ngm.nationalgeographic.com/2011/07/food-ark/siebert-text

- Many crop varieties have been lost as improved varieties have been adopted; many more are at risk.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SP & Crop Diversity

- **Birol et al. (2006):** DCE used to estimate how farmers valued four attributes of Hungarian home gardens.
- **Birol et al. (2007):** DCE used to estimate values placed by Mexican farmers on three components of crop diversity (crop species richness, maize variety richness and the presence of maize landraces) maintained in traditional *milpa* production systems.
- **Poudel and Johnsen (2009):** CV method, estimated WTP of Nepalese farmers to pay for the conservation of rice landraces at $4.18 for *in situ* and $2.20 for *ex situ* conservation per year.
- **Krishna et al. (2013):** used a SP approach to estimate the minimum amount farm households would be willing to accept to conserve minor millet species, with mean farmer WTA values per 0.10 acres of land ranging from $3 to $21.

Research Objective

Research Objective:

- To estimate WTP for the conservation of specific crop types
- To analyze preference heterogeneity
- **Key innovation:** eliciting preferences of the general public for crop conservation, permitting the estimation of aggregate value and capturing non-use values

Method

- Stated preference, discrete choice experiment with efficient design (Ngene)

Crop Diversity Conservation in the Czech Republic

- Crop diversity in the Czech Republic is primarily conserved by the publically funded National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity
- The Crop Research Institute in Prague-Ruzyne and fifteen other facilities maintain over 53,000 crop varieties, from wheat and potatoes to hops and fruit trees.
- The National Programme provides seeds and crop varieties for free to those who request samples of their holdings.

Questionnaire Structure

◆I focused on three crops that are directly consumed and recognizable by the Czech public: **hops, wine, and fruit trees**

◆ I used a discrete choice experiment to elicit preferences for:

- Conservation of hop varieties
- Conservation of wine varieties
- Conservation of fruit tree varieties, such as cherry tree varieties, apple varieties, and plum varieties

◆The CE alternated with an experiment on general crop diversity; and was followed by two other experiments

Survey Implementation

- Sample: ~1400 individuals (ages 18-69) in the Czech Republic
- Target population:
  - 2/3rds: country-representative
  - 1/3rd: sub-set from South Moravia (agricultural region)
- Quota-based sampling from well-managed internet panel
- Mode of administration: CASI
- Data collection: summer 2016

Choice experiment design

- D-efficient design with 100 tasks, blocked in 25 blocks, resulting in 4 choice tasks per respondent
- Labelled experiment with 3 program alternatives and the status quo
- Each program was labelled "Wine," "Hops," or "Fruit tree," keeping the same order on the card and having the status quo on the very right, in the example to follow
- The order of the program alternatives and status quo varied randomly by respondent to control for any order-specific effects

Choice card example

Plodina	**Vinná réva**	**Chmel**	**Ovocné stromy**	**Současný stav**
Počet dalších odrůd, které budou uchovány	15 odrůd	35 odrůd	35 odrůd	Žádná nová odrůda
Jednorázová platba	100 Kč	250 Kč	300 Kč	0 Kč
Jakou možnost preferujete?	☐	☐	☐	☐

Econometric approach

Econometric Specification

$$V_{ij} = \beta_1 * Hops_{ij} + \beta_2 * Wine_{ij} + \beta_3 * Fruit\ Trees_{ij} + \beta_4(y_i - c_{ij}) + \varepsilon_{ij}$$

Modeling

- Conditional logit: $$P_{ij} = \frac{exp(Z_{ij}\alpha)}{\sum_{k=1}^{J} \exp(Z_k\alpha)}$$

- Log likelihood: $$\log L = \sum_i \sum_j y_{ij} P_{ij}$$

Conditional logit results

Czech representative sample

	Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
ASChops	-0.4878	0.0645	-7.56	<.0001***
ASCfruit	0.2018	0.0646	3.12	0.0018 ***
ASCwine	-0.3893	0.0641	-6.07	<.0001***
COST	-0.00363	0.00033	-10.95	<.0001***

S. Moravian sample

	Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
ASChops	-0.5662	0.0893	-6.34	<.0001***
ASCfruit	0.4098	0.0836	4.9	<.0001***
ASCwine	-0.141	0.0811	-1.74	0.082*
COST	-0.003167	0.00042	-7.56	<.0001***

Conditional logit results

Czech representative sample

	Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
HOPS	-0.01494569	0.00256447	-5.8280	5.61e-09 ***
FRUIT	0.01603491	0.00215482	7.4414	9.97e-14 ***
WINE	-0.01006852	0.00249489	-4.0357	5.445e-05***
COST:	-0.00432461	0.00025939	-16.6719	< 2e-16 ***

S. Moravian sample

	Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
HOPS	-0.02322621	0.00357035	-6.5053	7.75e-11***
FRUIT	0.02017263	0.00290365	6.9473	3.72e-12***
WINE	-0.00560351	0.00307757	-1.8208	0.0686*
COST:	-0.00319812	0.00033369	-9.5840	< 2.2e-16***

Conditional logit results

		Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
Male x	WINE	-0.013	0.005218	-2.48	0.013**
	HOPS	0.000454	0.005617	0.08	0.9356
	FRUIT	-0.005789	0.004218	-1.37	0.17
Age x	WINE	-0.000467	0.000136	-3.44	0.0006***
	HOPS	-0.000463	0.000141	-3.29	0.001***
	FRUIT	-0.000311	0.000108	-2.87	0.0041***
Low educ x	WINE	0.007532	0.005187	1.45	0.1465
	HOPS	0.0137	0.005349	2.56	0.0106***
	FRUIT	0.004569	0.004209	1.09	0.2777
Village x	WINE	0.001192	0.005285	0.23	0.8216
	HOPS	-0.005936	0.005452	-1.09	0.2762
	FRUIT	0.008262	0.004308	1.92	0.0551*
P. income x	WINE	0.007388	0.002898	2.55	0.0108**
	HOPS	0.004266	0.003278	1.3	0.1931
	FRUIT	0.006639	0.002346	2.83	0.0047***

Conditional logit results

		Coefficient	*Std. Error*	*t-value*	*Pr(>|t|)*
Gardener x	WINE	0.0112	0.005076	2.21	0.027**
	HOPS	0.001289	0.005221	0.25	0.8049
	FRUIT	0.0132	0.004078	3.22	0.0013***
Drinker x	WINE	0.0149	0.005421	2.75	0.006***
	HOPS	0.027	0.005562	4.85	<.0001***
	FRUIT	-0.007211	0.004689	-1.54	0.1241
Wine lover x	WINE	0.0177	0.005296	3.34	0.0008***
	HOPS	-0.008431	0.006534	-1.29	0.1969
	FRUIT	-0.004951	0.004896	-1.01	0.3119
Praha x	WINE	0.0154	0.007643	2.02	0.0434**
	HOPS	-0.0197	0.0102	-1.94	0.0526*
	FRUIT	0.008862	0.006372	1.39	0.1643
Usti x	WINE	0.006313	0.0114	0.56	0.5782
	HOPS	0.033	0.009328	3.54	0.0004***
	FRUIT	-0.001197	0.009378	-0.13	0.8985
Morava x	WINE	0.0243	0.007546	3.23	0.0013***
	HOPS	0.007329	0.009377	0.78	0.4345
	FRUIT	0.00446	0.00654	0.68	0.4952

Conclusions

- The Czech population was shown to have **a strong preference for conserving fruit trees** over hops and wine
- The mean WTP for general fruit tree conservation was found to be **55.58 Kč ($2.26)** for the Czech repr. sample and **129.40 Kč ($5.26)** for the S. Moravian sub-sample
- Based on the Czech representative sample (n=731), we estimate that the Czech population (18-69) is willing to pay approximately **415 million Kč ($16.8 million)** for additional fruit tree conservation

Next Steps

- **Mixed logit estimation** (not dependent on Independence of Irrelevant Alternatives)
- **Latent class estimation** – are there classes of individuals in the sample that had positive WTP for conserving hops & wine?

Acknowledgements

Any thoughts or questions?

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