The Interaction Effects of Disability Types and Gender on Employment
Assessing Intersectionality in the 2011 Irish Census

Kenjiro Sakakibara

Department of Advanced Social and International Studies,
Graduate School of Arts and Sciences, University of Tokyo

East Asia Disability Studies Forum 2019

Outline

- The concept of intersectionality
- Additivity and interaction
- Modeling intersectionality
- Results (1): intersectionality in employment opportunity
- Results (2): intersectionality in occupation

Disability and Gender

Article 6 of the CRPD: "...women and girls with disabilities are subject to multiple discrimination..."[1]

Multiple disadvantage for women with disabilities is suggested in the context of employment[2]
···Women with disabilities are less likely to be employed and more likely to be inactive than men with disabilities

Intersectionality[3][4]

Multiple inequalities crossing with each other: gender, disability, ethnicity etc.
Possibility of additional disadvantage
↔the relation can be complicated

Example [4]
A woman with disability was not forced into being a homemaker, got an education in office work and became self-sufficient

RQ: additivity or interaction?

Two types of intersectionality can be distinguished:
- Additivity : simple synthesis of different forms of disadvantage
- Interaction : more complicated effect (positive or negative) caused by the intersection of different forms of disadvantage

Research Question

Which form of intersectionality applies to the employment disadvantage for women with disabilities?

···Considering disability types

Statistical Effects

The tendency of something to increase/decrease another thing
Example Suppose men are taller than women on average
=The effect of gender on height (β_G)

Statistical Model:

$$X = \mu + \beta_G + \epsilon$$

(X: height, μ: female average, ϵ: error)

Additivity and interaction

β_A, β_B: The effects of A and B on the outcome X

Additivity $X = \mu + \beta_A + \beta_B + \epsilon$
(Simple synthesis of two effects)
Interaction $X = \mu + \beta_A + \beta_B + \beta_{AB} + \epsilon$
(Different from the simple synthesis)

β_{AB}: the interaction term

Probability Modeling

Estimates the effect of something on the probability of an event
Example The probability of being employed

$$f(p) = \mu + \beta_G + \beta_D + \epsilon \text{(additive model)}$$

$$f(p) = \mu + \beta_G + \beta_D + \beta_{GD} + \epsilon \text{(interaction model)}$$

(p: probability, G: gender, D: disability)

Logit models $f(p) = logit(p) = log\frac{p}{1-p}$
···Logit corresponds to log-odds

Odds and log-odds

$\boxed{\text{Odds}}$ $\frac{p}{1-p}$

$\cdots$ The ratio of the probabilities that an event occurs or not

$\boxed{\text{Log-odds}}$ The logarithm of the odds

$\boxed{\text{Odds ratio (OR)}}$ The ratio of odds with and without a condition

e.g. 1 wins : 1 losses $\rightarrow$2 wins : 1 losses

$\cdots$ Odds ratio = 2

Additive/multiplicative

β's in a logit model exponentiated = OR

The effect of both A and B: $\beta_A + \beta_B$

The OR: $e^{\beta_A + \beta_B} = e^{\beta_A} e^{\beta_B}$ $\cdots$ The OR of A and B multiplied

Additive model of log-odds
=Multiplicative model of odds ratio

Modeling Employment

Women and disabled people may be less likely to be employed
=The β_G and β_D below are asuumed to be negative

$$logit(p_{Working}) = \mu + \beta_G + \beta_D[+\beta_{GD}] + \ldots + \epsilon$$

The OR for Women with disabilities:

$$e^{\beta_G + \beta_D[+\beta_{GD}]}$$

$\boxed{\text{RQ operationalized}}$

Can β_{GD} be considered as zero or not?

Type-sensitive approach

Disability types (self-reported) are handled separately to explore the possibility of difference in work disadvantage

┌─ Statistical definition of disability ─────

A significant or strong association between a bodily condition and a social exclusion measure

$\rightarrow$Disabilities are called "limitations" until their associations with some exclusion metric are confirmed

---

Data Description

The microdata of Irish Census 2011

- Disability-related information is included
- Available from the IPUMS-International database[5]

Data size (a 10% subsample)	474,353
Working-aged persons (age 15-64)	303,773

Basic Statistics

Age	38.34	Irish language	39.08%
(S.D.)	13.37	Irish ethnicity	84.42%
Female	50.50%	Limitations:	
Education: Primary	9.93%	Visual	0.76%
Lower Secondary	19.20%	Hearing	1.17%
Upper Secondary	38.50%	Physical	3.35%
Tertiary (non-degree)	5.08%	Intellectual	1.04%
Tertiary (degree+)	27.29%	Learning	2.11%
Religion: Catholic	84.12%	Psychological	2.26%
COI/Protestant	2.84%	OTher	5.09%
Other	5.70%		
None	7.34%		

$N = 286845$. Among persons with one or more bodily limitations (30,040), 9,842 persons reported multiple limitations, among whom 5,467 had more than one specified (except for "Other") limitations.

Employment Status (%, N=286,845)

	Male			Female		
	W	U	I	W	U	I
None	64.9	16.4	1.0	58.2	8.4	0.9
Visual	35.3	16.9	32.2	31.5	9.9	28.6
Hearing	46.1	18.0	20.0	38.5	10.7	19.4
Physical	17.2	12.7	57.9	18.3	7.7	49.6
Intellectual	17.3	11.5	51.6	14.4	5.6	55.7
Learning	22.5	16.7	36.1	19.8	11.2	37.0
Psychological	19.3	18.0	47.7	23.8	11.7	38.4
Other	33.8	15.1	36.9	30.5	8.7	33.8

W: working, U: unemployed, I: incapacitated
Other categories were dropped from the table.

Employment Status (%, N=163,058)

	Male			Female		
	M	P	E	M	P	E
None	11.3	16.1	9.4	7.0	24.5	7.6
Visual	10.8	14.7	12.9	5.1	16.1	11.6
Hearing	9.0	12.2	11.6	7.8	15.6	10.3
Physical	7.9	8.3	14.5	6.3	16.4	10.2
Intellectual	3.9	2.7	29.8	2.6	7.0	27.8
Learning	5.8	5.5	19.4	3.7	8.9	18.1
Psychological	7.0	15.8	14.3	5.6	17.2	8.3
Other	10.1	15.2	10.7	7.1	24.3	8.5

M: managerial, P: professional, E: elementary
Other categories were dropped from the table.

Logit Model 1: employment status

Dependent :
Stage 1: $log\frac{p_{Working}}{p_{NotWorking}}$
Stage 2: $log\frac{p_{Homemaker}}{p_{Unemployed}}$, $log\frac{p_{Incapacitated}}{p_{Unemployed}}$, ...

Independent : Age, Age^2, Gender, Education (Dummy), Religion (Dummy), Irish language ability, Irish ethnicity, Disability types

Interaction : Gender*Disability types

$N = 286845$ (complete cases)

Logit Model 2: occupation

Dependent : $log\frac{p_{Managerial}}{p_{Elementary}}$, $log\frac{p_{Professional}}{p_{Elementary}}$, ...

Independent : Age, Age^2, Gender, Education (Dummy), Religion (Dummy), Irish language ability, Irish ethnicity, Disability types

Interaction : Gender*Disability types

$N = 163058$ (complete cases, working)

Model fit

	AIC	BIC
Model 1 Stage 1	312125.8	312411.1
(Without Interaction)	312237	312448.3
Model 1 Stage 2	213430	215141.8
(Without Interaction)	213370.4	214638.4
Model 2	570243.7	572404.1
(Without Interaction)	570192.8	571793.1

Model fit and interaction

Interaction between gender and disability types is:

- Rejected concerning Model 1 Stage 2 (unemployment/other non-working options) and Model 2 (occupation)
- Accepted concerning Model 1 Stage 1 (working/not working)

Model 1 Stage 1 (with interaction)

Age	1.79**	Religion (ref. Catholic)	
Age^2	0.50**	COI/Protestant	0.85**
Female	0.62**	Other	0.61**
Education (ref. Primary)		None	0.80**
Lower Secondary	1.41**	Irish language	1.03**
Upper Secondary	2.70**	Irish ethnicity	1.09**
Tertiary (non-degree)	3.95**		
Tertiary (degree+)	6.61**		

(Continued)

Model 1 Stage 1 (with interaction)

Limitations		Gender*Limitations	
Visual	0.58**	F*Visual	1.18
Hearing	0.80**	F*Hearing	0.97
Physical	0.20**	F*Physical	1.45**
Intellectual	0.58**	F*Intellectual	1.09
Learning	0.63**	F*Learning	1.13
Psychological	0.17**	F*Psychological	1.75**
Other	0.49**	F*Other	1.01
McFadden	0.20**		

$** : p < .01, * : p < .05$, intercept omitted
Age is normalized by (Age-Mean)/S.D.

Model 1 Stage 1 (with interaction)

- All limitation types as well as being a woman are negatively correlated with work opportunity
- On the whole the disadvantage for women with limitation is additive (multiplicative when exponentiated)
- For women with physical and psychological limitation, the disadvantage by being a woman is nealy offset.

Stage 2 (without interaction)

Age	2.20**	Irish language	1.12**
Age^2	1.07**	Irish ethnicity	1.77**
Female	1.71**	Limitations	
Education (ref. Primary)		Visual	2.28**
Lower Secondary	0.98	Hearing	1.26**
Upper Secondary	0.76**	Physical	8.94**
Tertiary (non-degree)	0.61**	Intellectual	12.68**
Tertiary (degree+)	0.54**	Learning	1.27**
Religion (ref. Catholic)		Psychological	8.61**
COI/Protestant	0.84*	OTher	4.72**
Other	0.85*		
None	0.76**		
McFadden	0.43**		

Only incapacity/unemployed odds ratios are provided
$** : p < .01, * : p < .05$, intercept omitted
Age is normalized by (Age-Mean)/S.D.

Unemployment and Incapacity

The tendency among non-working persons to classify their status as incapacitated rather than unemployed is stronger among

- persons with all limitation types (in varying degrees)
- women
- persons with less education
- persons with Irish language ability and/or Irish ethnicity

The disadvantage for women with some limitation is additive
(The odds ratios are multiplied)

Model 2 (without interaction)

	Managerial	Professional
Age	1.81**	1.80**
Age^2	0.76**	0.84**
Female	0.66**	1.52**
Education (ref. Primary)		
Lower Secondary	2.42**	18.51**
Upper Secondary	6.82**	102.87**
Tertiary (non-degree)	15.77**	873.69**
Tertiary (degree+)	43.62**	7843.62**
Religion (ref. Catholic)		
COI/Protestant	2.90**	2.81**
Other	1.11**	1.64**
None	1.56**	2.02**

(Continued)

Model 2 (without interaction)

	Managerial	Professional
Irish language	1.37**	2.06**
Irish ethnicity	4.91**	5.74**
Limitations		
Visual	0.85**	0.77**
Hearing	0.73**	0.77**
Physical	0.69**	0.70**
Intellectual	0.53**	0.24**
Learning	0.45**	0.40**
Psychological	0.62**	0.71**
Other	1.22**	1.02**
McFadden	0.18**	

Other occupations dropped from the table
$**: p < .01, *: p < .05$, intercept omitted
Age is normalized by (Age-Mean)/S.D.

Women with disabilities and occupation

- Women are underrepresented among managers but overrepresented among professionals
- Persons with some limitation are underrepresented among managers and professionals
- Education has a very strong favorable effet

Additive effects for women with some limitation
(The odds ratios are multiplied)

Discussion

- Interactions are only partially supported
- Interactions regarding the odds of "working" ($\frac{p_{Working}}{1-p_{Working}}$) for some limitation types alleviate multiple disadvantages
- Additive (multiplicative when exponentiated) effects in the models roughly correspond to multiple disadvantages, although women are more likely than men to be in professional occupation

Conclusion and Acknowledgements

- Intersectionality of disability types and gender mainly as additivity rather than interaction
- Multiple exclusion of women with bodily limitations from the labor market
- Additive effects on sociall stratification

References

1. *Convention on the Rights of Persons with Disabilities*, A/RES/61/106.
2. Moodley, J. and L. Graham (2015), "The importance of intersectionality in disability and gender studies," *Agenda*, 29(2): 24–33.
3. Walby, S. et al.(2012), "Intersectionality," *Sociology*, 46(2): 224–240.
4. Söder, M. (2009), "Tensions, perspectives and themes in disability studies," *Scandinavian Journal of Disability Research*, 11(2): 67–81.
5. Minnesota Population Center (2017) "Integrated Public Use Microdata Series, International," Available at https://doi.org/10.18128/D020.V6.5 .