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Differences in Material Deprivation by Disability Certificates: A Focus on Physical and Mental Health

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1. Introduction

This study used multivariate analysis to determine whether the effect of material deprivation differs depending on the possession of a disability certificate. The concept of material deprivation has gained attention in recent years due to its multidimensionality and has been used to define the medium-term growth strategy of the European Union (EU). For example, in 2009, the 27 EU member states and the European Commission introduced this concept into the international EU Statistics on Income and Living Conditions (EU-SILC) survey. Currently, the situation of material deprivation is surveyed annually in the participating countries.

The EU-SILC study was inspired by Townsend's (1979, 1993) concept of relative deprivation. Relative deprivation involves the following conditions: Being unable to completely fulfill the roles expected of one as a member of society, participate in interactions with others, or satisfy the conditions of life such as daily diet, comfort, standards, and services.

Currently, there are two debates on the concept of material deprivation, especially in Europe: (1) material deprivation is a substitute indicator for income, and (2)the combination of both material deprivation and income is important. For example, Watson et al. (2021) suggest that using a measure of material deprivation instead of income leads to a more accurate identification and understanding of poverty. On the other hand, Ringen (1988) argues for the importance of combining both material deprivation and income in poverty research because income indirectly measures poverty, whereas material deprivation

indicators directly measure poverty in terms of consumption. More material deprivation research is needed to settle which of these two discussions is correct.

In addition to the above discussion, empirical studies using indicators of material deprivation have also shown that people with activity limitations due to health problems and people with disabilities are at higher risk of material deprivation. For instance, Guio and Marlier (2017), using EU-SILC data, identified higher risks of material deprivation for individuals with low incomes, those with activity limitations due to health problems, those living in households with low work intensity, and migrants. Furthermore, Watson et al. (2021), using EU-SILC data from 2005 to 2014, suggest that single parents and persons with disabilities are at the highest risk of material deprivation in all 11 European countries. Most of these studies focused on Europe, and among those focused on Asia-Pacific countries, few have focused on Japan.

There are fewer studies using material deprivation as a measure of poverty in Japan than Europe. This is because the first measurement and analysis of national deprivation indicators in Japan was conducted in 2006, and the research is still in its infancy (Otsu and Watanabe 2019). Abe (2006) analyzed target groups, which included elderly persons aged over 65 years, households with children, young women, and persons who had experienced homelessness. Outside of academic research, the Ministry of Health, Labor and Welfare (MHLW) has also identified material deprivation among welfare recipient households through its "Survey of Lifestyle Value and Actual Living Conditions."

The number of studies of the relationship between health and material deprivation has recently increased in Japan, as in Europe; however, this relationship needs to be better defined. There are two reasons for this: The first is that prior studies have not simultaneously discussed persons with health problems and persons with disabilities, such as those who hold disability certificates (disability ID). Otsu and Watanabe (2021) analyzed elderly and

nonelderly individuals separately and found that health problems were associated with material deprivation or low income, rather than differences in material deprivation status depending on whether a person was elderly or not. Izumida and Kuroda (2019), who analyzed differences in material deprivation by eligibility status for disability support, and that disability certificate holders are more materially deprived than non-disability certificate holders; however, this study did not address health issues. In addition, their study was limited to a cross-tabulation level of analysis. If both disability ID holders and non-disability ID holders have health problems, do the former experience more material deprivation than the latter?

The second reason why the link between health problems and material deprivation in Japan should be made clearer is that not all people with health problems receive institutional support because some of their conditions do not fit the national government's definition of disability. Particularly, disability IDs provide incentives that are most relevant to the statutory employment rate of persons with disabilities. The employment of persons with disabilities is mandatory for employers by law. Specifically, this means that private companies with 43.5 or more employees must hire at least one person with a disability ID. Because the possession of a disability ID requires a diagnosis by a doctor and government approval, it is inferable that individuals who have health problems or disabilities but do not possess a disability ID are not using the welfare system for persons with disabilities. Momose (2022) described that the number of people in Japan who have mental or physical problems but do not have a disability ID is 9.7 times than that of people who do have a disability ID.

To the best of my knowledge, there are no previous studies in Japan that have used multivariate analysis to examine the relationship between disability ID status and health and their effects on material deprivation. Therefore, this study was performed to further clarify the relationship between health and material deprivation.

2. Methods

2.1 Data

This analysis used the dataset of the nationally representative "Survey on Social Security and People's Life", which was conducted in 2017 by the National Institute of Population and Social Security Research (IPSS). The survey forms for these data included a household form (for the head of the household) and an individual form (for household members aged 18 years and older), and the data are nested. Both questionnaires were used to calculate material deprivation scores. Furthermore, this survey is unique among national surveys in Japan because it provides two sets of data simultaneously: Information on disability ID status and health conditions. The analysis in this study was limited to subjects aged 18-59 years who were not currently attending school. This is because elderly individuals are more likely to possess a disability certificate and have health problems. This study focused on those who were currently working.

2.2 Variables

This study used the material deprivation score as the dependent variable. Material deprivation scores were calculated using a method similar to that of Otsu and Watanabe (2019), with the simple addition of materially deprived items[1]. The distribution of the

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[1] The items used for the material deprivation score were as follows: Having access to food, able to eat a meal containing meat or fish (or their equivalent if vegetarian) every other day, having clothing, receiving medical care, having access to a doctor when needed, having access to a dentist when needed, able to purchase over-the-counter medicines (cold remedies, pain relievers, ointments, etc.), bus or train fare, having a car, having a washing machine, having a color TV, having a telephone, having a bed or futon for each family member, having a fire alarm, having room temperature control, able to pay rent, having a suit for employment or work, attending a relative's wedding or funeral, taking annual trips, having money that

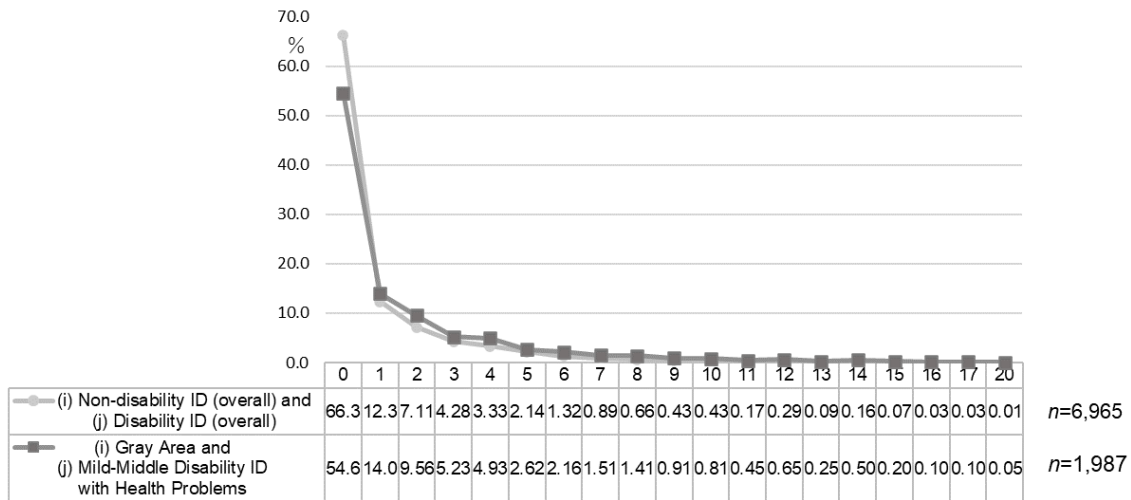material deprivation scores (individuals aged 18-59 years, excluding current students) is shown in Figure 1.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	20	
(i) Non-disability ID (overall) and (j) Disability ID (overall)	66.3	12.3	7.11	4.28	3.33	2.14	1.32	0.89	0.66	0.43	0.43	0.17	0.29	0.09	0.16	0.07	0.03	0.03	0.01	*n*=6,965
(i) Gray Area and (j) Mild-Middle Disability ID with Health Problems	54.6	14.0	9.56	5.23	4.93	2.62	2.16	1.51	1.41	0.91	0.81	0.45	0.65	0.25	0.50	0.20	0.10	0.10	0.05	*n*=1,987

FIGURE 1   Material Deprivation Score

Eligibility status for disability support was the independent variable. First, respondents were classified according to whether they possessed a disability ID. Holders of disability IDs were divided according to the type and grade of their disability: Severe disability (level 1 mental disability certificate, except severe disability according to the medical rehabilitation handbook, level 1 to 2 physical disability certificate, and two or more of the three disability certificates) and mild-middle disability (level 2 to 3 mental disability certificate, except severe disability according to the medical rehabilitation handbook, and level 3 to 6 physical disability certificate).

Additionally, health condition variables were used. The survey included three health items: Subjective health, mental health, and activity restrictions due to health

can be used for yourself and not for your family, having savings for unexpected expenses, and having life insurance. Regarding telephones, the household form (having a landline phone at home) and individual form (having a cell phone, including a smartphone) included questions for respondents. The absence of either condition was considered material deprivation.

problems. The first question related to subjective health was "How is your current health condition?", which was rated using a 5-point scale: Very good (1), good (2), ordinary (3), not good (4), and poor (5). Subjective health was scored as 1 if responses of (4) not good and (5) poor were given and 0 otherwise. Second, the Kessler Psychological Distress Scale (K6) was used to evaluate mental health, with items scored as follows: (1) nervous, (2) hopeless, (3) restless or fidgety, (4) so depressed that nothing could cheer me up, (5) everything is an effort, and (6) worthless. K6 scores were calculated as in a previous study and then score as 1 for 10 or more points and 0 for all others. The question, "Over the past 6 months, have you had any activity restrictions due to your health problems for activities that people around you normally engage in?" was used to evaluate activity restrictions due to health problems. Respondents were classified as having many activity restrictions (1), activity restrictions but not severe (2), and no activity restrictions (3). Responses with "many activity restrictions" and "activity restrictions but not severe" were coded as 1 and other responses were coded as 0. Next, a person was considered to have a health problem if at least one of the three health items was applicable.

Finally, the data were divided into four categories based on the two axes of disability ID/non-disability ID holders and those with health problems/without health problems: (a) non-disability ID with health problems (gray area), (b) non-disability ID without health problems, (c) Disability ID with health problems, (d) Disability ID without health problems. In addition, Disability IDs in (c) or (d) were divided into the following categories depending on whether the person has a mild–middle or severe disability: (e) mild–middle disability ID with health problems, (f) mild–middle disability ID without health problems, (g) severe disability ID with health problems, and (h) severe disability ID without health problems. In this study, individuals classified as (a) and (e) were focused on to examine the line of eligibility status for disability support. Before looking at the relationship between (a) and (e), these variables were also used to clarify the relationship between (i) not having a disability ID (overall = (a) + (b)) and (j) having a disability ID (overall = (c) + (d)= (e) + (f) + (g) + (h)).

The following variables were used as control variables and covariates: (1) individual attributes (male dummy, age, years of education, no spouse dummy (such as

never married, separated, or bereaved), child dummy, and full-time employment at first job dummy), (2) social security receipt status (welfare receipt dummy and public support dummy), and (3) health problems (subjective health, mental health, and activity restrictions due to health problems).

3.3 Analytical Methods

One method for estimating causal effects is propensity score analysis as well as analysis of covariance, which assumes a regression model (Bai and Clark 2018). A propensity score method was proposed by Rosenbaum and Rubin (1983) to estimate causal effects in correlational studies where random assignment is not possible. This method was proposed based on the idea that if multiple covariates can be aggregated into a single variable, it is possible to perform stratification on that single variable. Hoshino (2009) noted that there are various previous studies on the comparison between the analysis of covariance method, which assumes a regression model, and the adjustment method using propensity scores, indicating that the results of propensity score analysis are better than those of regression models.

In this study, after identifying the means, single regression analysis, multiple regression analysis, and propensity score analysis were conducted to ensure the robustness of the analysis. The propensity score analysis was adjusted with an inverse-probability weighting (IPW) estimator. In addition, an augmented inverse probability weighted (AIPW) estimator, which is called a doubly robust estimator, was used in the analysis. An AIPW estimator does not simply weigh by the inverse of the propensity score; it improves the efficiency of data use by adding a term to the estimating equation with covariate data for the $z=0$ group. The AIPW estimator is based on the idea of reducing the variance in the estimator. This enables the correct estimation of the marginal expectations and causal effects of the outcome variable.

The following steps were performed in the analysis: The first was to determine the extent to which the average material deprivation score differed depending on eligibility status for disability support. The second step was to examine the effect of eligibility status for disability support on material deprivation scores in a single regression analysis. The third step was to run a multiple regression analysis, including a control variable. Finally, the fourth step was to perform a propensity score analysis of the IPW and AIPW estimators to ensure the robustness of the analysis.

TABLE 1   Descriptive Statistics

	Model A					Model B				
	Obs	*Mean*	*Std. dev.*	*Min*	*Max*	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
Material Deprivation Score	6,965	1.02	2.09	0	20	1,987	1.63	2.80	0	20
Eligibility Status for Disability Support										
(i) Non-disability ID (overall) vs (j) Disability ID (overall)	6,965	0.02	0.15	0	1					
(a) Gray Area vs (e) Mild-Middle Disability ID with Health Problems						1,987	0.02	0.15	0	1
Individual Attributes										
Male Dummy	6,965	0.48	0.50	0	1	1,987	0.46	0.50	0	1
Age	6,965	42.33	10.43	18	59	1,987	42.05	10.66	18	59
Years of Education	6,965	13.72	1.91	9	16	1,987	13.59	1.94	9	16
No Spouse Dummy	6,965	0.26	0.44	0	1	1,987	0.30	0.46	0	1
Child Dummy	6,965	0.64	0.48	0	1	1,987	0.59	0.49	0	1
Full-Time Employment at First Job Dummy	6,965	0.84	0.37	0	1	1,987	0.82	0.39	0	1
Social Security Receipt Status										
Welfare Receipt Dummy	6,965	0.00	0.06	0	1	1,987	0.01	0.08	0	1
Public Support Dummy	6,965	0.01	0.09	0	1	1,987	0.01	0.11	0	1
Health Problems										
Subjective Health	6,965	0.09	0.29	0	1	1,987	0.30	0.46	0	1
Mental Health	6,965	0.19	0.39	0	1	1,987	0.66	0.47	0	1
Activity Restrictions due to Health Problems	6,965	0.13	0.34	0	1	1,987	0.44	0.50	0	1

*(i) Non-disability ID (overall)=0, (j) Disability ID (overall)=1. (a) Gray Area=0, (e) Mild-Middle Disability ID with Health Problems=1.

Regarding the analytical model, the following two models were examined based on eligibility status for disability support. The first simply divided individuals into two groups based on disability ID status, without separating them by health conditions. Then, the effect of eligibility status for disability support on material deprivation scores was determined. Disability ID holders included all persons with disabilities, including those with mild, middle,

and severe disabilities. For the no disability ID holders, those with no health problems and those in the gray area (no disability ID with health problems) were included without distinction. Let this be Model A.

3. Results

Table 2 shows the descriptive statistics of the material deprivation scores. First, looking at the mean material deprivation score values in the analysis of Model A, the mean value for the no disability ID (overall) group was 1.00, while that for the disability ID (overall) group was 1.75. The disability ID group tended to be more materially deprived than the no disability ID group. Model B compared both groups of the gray area and mild–middle disability ID, by limiting the subjects to those with health problems.

Model B compared individuals with mild-middle disability IDs with health problems and those in the gray area, limited to those with health problems. In Model B, the mean score for the gray area group was 1.61, and that for the mild-middle disability ID group with health problems was 2.58; there was a trend toward more material deprivation in the mild-middle disability ID group with health problems than for the gray area group.

On the other hand, when limited to individuals without health problems, the material deprivation score was less than 1. The mean material deprivation score for the no disability ID group without health problems was 0.76, that for the disability ID group without health problems was 0.55, and that for the mild-middle disability ID group without health problems was 0.59. In other words, when limited to individuals without health problems, the material deprivation score was less than 1, even for disability certificate holders, and the gray area group was more materially deprived than the disability ID group without health problems.

To summarize the results of the analysis, it is clear that the effect of eligibility status for disability support on the material deprivation score was only between these two variables

and that the effects related to individual attributes, social security receipt status, and health problems were larger. When limited to individuals with health problems, there was no tendency for either the gray area group or the mild-middle disability ID group with health problems to be materially deprived.

Second, the results of the single regression analysis when the eligibility status for disability support was used as the independent variable and the material deprivation score was used as the dependent variable (Table 3) were reviewed. In Model A, the results were significant at the 1% level, with a trend toward a material deprivation score of 0.74 points higher for the disability ID (overall) group than for the no disability ID (overall) group. No significant results were obtained in Model B.

Third, multiple regression analysis was conducted with disability ID as the independent variable and the material deprivation score as the dependent variable (Table 3). First, individual attributes and social security receipt status were controlled in the analysis. Model A, which had significant results in the single regression analysis, did not have significant results when controlling for individual attributes and social security receipt status. Model B also did not yield significant results. In addition, no significant results were obtained for either Model A or Model B when controlling for health problems as well as individual attributes and social security receipt status.

Fourth, the results of the propensity score analysis were discussed (Table 3). The presence of a disability ID was used as the assignment variable (Model A: disability ID=1, no disability ID=0, Model B: mild-middle disability ID with health problems=1, gray area=0), and the material deprivation score was used as the outcome variable. The covariates were individual attributes, social security receipt status, and health problems. TABLE 4 shows the results of the balance check. As a result, the standardized difference was close to 0, and the variance ratio was close to 1 for both the IPW and AIPW estimators of Model A and Model B. Therefore, we can say that there is no bias in the matched data. The results of the propensity score analysis, similar to those of the multiple regression analysis, were not significant for either Model A or Model B.

TABLE 2   Mean Material Deprivation Score Values

		Obs	Mean	Std.dev.	Min	Max
Model A	(i) Non-disability ID (overall)	6,812	1.00	2.07	0	20
	(j) Disability ID (overall)	153	1.75	2.98	0	13
Model B	(a) Gray Area	1,939	1.61	2.77	0	20
	(e) Mild-Middle Disability ID with Health Problems	48	2.58	3.65	0	12
	(b) Non-disability ID without Health Problems	4,873	0.76	1.65	0	15
	(d) Disability ID without Health Problems	55	0.55	1.10	0	5
	(f) Mild-Middle Disability ID without Health Problems	39	0.59	1.19	0	5

TABLE 3   Multivariate analysis results

	Model A (i) Non-disability ID (overall) vs (j) Disability ID (overall)		Model B (a) Gray Area vs (e) Mild-Middle Disability ID with Health Problems	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
Single Regression Analysis	0.741 **	0.241	0.975	0.526
Multiple Regression Analysis (Individual Attributes + Social Security Receipt Status)	0.118	0.218	0.065	0.408
Multiple Regression Analysis (Individual Attributes + Social Security Receipt Status + Health Problems)	-0.268	0.214	-0.168	0.417
IPW	-0.162	0.157	0.151	0.488
AIPW	-0.017	0.180	0.213	0.506
n	6,965		1,987	

**p<.01, *p<.05. (Two-tailed test). Models A and B are both limited to subjects of analysis aged 18-59 who are not currently attending school.

TABLE 4　Results of the balance check

	Model A							
	IPW				AIPW			
	Standardized differences		Variance ratio		Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Individual Attributes								
Male Dummy	0.36	-0.05	0.91	0.99	0.36	-0.05	0.91	0.99
Age	-0.03	0.02	1.17	1.24	-0.03	0.02	1.17	1.24
Years of Education	-0.47	-0.21	1.32	0.85	-0.47	-0.21	1.32	0.85
No Spouse Dummy	0.76	0.14	1.27	1.13	0.76	0.14	1.27	1.13
Child Dummy	-0.75	-0.25	0.91	1.08	-0.75	-0.25	0.91	1.08
Full-Time Employment at First Job Dummy	-0.55	-0.03	1.82	1.05	-0.55	-0.03	1.82	1.05
Social Security Receipt Status								
Welfare Receipt Dummy	0.38	0.00	38.19	1.05	0.38	0.00	38.19	1.05
Public Support Dummy	0.53	0.01	21.48	1.14	0.53	0.01	21.48	1.14
Health Problems								
Subjective Health	0.75	0.09	3.11	1.27	0.75	0.09	3.11	1.27
Mental Health	0.46	-0.03	1.57	0.95	0.46	-0.03	1.57	0.95
Activity Restrictions to Health Problems	0.96	0.11	2.34	1.24	0.96	0.11	2.34	1.24
	Model B							
	IPW				AIPW			
	Standardized differences		Variance ratio		Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Individual Attributes								
Male Dummy	0.35	-0.01	0.97	1.00	0.35	-0.01	0.97	1.00
Age	0.05	0.19	1.21	1.66	0.05	0.19	1.21	1.66
Years of Education	-0.26	-0.09	1.51	0.88	-0.26	-0.09	1.51	0.88
No Spouse Dummy	0.57	0.05	1.22	1.04	0.57	0.05	1.22	1.04
Child Dummy	-0.59	-0.12	0.91	1.03	-0.59	-0.12	0.91	1.03
Full-Time Employment at First Job Dummy	-0.50	0.05	1.68	0.92	-0.50	0.05	1.68	0.92
Social Security Receipt Status								
Welfare Receipt Dummy	0.51	0.04	31.04	1.65	0.51	0.04	31.04	1.65
Public Support Dummy	0.63	0.05	20.26	1.56	0.63	0.05	20.26	1.56
Health Problems								
Subjective Health	0.71	-0.24	1.16	0.75	0.71	-0.24	1.16	0.75
Mental Health	0.10	-0.05	0.94	1.03	0.10	-0.05	0.94	1.03
Activity Restrictions to Health Problems	0.80	0.21	0.69	1.01	0.80	0.21	0.69	1.01

4. Discussion

These studies examined the relationship between disability ID status and health and their effects on material deprivation. Specifically, the study compared whether there were differences between the no disability ID and disability ID groups, taking into account

individual attributes, social security receipt status, and mental and physical health conditions. The analysis was not limited to a simple comparison of differences based on the presence or absence of a disability ID but also compared individuals in the gray area (no disability ID with health problems) or those not holding a disability ID who have physical or mental disabilities. The gray area and mild-middle disability ID touch the line of access to the welfare system for persons with disabilities.

The robustness of the analysis was ensured by conducting single regression analysis, multiple regression analysis, and propensity score analysis after checking the mean values. This is the first empirical study to clarify the relationship between disability ID status and health and the effect of the possession of a disability certificate on material deprivation by conducting a multivariate analysis that ensured robustness using national survey data in Japan.

First, the results of the analysis showed that the trend, observed by Izumida and Kuroda (2019), of material deprivation being greater for holders of disability IDs than for non-holders of disability IDs was not found in the present study. In particular, in the study by Izumida and Kuroda (2019), a tendency of disability ID holders to be more materially deprived than disability ID non-holders was found; however, the differences in this study based on whether or not a person held a disability ID were explained by individual attributes, social security receipt status, and physical and mental problems.

On the other hand, the mean material deprivation score, which indicates the tendency to be materially deprived, was lower for individuals with mild-middle disabilities who had no mental or physical problems than for those with disability IDs who had mental or physical problems. Furthermore, in the absence of physical or mental problems, the average material deprivation score was lower for disability ID holders, including those with severe disabilities, than for disability ID non-holders with physical or mental problems.

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This suggests that the risk of material deprivation may be higher for individuals who have a mental or physical problem than for those possessing a disability ID. In other words, health problems may increase the risk of material deprivation.

Second, a comparison of the gray area group and mild-middle disability ID group with health problems did not reveal a higher risk of material deprivation for either group. Thus, the gray area was determined to be a situation of risk similar to that of persons with mild-middle disability IDs with health problems. However, persons with mild-middle disability IDs receive some assistance through social policies. Previous studies have noted that people with disabilities have difficulties. Concerning the gray area, this study suggests that their material deprivation has likely not been recognized by Japanese social policy to date. The resolution of difficulties for individuals in the gray area is an urgent issue. Furthermore, it is undeniable that other countries may be facing the same problems as Japan.

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