

# Tsunami Impact Assessment and Vulnerability Index Development using Computable General Equilibrium (CGE) Model and Geographic Information System (GIS) – A Study on Mie Prefecture, Japan

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## Appendix

**Table A.1.** Building ratio in Mie Prefecture

District	Wooden ratio	Non-wooden ratio
Inabe city	61.3%	38.7%
Iga city	74.5%	25.5%
Ise city	64.8%	35.2%
Toin town	64.6%	35.4%
Kameyama	65.2%	34.8%
Kumano city	87.7%	12.3%
Kisosaki town	62.1%	37.9%
Kuwana city	67.1%	32.9%
Komono town	68.1%	31.9%
Kawagoe town	60.4%	39.6%
Asahi town	66.2%	33.8%
Yokkaichi city	66.4%	33.6%
Shima city	69.7%	30.3%
Matsuzaka city	68.6%	31.4%
Taki town	64.4%	35.6%
Odai town	72.1%	27.9%
Meiwa town	68.3%	31.7%
Toba city	66.4%	33.6%
Tsu city	70.2%	29.8%
Tamaki town	67.9%	32.1%
Taiki town	71.8%	28.2%
Watarai town	64.6%	35.4%
Minami Ise town	70.8%	29.2%
Kiho town	87.9%	12.1%
Mihama town	88.4%	11.6%
Owase city	82.4%	17.6%
Kihoku town	83.1%	16.9%
Nabari city	74.3%	25.7%
Suzuka city	63.9%	36.1%

Source: Ministry of Internal Affairs and Communications (2019)

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Table A.2. Sectoral classification

Abbreviation	Sector (22)	IO table sector (42)	GIS sector (155)
AGR	Agriculture	Agriculture; Forestry	Agricultural cooperative; Agriculture and forestry; Horticulture; Livestock
FIS	Fishery	Fishery	Fisheries cooperative; Fisheries
POA	Petroleum & mining	Mining; Petroleum and coal products	Gas station and rest area; Mining and energy
FOD	Food processing	Beverage	Food
WPP	Wood & printing	Textile; Pulp, paper, and wood products	Printing; Publishing; Textiles and clothing; Life miscellaneous goods; Fashion accessories, hobbies, folk art, crafts; Wood products, paper, and pulp
CHM	Chemical	Chemical products; Plastic and rubber	Chemistry, Rubber, and Plastic
POT	Pottery	Ceramics, earth, and stone products	Ceramic industry
STL	Steel	Steel; Non-ferrous metal; Metal products	Steel; Non-ferrous metal; Metal products
MCH	Machinery	General machinery; Production machinery; Commercial machinery	Machine tools and general machinery; Precision machinery
EEQ	Electronic equipment	Electronic components; Electrical machinery; Information and communication equipment	Electricity and office equipment
TEQ	Transportation equipment	Transport equipment	Transport machinery
MAN	Manufacture	Manufacturing	Manufacturing
CON	Construction	Construction	Construction; Construction materials; Equipment work; Housing equipment
ELY	Electricity & water	Electricity, gas, and heat supply; Water supply	Electricity; Gas
PUB	Public administration	Waste disposal; Public administration	National administration; Prefectural administration; Municipality; Police; Fire and disaster management agency; Business and public corporation; Other unions and organizations; Hall; Other public facilities; Cleaning industry and waste treatment
COM	Commerce	Commerce	Car, motorcycle, and bicycle sales; Used car sales; Trading company; Wholesale market; Department store super discount shop; Convenience store; Food and luxury items; Textiles and clothing; Cosmetics, accessories, ornaments, folk crafts; Furniture and household goods; Books and stationery; Sporting and hobby goods; Electrical and office equipment; Watch and camera store; Other sales

FIN	Finance	Finance and insurance; Real estate	Bank; Credit union and labor bank; Credit and other finance; Life insurance and non-life insurance; Securities; For rent; Housing; Real estate transaction; Exhibition hall
TRS	Transportation	Transportation	Post office; Airport and aviation; Harbor; Shipping; Train station; Bus; Taxi; Road tollhouse; Land transportation; Warehouse; Customs clearance, packaging, etc.
EDU	Education & Research	Education and research	Research institute and training center; University; High school and technical college; Junior high school; Primary school; Kindergarten and nursery school; Vocational school; Cram school and preparatory school; Language school; Culture center and hobby class; Library; Educational materials; Other schools and classrooms; Other educational and cultural facilities
MED	Medical service	Medical and welfare	Welfare facility; Hospitals and clinics; Health center and facility; Massage, acupuncture and moxibustion, various therapies; Pharmacy; Medical equipment
REC	Recreation	Accommodation business; Food and beverage service; Entertainment services	Hotel; Hotel and hot spring; Hostel; Motel; Recreation center, mountain lodge, public dormitory; Travel agency; Tourism and others; Kappou, ryotei, and kaiseki; Sushi; Grilled meat; Grilled chicken and robatayaki; Soba and udon; Japanese restaurant; Ramen and dumplings; Chinese cuisine; French cuisine; Italian food; Other restaurants; Fast food; Family restaurant; Caterer, Lunch, and delivery; Snacks, bars, and taverns; Café; Golf; Tennis; Sports Facilities; Game center; Pachinko parlor; Theaters; Bicycle race, horse race, boat race, auto race; Karaoke box; Pets; Other leisure facilities; Barber and salon; Baths, saunas, entertainment
SRV	Service	Other non-profit services; Service to business establishments; Personal service; Office supplies; Miscellaneous	Religious organization; Co-operation; Communication; Broadcast; Newspaper; Sales of automobile parts and tires; Car repair, maintenance, and wash; Parking lot; Agency service; Driving school; Car rental; Road service; Cleaning; Security and management; Rental; Repair and maintenance; Temporary staffing, introduction, and agency service; promotional ads; Survey and consultant; Lawyer; Professional services; Photograph, design, decoration, and recording; Information service; Ceremonial occasion

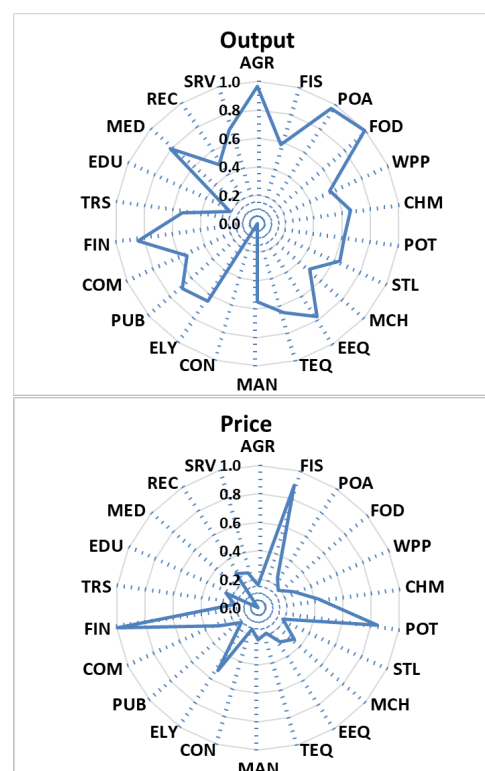
Source: Categorized by the authors

## Sensitivity analysis

We perturbed Armington's elasticity of substitution by 30% upward and downward while assuming the same disaster shocks. The simulation results were little affected by the alternative assumptions, implying that the results are robust and consistent.

**Table A.3.** Disaster impact with 130% Armington's elasticity of substitutions/transformations

Sector	Output	Price	Export	Import
AGR	-7.2	1.0	-4.3	-13.5
FIS	-41.6	17.5	-53.7	-3.3
POA	-12.1	2.0	-12.2	-11.4
FOD	-15.0	2.1	-15.5	-10.7
WPP	-9.3	1.9	-9.2	-9.5
CHM	-7.5	1.9	-7.2	-9.0
POT	-4.0	1.6	-2.6	-10.5
STL	-11.6	2.0	-11.8	-10.4
MCH	-8.4	2.0	-8.6	-6.8
EEQ	-12.2	2.3	-13.8	-7.3
TEQ	-12.4	2.1	-13.0	-10.1
MAN	-9.7	1.9	-9.5	-10.5
CON	-6.3	1.6	-5.4	-7.2
ELY	-16.2	4.6	-23.6	-2.6
PUB	-9.8	1.5	-8.9	-10.9
COM	-6.3	1.4	-5.0	-10.5
FIN	-13.1	5.2	-19.7	-5.4
TRS	-9.2	1.6	-8.4	-10.6
EDU	-8.0	2.0	-8.1	-7.8
MED	-9.3	0.9	-7.0	-11.5
REC	-10.7	2.4	-11.6	-9.5
SRV	-9.6	1.8	-9.3	-10.0
EV		--495,733 million JPY		



**Table A.4** Disaster impact with 70% Armington's elasticity of substitutions/transformations

Sector	Output	Price	Export	Import
AGR	-7.5	0.2	-4.7	-13.5
FIS	-37.2	25.6	-47.7	-6.5
POA	-12.1	2.0	-12.2	-11.3
FOD	-15.6	2.3	-16.2	-10.7
WPP	-9.4	1.9	-9.4	-9.5
CHM	-7.8	1.8	-7.5	-9.0
POT	-4.7	1.3	-3.5	-10.2
STL	-11.7	2.0	-11.9	-10.4
MCH	-8.4	2.0	-8.7	-6.8
EEQ	-11.9	2.5	-13.5	-7.4
TEQ	-12.3	2.2	-12.9	-10.1
MAN	-10.2	1.9	-10.2	-10.3
CON	-6.2	1.6	-5.8	-6.7
ELY	-15.3	5.7	-21.1	-4.9
PUB	-9.8	1.6	-9.4	-10.3
COM	-6.9	1.1	-5.9	-10.2
FIN	-13.0	5.7	-17.2	-8.3
TRS	-9.4	1.5	-9.0	-10.3
EDU	-7.9	2.1	-8.1	-7.7
MED	-9.2	1.0	-8.1	-10.4
REC	-10.6	2.5	-11.2	-9.7
SRV	-9.6	1.8	-9.5	-9.8
EV		---497,815million JPY		

