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An Empirical Study on the Poverty and Employment of Persons with Disabilities in South Africa

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Were the Adverse Effects of Disability on Employment Mitigated during 2002-2015 in South Africa?: A Pseudo-Panel Approach

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Abstract

This study examines the effects of disability on employment status and changes in these effects over time in South Africa by applying a pseudo-panel approach based on annual cross-section surveys from 2002 to 2015. Pseudo-panel regression models are separately estimated for the periods 2002-08 and 2009-15 due to inconsistencies in the disability question in these surveys. The main finding in both periods is that the effects of disability are significantly negative for the probability of being employed and significantly positive for the probability of being economically inactive. These effects are found to be underestimated by the conventional OLS regression, which may be attributed to the measurement errors associated with disability status. It could not be confirmed that the effect of disability on the probability of being employed was mitigated in 2002-08 and 2009-15.

Keywords: Disability, Employment, South Africa, Pseudo-panel approach

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1. Introduction

Engaging in work is essential to make a decent livelihood and is one of the most important ways to participate in society for all people, including those with disabilities. To ensure that persons with disabilities have the opportunity to work on an equal basis with those without disabilities, the United Nations Convention on the Rights of Persons with Disabilities (CRPD) was adopted in 2006, and had been ratified by more than 160 countries as of 2017. Even before the CRPD many countries had adopted several types of measures, including laws and regulations against disability-based discrimination and those on the reasonable accommodation of people with disabilities at the workplace, quotas for the employment of persons with disabilities in private and public organizations, vocational rehabilitation and training, and programs to change the attitudes toward this group (WHO and World Bank 2011). However, it is still questionable whether these measures have contributed to the improvement of employment of persons with disabilities, and the empirical studies examining their effects are limited, particularly in developing countries.[1]

The number of empirical studies on the employment of persons with disabilities in developing countries has been increasing. The existing studies have consistently found a negative relationship between disability and employment conditions in several developing countries (Lamichhane 2015; Mani, Mitra, and Sambamoorthi 2018; Mitra 2018; Mitra, Posarac, and Vick 2013; Mitra and Sambamoorthi 2008; Mizunoya and Mitra 2013; Mizunoya, Yamasaki, and Mitra 2016; Mont and Cuong 2011; Takasaki 2016; Trani et al. 2015; Trani and Loeb 2012). While most of these studies showed a correlation between disability and employment conditions, a few studies examined the causal impacts of disability on employment conditions. Takasaki

[1] Some studies have examined the effects of anti-discrimination law for person with disabilities, represented by the *Americans with Disabilities Act*, on employment in the U.S. and U.K. (Acemoglu and Angrist 2001; DeLeire 2000; Jones 2009). See Jones (2008) for a review of the literature in developed countries.

(2016) evaluated the impacts of landmine amputations on poverty and employment in Cambodia by carefully selecting amputees that were due to landmine accidents and matching them with non-disabled adults within a village based on age, gender, education, and location of residence. Mitra (2018) analyzed the association between transition of work status and the change in functional difficulties in Ethiopia and Uganda, by controlling for the endogeneity bias from time-invariant omitted variables with the difference-in-difference model. Mani et al. (2018) investigated the impacts of the onset of and recovery from physical disability on being employed, and hours worked, by combining the instrumental variable method with the difference-in-difference model.[2]

This study estimates the effects of disability on employment outcomes in South Africa by considering the endogeneity problem of disability status. In addition, this study attempts to explore how much the effects of disability on employment outcomes change over time. Existing studies have investigated the employment conditions of persons with disabilities at a point or limited number of points in time, and there seem to be no studies examining whether the employment conditions of persons with disabilities have improved or worsened in the long-run in a specific developing country. This study adopts the pseudo-panel or synthetic panel method (Deaton 1985) because panel household surveys with more than two rounds are not often available in developing countries, and even less so for surveys that include questions about disability. In the case of the absence of panel data, Deaton (1985) proposed the construction of pseudo-panel data from repeated cross-section surveys in which the unit of analysis is cohorts incorporating individuals with the same characteristics (e.g., age cohorts), to estimate fixed effect models in order to obtain a consistent estimator of an endogenous variable of interest. Since this seminal work by Deaton (1985), the pseudo-panel method has been refined and

[2] In the literature on health and employment in developed countries, the measurement error and endogeneity related to self-reported health status have been tackled for a long time by applying instrumental variable method and regression of simultaneous equations (Au, Crossley, and Schellhorn 2005; Bound et al. 1999; Cai and Kalb 2006; Campolieti 2002; Lindeboom and Kerkhofs 2009).

extended by subsequent papers (Devereux 2007; Moffitt 1993; Verbeek and Nijman 1992, 1993), and has been widely applied, for example, to analyses of income and consumption (Antman and McKenzie 2007; Banks, Blundell, and Brugiavini 2001; Deaton and Paxson, 1994), returns from education (Himaz and Aturupane 2016; Warunsiri and McNown 2010), and the impact of early marriage (Delprato, Akyeampong, and Dunne 2017). In the literature on disability, Jones (2009) estimated the employment effect of the *Disability Discrimination Act* in England by combining the pseudo-panel method with the difference-in-difference model.

This study utilizes the series of an annual national representative survey in South Africa from 2002 to 2015, called the General Household Survey, implemented by Statistics South Africa. In the following sections of the paper it is noted that the survey is inconsistent due to a change in the definition of disability in 2009. Therefore, this study separately applied the pseudo-panel method to the datasets from the periods of 2002 to 2008 and 2009 to 2015, and attempted to consistently estimate the effects of disability on employment status. Further, it also examined whether the effects of disability on employment outcomes have changed over time.

The remainder of this study is organized as follows: Section 2 briefly explains the laws for persons with disabilities and their employment conditions in South Africa. Section 3 introduces the data used by this study and discusses its consistency, particularly that on disability status. Section 4 explains the pseudo-panel method and shows the regression results. Section 5 concludes with the implications of the findings.

2. Background

In South Africa, (un)employment has been a severe problem for a long time, not only for persons with disabilities, but also for those without disabilities.[3] The previous studies confirmed that

[3] The unemployment rate in South Africa was 25.9 % in 2016, which is much higher than the average rate in Sub-Saharan Africa (7.2 percent), and middle-income countries (5.6 percent) (International

having disabilities led to an even worse employment status. Graham et al. (2014) found from the first wave of the National Income Dynamics Study in 2008 that the employment rate is slightly lower for persons with disabilities than those without disabilities (39% versus 46%), and the rate of being economically inactive is higher for those with disabilities (47% versus 34%). According to the population census of 2011, while there is no large difference in employment status between persons with and without disabilities when using the disability status index, the employment rate is lower for person with severe difficulties than those without difficulties when comparing both by disability type (Statistics South Africa 2014). WHO and World Bank (2011, 238) reported the employment ratios (the employment rate of persons with disabilities divided by the employment rate of overall population) of several developed and developing countries. According to their calculation, the ratio of South Africa was 0.30 (≈12.4%/41.1%) and the lowest among selected countries, which means that there is a more than three times gap in the employment rates for persons with disabilities and for the overall population. Mizunoya and Mitra (2013) also computed the employment ratio for 15 developing countries using the World Health Survey conducted in 2003, and showed that the employment ratio of all countries exceeded 0.4. Although we need to interpret these findings with caution given differences in the data, the definition of disability, and the year of survey by country, there seems to exist a gap in employment status between persons with and without disabilities in South Africa.

The South African government has been addressing disability issues since the Apartheid era, though their main schemes used to be the provision of social grants and rehabilitation and habilitation services without sufficient consideration of the need for the social inclusion of persons with disabilities (Government of South Africa 2016). Since the 1980s, the social movement for the rights of persons with disabilities has been increasingly active together with the movement against the Apartheid regime (Howell, Chalklen, and Alberts 2006). Section 9 of

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Labour Organization 2017).

the Constitution adopted after democratization explicitly prohibits discrimination based on disability status as well as on race and gender, and the *Promotion of Equality and Prevention of Unfair Discrimination Act* was legislated in 2000 to validate this clause. Among other reports, the White Paper on an Integrated National Disability Strategy published in 1997 follows the concept of social model of disability and advocates "an integration of disability issues in all government development strategies, planning and programmes" (Office of the Deputy President 1997).

In 2007, South African government ratified the United Nations Convention on the Rights of Persons with Disabilities and internationally manifested their commitment to the protection and realization of rights of persons with disabilities. Additionally, the latest national plan of South Africa, the National Development Plan 2030 launched in 2012, emphasizes the efforts to guarantee the access of persons with disabilities to quality education and employment, skill development programs, and equal opportunities for employment (National Planning Commission 2012, 42). Regarding employment of persons with disabilities, in 1995, South Africa government set the target that persons with disabilities should account for 2 percent of the total number of public service personnel (Department of Public Service and Administration 1995). Similarly, the Expanded Public Works Programme, which provides the unemployed with the opportunities of temporary work in the infrastructure, non-state, environment, culture, or social sectors, aims to allocate 2 percent of the total work opportunities to those with disabilities. In terms of legislation, the *Employment Equity Act* established in 1998 refers to Africans, women, and persons with disabilities as "designated groups," prohibits unfair discrimination against these groups, and obligates employers to take affirmative action measures such as elimination of employment barriers and provision of reasonable accommodation for these groups. The purpose of this Act is clarified in Section 2 as "to achieve equity in the workplace" or "to ensure their [designated groups'] equitable representation in all occupational categories and levels in the workforce," which means to reach a state of employment in which the share of workers from the

designated groups in the workplace reflects that of the whole population of South Africa. "Designated employers," defined in the Act as those who employ 50 or more people or have annual turnover above the prescribed criteria, and those in the public sector, have duties to prepare and carry out a plan to attain the employment equity in each workplace and submit a report about employee profile, movement, and skills development at several occupational levels every year.[4] Additionally, to support employers in hiring persons with disabilities, the Department of Labour issued the "Code of Good Practice on Key Aspects on the Employment of People with Disabilities" in 2002 and "Technical Assistance Guidelines on the Employment of People with Disabilities" in 2007.

Among others, the program most strongly related to the poverty and employment of persons with disabilities in South Africa is the disability grant program. South Africa has a social security system that covers such programs as child support grants, care dependency grants, foster child grants, war veteran grants, and old-age grants. To receive the disability grant and grant-in-aid, persons with disabilities must meet the requirements such as the age cutoff of 18 to 59 years old, being unemployed for a period of six or more months, earning and value of assets being less than a prescribed value depending on marital status, and taking a medical examination about the body or mental conditions.[5] The maximum amount of the disability grant is 1,600 South African Rands per month (about 120 US Dollars) as of June 2017, which is the same as the care dependency grant, the war veterans grant and the old-age grant. Children with disabilities aged 0 to 17 years and 60 years or above with disabilities receive the care dependency grant and the old-age grant, respectively. According to Gooding and Marriot (2009), the amount of the

[4] Until 2013, employers with 150 or more people were required to report every year, and those with 50-150 people were required to report every two years. The *Employment Equity Act* was amended in 2014 such that those with 50-150 people must report every year as well.

[5] The details of the requirements and procedures are available from the following website: http://www.gov.za/services/social-benefits/disability-grant

disability grant and the number of recipients is much larger in South Africa than in other developing countries.

While South Africa government has been actively involved with the legislation and targeting about the employment of persons with disabilities, the implementation seems to be questionable. The original deadline of the 2 percent target for employment of persons with disabilities in the public service was 2005 but was eventually postponed to March 2013. According to the first periodic country report to the CRPD drafted in 2015, the share of employees with disabilities in the public service was 0.39 percent in 2012/13, and only 20 national and provincial departments out of 153 reached the target (Government of South Africa 2015). The report also showed that the Expanded Public Works Programme created 17,854 work opportunities for persons with disabilities between April 2009 and June 2013, but that amounted to only 0.44 percent of the total. Moreover, the annual report summarizing the employment equity conditions based on the reports of employers reveals that the share of employees with disabilities was 1.1 percent in the private sector in 2014/15 (Commission for Employment Equity 2015). Since the prevalence rate of persons with disabilities in South Africa was around 3-10 percent in 2015 as shown below, it can be said that they are underrepresented in the workplace of the private sector. According to this report, an upward trend can be observed for the share of employees with disabilities in several occupational levels from 2010 to 2014, but the slope of trend is quite gentle.

As for the disability grant program, Gooding and Marriot (2009) mentioned the problems in the complicated criteria, the payment procedures, and the physical accessibility of local authorities paying the grant. The results of previous studies of its effect on poverty reduction are mixed. Loeb et al. (2008) found that the disability grant led to a financial improvement in the recipient households, but several papers cited in Banks et al. (2017) verified that the exclusion of persons with disabilities from the disability grant and care dependency grant programs occurred, and their limited effects on poverty reduction in South Africa. Mitra

(2010) found that incorrect assessment as a beneficiary of the grant matters in terms of mistakenly excluding persons with disabilities rather than mistakenly permitting those without disabilities. The empirical findings on the effect of the disability grant program on labor participation and employment of persons with disabilities are mixed. Mitra (2008) verified the decline in the employment and labor participation rate of persons with disabilities from 1998 to 2006 and attributed this in part to the nationwide growth of the disability grant payment, particularly in 2002 and 2003, when some provinces initiated the reforms of the disability assessment process. On the other hand, Mitra (2009) detected significant adverse effects only on the labor participation of the older discouraged males, and Mitra (2010) found no significant effects on any group of people, based on different datasets and empirical strategies.

3. Data and descriptive analysis

The analysis in this study depends on a series of national representative surveys, called the General Household Survey (GHS), and undertaken by the Statistics South Africa (Stats SA) every year since 2002.[6] According to Statistics South Africa (2016, 1), the GHS is "an omnibus household-based instrument aimed at determining the progress of development" in South Africa. The questionnaire has been revised every year depending on the interest of the government at that time, but the questions on the demographic characteristics, education, employment, and

[6] In South Africa, a panel household survey with four waves (2008, 2010/11, 2012, and 2014/15), the National Income Dynamics Study (NIDS), has been being implemented by the South African Labour and Development Research Unit of the University of Cape Town. Although it includes questions about disability based on WHO's International Classification of Functioning, Disability and Health, the present study decided to use the GHS instead of the NIDS for the following reasons: First, the GHS covers the longer periods including 2007 when South Africa ratified the CRPD, and has more data points than the NIDS. Second, the disability type considered in the NIDS is limited only to sight, hearing, and mobility, whereas the GHS incorporates other types of disability such as intellectual impairment. Last, Graham et al. (2014) cast doubt about the consistency of self-reporting disability between the different waves of the NIDS. According to them, only 32% of persons defined as disabled at the first wave remained disabled at the second wave. As discussed below, the transition in disability status is observed in other countries as well but complicates the estimation of the disability effect on employment status.

some household characteristics are the same or manageable, thus making the responses consistent across different years. The sample of households of all GHS was determined based on the two-stage stratified sampling with a few changes of the master sampling frame, and the the face-to-face interviews were conducted.[7] Stats SA updated the micro data of GHS 2002-11, including the new weights in 2012 to improve the comparability of the GHS across years. Thus, the comparability of the statistics across GHS in different years is high. The data used in this study is the GHS datasets open to the public as of the time of writing; that is, the GHS from 2002 to 2015.[8] Each sample size in the GHS ranges from about 65,000 to 94,000, and that of individuals in the core working-age (25-59) from about 31,000 to 42,000.

One important note about the GHS is that the question on disability is fundamentally different in GHS 2002-08 and 2009-15. In the GHS 2002-2008, the question on disability begins with "I am now going to ask you about *disabilities* experienced by any persons within the household" [emphasis added], and asks "Is …… [each household member] limited in his/her daily activities, at home, at work or at school, because of a long-term physical, sensory, hearing, intellectual, or psychological condition, lasting six months or more?" The choice of response is yes and no. Then, only for those answering "yes," the next question asks "What difficulty or difficulties does …… [the household member] have? Is it ……" with the choices of "Sight," "Hearing," "Communicating," "Physical," "Intellectual," "Emotional," and "Other." On the other hand, the GHS 2009-15 adopted the short set of questions recommended by the United Nations Washington Group on Disability Statistics. Specifically, the GHS 2009-15 begins with "I am now going to ask about the *general functioning* of persons within the household" [emphasis added], and asks "Does … [each household member] have difficulty in doing any of

[7] The latest master sample for the GHS 2015 and onwards was constructed based on the results of the Census in 2011 (Statistics South Africa 2016).

[8] The micro data, questionnaire, and official reports for GHS of the whole periods were downloaded in 25th March 2017 from the data portal of DataFirst, a research unit and data service at the University of Cape Town, https://www.datafirst.uct.ac.za/dataportal/index.php/catalog

the following?" The choices for the type of difficulty are "Seeing," "Hearing," "Remembering and concentrating,"[9] "With self-care, such as washing or dressing," and "In communicating in his/her usual language including sign language." Basically, four choices for the degree of each difficulty are provided: "No difficulty," "Some difficulty," "A lot difficulty," and "Cannot do at all" while allowing the responses of "Do not know" or "Cannot yet be determined," and "refuse to respond."

For the questions about disability in the GHS 2002-08 and 2009-15, a household head or acting head was supposed to answer the disability status of all household members. However, it was possible for a household member to respond to the question by him/herself. According to the GHS 2009-14 which include the information about who responded to the disability question, about half of responses were based on self-report in each GHS of these years.

The purposes behind these two disability questions are different and as is what each measures. The disability question in the GHS 2002-08 defines disabilities as participation limitations within or outside the home that last six months or more due to body or mind conditions, and asks whether such disabilities exist for each household member at the time of the survey. Altman and Rasch (2016), referring to a similar question in the U.S. 2013 National Health Interview Survey, argues that this type of question is suitable for monitoring participation limitations, but not for identifying persons who may be at risk because of the limitations in different environments even if they are not currently limited. The Washington Group (WG) questions used in the GHS 2009-15 are appropriate for both. According to Altman and Rasch (2016), the purpose of the WG disability measures is to assess the equalization of opportunities, which is consistent with the purposes of the World Programme of Action concerning Disabled Persons adopted by the United Nations in 1982, and the United Nations Convention on the

[9] The GHS 2009 separated the choice of "Remembering and concentrating" into "Remembering" and "Concentrating," but since GHS 2010, Stats SA followed the original unseparated choice, which is the standard short set of disability questions by the Washington group.

Rights of Persons with Disabilities adopted in 2006. As the approach for the assessment of opportunity equalization, the WG separated the questions on functional limitations in body or mental state and on participation in several activities in the country or community to be examined and prepared for the questions on the difficulties in the six basic functionings specified above. In addition, four choices of response from “No difficulty” to “Cannot do at all” were prepared for the WG questions so that we can find more widely those who may be at risk from participation limitations. In summary, the WG questions can be used to capture persons with difficulties in body or mental functionings who may be exposed to the possibility of being limited in participation in the society, and those who are limited through the combination with other questions on participation. Therefore, it can be considered that the WG questions, the GHS 2009-15 questions, are more inclusive measures of disability than the GHS 2002-08 questions.

The difference in the wording of the disability question and the choice of response can have a large influence on the responses. Compared to “difficulty,” the term “disabilities” in the GHS 2002-08 question may underestimate the number of persons with disabilities because it may give rein to respondents’ conventional prejudice against disability or induce those with moderate impairment to judge by mistake that their impairments are not so heavy as to be counted as “disabilities.” In 2006, Professor Marguerite Schneider and Stats SA carried out the research for the revision of disability question in the South African census in 2011 (Schneider 2009; Schneider et al. 2009; Statistics South Africa 2006). Schneider (2009) found from the focus group discussion that the participants had a negative impression of their disability and were less likely to self-identify as disabled when a question including the term “disabled” or “disability” was used than when the WG question was used. A similar result was obtained from the quantitative survey in that the WG question yielded a higher proportion of persons with difficulties than the “disability” question (Schneider et al. 2009). In addition to negative image related to the term “disability,” Schneider et al. (2009) states that four choices of response for the WG question led the respondents to be less conscious of identifying themselves as disabled than

a yes/no response to the “disability” question. As a result, the WG question was adopted as the disability question in the census in 2011, and the use of the term “disability” was avoided in the questionnaire by changing the heading of the section related to disability from “Disability” to “Health and functioning” (Schneider 2016). Similarly, the term “disability” was not used in the health section of the questionnaire of the GHS 2009-15.

The following examines the comparability of persons with disabilities defined by each disability question in GHS 2002-08 and 2009-15. Figure 1 illustrates the population proportion of persons with disabilities in the population aged from 25 to 59 years from 2002 to 2015. The population proportion in each year was estimated by using the sampling weight contained in each GHS dataset. Three definitions for persons with disabilities based on the WG question were used in 2009-15. This study adopts the definition used in most of the literature and the report based on the GHS of each year published by Stats SA, i.e., those who chose “A lot difficulty” or “Cannot do at all” for at least one of the functionings specified above or “Some difficulty” for two or more functionings. As other definitions, I use the broad definition meaning “Some difficulty,” “A lot difficulty,” or “Cannot do at all” for at least one functioning, and the narrow one meaning “A lot difficulty,” or “Cannot do at all” for at least one functioning. The average proportion of persons with disabilities in 2002-08 is 4.1 percent and does not change during the periods. During 2009-15, the proportion from the adopted definition takes a similar value to that in 2002-08, 3.4 percent on average, though slightly decreasing over time. These proportions of persons with disabilities at working-age from the GHS are lower than those from another data in South Africa and other countries. The proportion of persons with disabilities at working-age is 6.0 percent in 2011 based on the population census in this year and calculated from the table reported in Statistics South Africa (2014). According to Mizunoya and Mitra (2013), for instance, the proportion ranges between about 7-15% in most developing countries. These differences seem to be attributable to the difference in the way the survey was implemented in the case of the population census and in the disability questions, the definition of disability, and

the purpose and year in the case of Mizunoya and Mitra (2013). The proportions of widely and narrowly defined persons with disabilities are about 9-12 percent and 2-3 percent, respectively. Among the three definitions in 2009-15, there appears to be the least discontinuity between the proportion in 2008 and that in 2009 from the adopted definition.

Table 1 describes persons with disabilities in the GHS 2002-08 and 2009-15 in terms of disability-related and other basic characteristics. As shown on the top of Table 1, the age distribution of persons with disabilities differs between the GHS 2002-08 and 2009-15. The ratios of the four groups younger than 44 years are higher for the GHS 2002-08, whereas the ratios of the three groups older than 45 years are higher for the GHS 2009-15. Thus, the ratios of the characteristics other than gender and race are age-adjusted with the weight of five-year age bands to remove the influence of the difference in age distribution between these two periods. Among other factors, the education level of persons with disabilities in 2002-08 is lower, i.e., lower proportions of those who completed primary, secondary school, or higher education. This suggests two possibilities: the opportunity of schooling might be limited due to congenital impairments or that the low level of education might cause working at unsafe environments or insufficient earnings for payments to medical services, resulting in the person acquiring impairments.

Persons with disabilities in 2002-08 are more likely to experience any illnesses or injuries within a month before the survey and receive a disability grant than those in 2009-15. To receive the disability grant in South Africa, applicants are required to be unemployed for a period of six or more months, earn less and have assets worth less than a prescribed value depending on marital status, and take a medical examination of body or mental conditions. Thus, they seem to be in more serious difficulties, which is consistent with the definition, i.e., they self-reported their activities as being limited due to body or mental condition. In addition, persons with disabilities in 2002-08 are more likely to live in the area where it takes more than 30 minutes to visit the nearest health institution, which seems to be associated with the lower rate

of living in urban areas. This suggests that remoteness from health institutions may hamper early detection or treatment of health problems and medical rehabilitation and lead to a worsening in body or mental conditions. Although most of these differences in the profile of persons with disabilities derive from the differences in the disability questions, it is also possible that the composition of persons with disabilities might change over time because of the reinforcement of policies against disability after ratifying the CRPD reviewed in the previous section, or the resulting social changes in attitudes toward them. In fact, the South African Social Security Agency (2016) reported that the number of recipients of the disability grant constantly decreased from 1.423 million in 2006/07 to 1.086 million in 2015/16.

To confirm the effects of the difference in disability questions more directly, this study utilizes the GHS 2011 in which both questions were asked.[10] Among the 37,213 sample individuals aged from 25 to 59 years, 1,230 people are defined as having "disabilities" according to the disability question (3.3% of the total), and 1,474 people are defined as having "difficulty" according to the WG question (4.0% of the total). Table 2 reports on the result of the cross-tabulation of these two definitions. The results of these definitions are the same for almost all of individuals (95.7%=(35,069+560)/37,213). However, 54.5% of persons with "disability" are defined as those WITHOUT "difficulty," and 62.0% of those with "difficulty" are defined as those WITHOUT "disability." The existence of the former group can be attributed to the fact that the disability question mentions the type of difficulties more vaguely than the WG question, e.g., "physical" or "intellectual" condition, and refers to a psychological condition not covered in the WG question. The existence of the latter group is understandable because not all persons with "difficulty" are limited in their activities. Even in the case of using the narrow definition for those with "difficulty," the results are similar to the above: 62.3% is the proportion of those with

[10] In the questionnaire of GHS 2011, the WG question is followed by the "disability question," and there is no interval much between these questions (the former on the p.21 and the latter on the p.23). Although this order and the proximity of these questions might affect the response to each, it seems to be hard to estimate the possible size and direction of the effect.

"disability," but not with "difficulty" and 53.5% is that of those with "difficulty," but not with "disability."

Table 3 shows the summary statistics of persons with "disability," those with "difficulty," and those without "disability" or "difficulty." Consistent with the results of Table 1, persons with a "disability" are younger, the proportion of males and those not completing primary school is higher, and the proportion of Africans and living in a formal dwelling is lower. There is no large difference in the experience of illnesses or injuries, the distance to health institution or other basic characteristics between those with "disability" and "difficulty." The proportion of the recipients of a disability grant is the highest for those with "disability," and given the requirements for receiving a disability grant, so is the proportion of economically inactive persons. While the proportion of the employed is higher for those with "difficulty," the proportion of the self-employed is higher for those with "disability." For reference, those without "disability" or "difficulty" are more likely to be Whites and have higher education level, indicating the strong correlation between disability and poverty. They are also less likely to suffer from illnesses or injuries, and more likely to live in an area closer to health institutions, be employed and be economically active in comparison to the other two disability groups. Therefore, since the disability and WG questions are confirmed to capture the different type of individuals basically in a way corresponding to each purpose, their definition is not compatible between the GHS 2002-08 and 2009-15.

Figure 2 illustrates employment status by disability status across the periods of the analysis. As with Figure 1, presented throughout the panel (a) to (c) of Figure 2 are the population means of each employment status in each year, estimated with the sampling weight of each GHS. The sample individuals in this study are categorized into one of three employment statuses: employed, unemployed, or economically inactive. They are categorized as employed if in the week immediately preceding the survey they worked with or without payment, ran their own business, or did not work but had a job that they can return to. The questions used to

measure employed persons in the GHS were slightly changed after 2009, so that they are comparable only within the GHS 2002-08 or within the GHS 2009-15 and not across those periods. The unemployed, following the official definition of employment status in South Africa, are defined as those who are not employed, but willing to work, and taking actions to find jobs. People who do not work for the reason of being students, housewives, retirees, and/or having serious health conditions are not counted as unemployed. The question used to measure the unemployed is consistent within the GHS 2002-08, but not within the GHS 2009-15 because the question about whether to take any action to search for a job was not asked in the GHS 2009 and 2010.

In South Africa, the unemployed who are willing to work but not looking for jobs are categorized as the discouraged unemployed or discouraged work-seekers and counted as the unemployed under the broad definition of that group. The unemployed identifiable in the GHS 2009 and 2010 are the broadly defined ones. It is reasonable to assume that persons with disabilities are more likely to be discouraged from searching for a job in expectation of their lower chance of being employed compared to those without disabilities. However, it may be also true that those with disabilities are more likely not to desire to work in the first place, in which case they should be categorized as economically inactive. Thus, it is not certain how much the broad definition of unemployment leads to an overestimation of the proportion of the unemployed among persons with disabilities relative to those among persons without disabilities. Economically inactive persons are defined as neither employed nor unemployed. Therefore, the proportions of economically inactive persons are underestimated in 2009 and 2010 due to the overestimation of the unemployed in these years. This study confirms how much the adoption of the broad definition of unemployment in 2009 and 2010 affects the estimates of the disability effects on being unemployed and economically inactive through analyses using the GHS 2011-15.

As shown in panel (a), the proportion of employed with disabilities is about 10-20% in 2002-08 and 30% in 2009-15, and much lower than those of the employed without disabilities that is constant across the periods of analysis at about 60%. Although it appears that the proportion of employed persons with disabilities increased from 2002-08 to 2009-15, this might result from the inconsistency of the definitions of persons with disabilities and the employed across these periods mentioned above. Panel (b) illustrates that the proportion of unemployed persons is lower for those with disabilities than those without disabilities, possibly indicating that those with disabilities tend to discontinue looking for jobs and resign themselves to being economically inactive if they lose a job. As expected, the proportion of unemployed persons appear to sharply decline from 2010 to 2011 regardless of people being with or without disabilities. This is caused mostly by the difference in the questions about unemployment between 2010 and 2011. Panel (c) shows that the proportion of economically inactive persons is higher for those with disabilities than those without disabilities in the whole periods. As with the unemployed, the proportions of economically inactive persons with and without disabilities appear to increase from 2010 to 2011 due to the difference in the questions about unemployment between these years. Finally, it is difficult to detect any shrinking time trend for the gap between persons with and without disabilities in the three employment statuses both in 2002-08 and 2009-15.

Figure 3 illustrates the type of employment among the employed by disability status across the periods of the analysis.[11] As described in panels (a) and (b), the majority of the employed with disabilities are wage-workers in both periods. While the proportion of wage-workers is constantly higher for those without disabilities, the proportion of the self-employed is constantly higher for those with disabilities. Although the fact that persons with

[11] The total of the ratios of wage-workers and self-employed is not equal to 100% because the employed in these datasets includes those without payment and those who did not work at the time of the survey but have a job that they can return to.

disabilities are more likely to work as self-employed was also observed in other developing countries by Mizunoya and Mitra (2013), it should be noted that persons with disabilities might be forced to work as self-employed as a result of their exclusion from employment in public or private organizations, and because self-employment is often related to the vulnerable work in the informal sector. In fact, in 2010-2015 when information on the sector of employment was made available in the GHS, the proportion of employment in the informal sector is 32.2% and 20.0% for the employed with and without disabilities, respectively.

4. Regression analysis

4.1 Methodology

As noted earlier, simple regression analysis may yield biased estimates of the effects of disability on employment because of the endogeneity of disabilities. To deal with this problem, this study applies the pseudo-panel or synthetic panel method. To explain the method, consider a following linear probability model with individual fixed effects:

$$E_{it} = \beta D_{it} + x_{it}'\gamma + \delta_t + \alpha_i + u_{it}, i = 1, \dots, N,\ t = 1, \dots, T \quad (1)$$

where E_{it} is a dummy variable for employment outcome, D_{it} is a dummy variable for the disability status of an individual i at t-th cross-section survey, x_{it} is a vector of other explanatory variables, and δ_t is the survey-year fixed effects. N is the total number of individuals incorporated in T cross-section surveys. The expression of equation (1) may remind of a fixed effect model using panel data, but it is not true. It should be noted here that the same individual do not basically appear again across surveys in different years, so the range of i does not correspond to 1 to N in each survey.

Now the disability variable D_{it} may be endogenous to the model. This occurs when D_{it} is correlated with the unobserved individual fixed effects or time-variant error term, i.e., α_i or u_{it} in the equation (1). The correlation of D_{it} and α_i violates one of the fundamental assumptions for the unbiasedness of Ordinary Least Squares (OLS) estimates and makes the estimate of β by OLS inconsistent. The direction of the bias depends on the reasons for the endogeneity and is difficult to determine due to three possible reasons. The first is the correlation between disability status and uncontrolled or unobservable individual heterogeneity incorporated in the error term, the so-called "omitted variable." For instance, current disability status may be negatively correlated with non-cognitive ability or social network, with others not measurable with the available variables in the GHS datasets, i.e., persons with congenital impairments might have lost the opportunity to enhance such an ability or create a social network due to being excluded from the education system or community activities. Since it is reasonable to assume $\beta < 0$, the negative correlation between disability status and the error term overestimates the effects of disabilities.

The second reason is the simultaneity of disability and employment status, or the two-way causality between the two. While the interest of this study is in the causality from disability status to employment outcomes, employment status can have a negative influence on disability status. For instance, the unemployed are more likely to acquire impairments due to the lack of money to pay for medical treatment and medicines or to purchase nutritious food. In general, the direction of the simultaneity bias is too complicated to pre-determine.[12]

The last reason is the measurement error in the disability variable. As discussed in the previous section, the influence of the measurement error may not reasonably be ignored for both the disability and WG questions. The former question can underestimate the true number of

[12] According to Wooldridge (2009, p.552), in a simplified case, the direction of the bias depends on $\alpha_2/(1-\alpha_1\alpha_2)$, where α_1 corresponds to the effects of disability on employment, and α_2 to the effects of employment on disability. Since both α_1 and α_2 take values between 0 and -1 in the analysis, the sign of this term is negative, indicating a downward bias.

persons with disabilities due to negative images of "disability," i.e., the possibility of the exclusion error. On the other hand, the latter question can overestimate the true number of persons with disabilities because of its inclusiveness, i.e., the possibility of the inclusion error. Moreover, as explained above, a household head is supposed to answer the disability status of all household members in the GHS, and about half of responses to the disability question in GHS 2009-14 were made by household members, not by those with disabilities themselves. This can be considered as another cause of measurement error, because household heads might have misjudged the degree of household members' limitations in daily activities or difficulties in general functioning, or concealed those with disabilities. Finally, in general, disability is not fixed permanently because its severity can be lessened by supports of others, medical treatment, or the change in the perception of persons with disabilities from the experience. In fact, Mitra (2018) and other longitudinal studies she cited in developed and middle-income countries detected the existence of transition into and out of disability status. Thus, it can be said that disability is difficult to measure due to its dynamic nature, especially in a nationwide questionnaire-based household survey. Such a measurement error in an explanatory variable is known to yield the so-called attenuation bias, that is, the OLS estimates are biased towards zero, meaning the underestimation of the effects of disability (Wooldridge 2009, 320).

To remove these endogeneity biases and consistently estimate the effect of disability, Deaton (1985) suggested aggregating all observations to cohort level as follows:

$$\bar{E}_{ct} = \beta \bar{D}_{ct} + \bar{x'}_{ct}\gamma + \delta_t + \bar{\alpha}_{ct} + \bar{u}_{ct}, c = 1, \dots, C,\ t = 1, \dots, T \quad (2)$$

where $\bar{E}_{ct}$, $\bar{D}_{ct}$, and $\bar{x'}_{ct}$ are the means of each variable for the *c*-th cohort in the survey year *t*.

Considering cohorts as the unit of analysis, the analysis corresponds to that based on $C \times T$ panel data. There is a concern here: $\bar{D}_{ct}$ is likely to be correlated with $\bar{\alpha}_{ct}$ or $\bar{u}_{ct}$ because D_{it} is correlated with α_i or u_{it} in equation (1). Following the existing studies, it is

assumed that D_{it} is correlated only with time-invariant individual fixed effects, α_i. Therefore, the pseudo-panel analysis of this study may be subject to the endogeneity bias resulting from the correlation of D_{it} with the time-specific unobserved individual factor, u_{it}, which is a limitation of pseudo-panel analysis. More specifically, the correlation of D_{it} with u_{it} may result from time-varying omitted variables, measurement errors emerging for the unsystematic reason, and reverse causality that cannot be captured by the time-invariant individual fixed effects, α_i.

If it is possible to replace $\bar{\alpha}_{ct}$ with α_c, the equation (2) can be estimated using conventional panel data methods, but if not the deviation of $\bar{\alpha}_{ct}$ from the true cohort effect over time, $\bar{\alpha}_{ct}-\alpha_c$, matters. Regarding this, Verbeek and Nijman (1992, 1993) show that the estimation bias from the deviation $\bar{\alpha}_{ct}-\alpha_c$ can be ignored if cohorts are based on more than 100 observations. As most existing pseudo-panel studies adopt this criterion, this study follows them and rewrites the final regression model as:

$$\bar{E}_{ct} = \beta \bar{D}_{ct} + \bar{x'}_{ct}\gamma + \delta_t + \alpha_c + \bar{u}_{ct} \quad (3)$$

β can be consistently estimated with the conventional regression methods for the panel data. This study adopts the regression method commonly used in the existing studies, the weighted least squares (WLS), and a standard fixed effect (FE) estimation (the within estimator) to check the robustness of the findings. Regarding the WLS, the number of observations in each cohort is used as a weight for each cohort to deal with the heteroskedasticity of the error term $\bar{u}_{ct}$ resulting from the difference in the number of observations in each cohort; and the fixed effects of cohort and survey year are controlled.

The cohorts are constructed based on year of birth, gender, and race (Africans or not) within each GHS dataset. Since the population of interest in this study is the core working-age in South Africa (25-59 years), the size of the full sample of cohorts is 1,960, i.e., the product of 35 year-of-birth cohorts, two gender types, two racial types, and 14 years of GHS. The average and

median number of observations in the constructed cohorts is 270 and 191.5. In the following regression, 169 cohorts with a size of less than 100 were dropped (8.6 percent of the total number of cohorts), to meet the condition of the pseudo-panel analysis specified by Verbeek and Nijman (1992, 1993). Although not reported in this paper, the same analysis was conducted with the full sample including these cohorts. Since the results are similar to those shown below in terms of the statistical significance of coefficients as reported in Appendix Tables 1-3, the influence of dropping cohorts with size of less than 100 can be safely ignored.

To explore the change in the effects of disability over time, this study adopts the difference-in-difference model as follows:

$$\bar{E}_{ct} = \beta_t(\bar{D}_{ct} * Year_t) + \bar{x}'_{ct}\gamma + \delta_t + \alpha_c + \bar{u}_{ct} \quad (4)$$

The reference year is set to 2007, the year when South African government ratified the CRPD, for the analyses in 2002-08. For the analyses in 2009-15, the reference year is set to 2009 for the model of being employed, and to 2011 for the models of being unemployed and economically inactive due to the inconsistency of definition of unemployment between 2009-10 and 2011-15. If the cohorts constructed above are used, $\bar{D}_{ct}$ is the proportion of persons with disabilities in the cohort, but is not a binary variable. Thus, it is inappropriate to use the same cohorts for the analysis of the change in the disability effects over time using the difference-in-difference model. Following Jones (2009), the cohorts based on disability status and year of birth are reconstructed, which enables the assessment of the time changes on the employment status of persons with disabilities relative to those without disabilities. As the number of persons with disabilities in each GHS data are small, three-year intervals are adopted for year of birth, i.e., 1943-45, 1946-48, …, 1988-90, to ensure each cohort is of a sufficient size. As a result, 344 cohorts (12-13 year-of-birth cohorts, 2 types of disability status, and 14 years of GHS) are constructed, and 295 cohorts used for the analysis after dropping cohorts with a size of less than 100. The

regression results are found to be not sensitive to this change in the sample as reported in Appendix Table 4. Regarding the use of disability status for the construction of cohorts, it should be noted that the measurement error of disability status, $\overline{D}_{ct}$, is large relative to other characteristics such as years of birth and gender, which could be a cause for an attenuation bias in the estimation of disability effects.

The periods of the analysis are divided into 2002-08 and 2009-15 for all regression analyses in this study because of the differences in the definition of persons with disabilities. The dependent variables adopted for both analyses of the disability effect and its change over time are three employment statuses: employed, unemployed, and economically inactive. To keep consistency in the variables across the GHS of different years, explanatory variables other than disability status are limited to age bands of 5 years (25-29, 30-34, …, 55-59), the level of completed education, residence in urban areas, the province of residence, and survey-year dummies. Regarding the effect of macroeconomic conditions in South Africa, the average of the annual GDP growth rate was 4.4% and 1.8% in 2002-08 and 2009-15, respectively, according to the statistics from the World Development Indicators. Specifically, the South African economy has been said to fall into recession in the latter periods due to the global financial crisis. Survey-year dummies accommodate the difference in macroeconomic conditions over years.

The procedure of the analysis in this study is as follows: first, the original model (1) at individual level is estimated using the pooled OLS regression method as the reference, using the same dependent and independent variables. Second, the pseudo-panel model (3) is estimated, and the robustness of the estimates of disability effects checked through the regression models; limiting the years of analyses to 2011-15 and adopting the broad and narrow definition of disability. Third, the heterogenous effects of disability in terms of age (younger or older than 40 years), gender, and race (Africans or not) are examined by splitting the sample of cohorts and running the WLS and FE regressions for each sub-sample. Finally, the change in the effects of

disability over time during 2002-08 and 2009-15 are investigated by estimating the difference-in-difference model (4).

4.2 Regression results

Table 4 shows the results of the pooled OLS regression of model (1) at the individual level during the periods 2002-08 and 2009-15. All coefficients are statistically significant at the 1% level, which can be attributed to the large size of the aggregated sample. As suggested by Figure 2, having disabilities is negatively correlated to the probability of being employed and being unemployed in both 2002-08 and 2009-15. Persons with disabilities are less likely to be employed by 36.6 (19.8) percentage points and are less likely to stay unemployed by 9.6 (8.2) percentage points in 2002-08 (2009-15). The probability of being economically inactive is larger for persons with disabilities by 46.2 (28.0) percentage points in 2002-08 (2009-15). By definition, each coefficient in the model of the probability of being economically inactive is equal to the sum of the values of the corresponding coefficient in the model of employed and employed after inverting their signs. The magnitudes of the coefficients on disability status are larger for all models in 2002-08 than in 2009-15, which is consistent with the difference in the disability question across these periods. In GHS 2002-08 the disability question captured persons who were currently subject to participation limitations, whereas that in GHS 2009-15 captured those who may face the risk of participation limitations. As discussed above, however, these results should be interpreted with caution because the estimates are subject to bias from the endogeneity of disability status and are simply considered as a benchmark for the following analyses.

Table 5 presents the results of WLS and FE estimation with the cohort panel data from 2002-08. The coefficient of disability status is significantly negative in both the WLS and FE estimations of the model of being employed, and only in the FE estimation of the model of being unemployed in 2002-08. The coefficients of disability status are significantly positive in the

model of being economically inactive, to a large extent resulting from its effects on being employed. This indicates that persons with disabilities are less likely to be employed and more likely to exit from the labor market, but not look for jobs, if they are not employed. Table 6 gives similar estimation results for the analyses of the 2009-15 data. The effects of disability on being employed and economically inactive are statistically significant both in the WLS and FE estimation, whereas the effects on being unemployed is not. As a possible reason behind these results, the disability grant system in South Africa might function in a direction to discourage persons with disabilities to continue to search jobs, though the existing studies examining the adverse effect of the disability grant system provided the mixed results (Mitra 2008, 2009, 2010). In fact, the disability grant recipients in the pooled sample of GHS 2009-15 are much less likely to take any action in searching for jobs than non-recipients with disabilities (4.3 versus 33.8%), that is, they are more likely to be categorized as economically inactive. In addition, as with the results of pooled OLS estimation, it is confirmed that the effects of disability are larger in 2002-08 than in 2009-15, which can be explained again by the difference in the definition of disability mentioned above.

In comparison with the coefficients on disability status in Table 4, the magnitude of the coefficients are larger in the models analyzing being unemployed and economically inactive in 2002-08 in Table 5, and in being employed and economically inactive in 2009-15 as shown in Table 6.[13] These results indicate the possibility that the effects of disability may be underestimated with the pooled OLS estimation. As discussed above about the direction of bias of OLS estimation, this underestimation of the disability effects is attributable mostly to the

[13] As specified in the previous section, the pooled OLS regression and the pseudo-panel approach estimate the same coefficient, β, the effects of disability status, and so does the interpretation of the estimated coefficients. Strictly speaking, the coefficients on disability status estimated by the pseudo-panel approach amount to the differences in the average of the probability of employment outcomes between the cohorts with zero percent ratio of persons with disabilities and the cohorts with 100 percent ratio of those people. As the pooled OLS regression estimates the differences in the average of the probability of employment outcomes between persons with and without disabilities, the interpretation of the results of both methods is the same.

measurement error for the disability status. The disability question in GHS 2002-08 may cause an exclusion error, and the difficulty question in GHS 2009-15 may cause an inclusion error. Furthermore, in most cases household heads were asked to answer the degrees of the limitations in daily activities or difficulties in the general functioning of their household members as well. Thus, it seems to be difficult to correctly measure disabilities and the functional limitations of body or mental condition in a nationwide household survey that relies on the self-report of the respondents or responses by other household members. Aggregating the sample in the dataset at the cohort level contributes to a more precise measurement of disability status in each cohort.

Table 7 shows the results of the robustness check of regression results in 2009-15. Panel A reports the results of pooled OLS and pseudo-panel regression limiting the periods of analysis to 2011-15 during which the definition of the unemployed and not economically active are consistent. In comparison to the estimates in Tables 4 and 6, the estimates of the disability effects on being unemployed and economically inactive are not affected much by the periods of analyses. As with the estimates by the analyses of the whole periods, the disability effects on being unemployed are not significant in the WLS and FE models, but those on being economically inactive are. We cannot find any clear results that the disability effect on being unemployed (economically inactive) is overestimated (underestimated) by the analyses covering the whole period in which the broad definition of unemployment was adopted in 2009 and 2010: for example, the WLS regression estimates on being unemployed are -0.034 and -0.056 in 2009-2015 and 2011-15, respectively.

Panels B and C present the disability effects in the case of the broad and narrow definition of disability that was adopted for this study. Since the broad definition of disability includes moderate difficulties as well, it is reasonable that the effects of the broadly defined disability on being employed in columns (1)-(3) of panel B are smaller than those in Tables 4 and 6 regardless of the regression method. For a similar reason, the effects of narrowly defined disability on being employed in the columns (1)-(3) of the panel C became larger. We can also

find the same result in columns (1)-(3) of the panels B and C: the estimate on the disability effect on being employed is underestimated by the pooled OLS regression. Regarding the effects on being unemployed and economically inactive, the results of the broadly defined disability differ from those above: the effects on being unemployed estimated are significantly positive and those on being economically inactive are not significant in the case of the WLS and the FE regression. Similar results were obtained by the regression with the full sample of cohorts or limiting the periods of analyses to 2011-15. These discrepancies may be attributed to the difference in the endogeneity bias of the disability variable, because the results of the pooled OLS regression show that the estimates are similar to those in Table 4. Since the direction of the bias is negative in both models of being unemployed and economically inactive, the negative correlation of moderate difficulties with the unobserved or omitted variables seems to lead to these discrepancies.

Table 8 shows the results of the subgroup analysis of the disability effects by age, gender, and race. Reported are the coefficients on disability status in the estimation using each sub-sample and the test statistics of the Wald test for the equality of the disability effect on each sub-sample.[14] In 2002-08 (Panel A), the effect of disability on being employed is statistically significant only for the older group, whereas the effects of disability on being unemployed and economically inactive is significant for both groups. In 2009-15 (Panel B), the effects of disability on being employed and economically inactive are significant only for the older group. The results of the test for the equality in the disability effects by age are not robust for the estimation methods used. As for the disability effect by gender, in both 2002-08 and 2009-15, the effects on being employed and economically inactive are significant for both males and females. Males experience larger negative effects than females, though the significant difference by

[14] Specifically, the Wald test for the equality of the disability effect by each sub-sample was conducted based on the seemingly unrelated estimation scheme which is implemented with the Stata command "*suest*."

gender is detected only for the effects on being economically inactive in 2002-08. The larger effects for males are also found by previous studies in South Africa (Mitra 2008) and other countries (Mizunoya and Mitra 2013; Mizunoya et al. 2016; WHO and World Bank 2011, Table 8.2). In addition, disability status is found to influence employment status in a different way by race. In 2002-08, Africans experience significant disability effects on being employed and economically inactive, and non-Africans does on all employment outcomes. The magnitude of the disability effect on being employed and economically inactive is similar for both groups, but an increase in the probability of being economically inactive can be attributed to a decrease in the probability of being employed in the case of Africans. In 2009-15, while the effect on being employed is significant for both Africans and non-Africans, the effect on being economically inactive is significant only for Africans. These results imply that persons with disabilities in South Africa are possibly affected by racial discrimination as well as being mainly in terms of labor market participation.

Finally, the estimation results on the change in the effects of disability over time are reported in Table 9. Panels A and B here present the divergence in the effects of disability for each year from those in 2007 and 2009, respectively. Almost all the coefficients in the model of being employed in both periods are not statistically significant at the 10% level, indicating no systematic change in the effects of disability on the probability of being employed. Therefore, we cannot find that persons with disabilities were more likely to be employed even after ratifying the CRPD. The coefficients in both the WLS and FE estimations of being unemployed in 2003, 2004, and 2006 are -0.022 to -0.050 and statistically significant, which means that the probability for persons with disabilities to be unemployed in 2007 is 2.2-5.0 percentage points higher than in these years. The estimates for 2008 are positive, though nearly equal to zero and not statistically significant. Conversely, most of the coefficients in the model of being economically inactive are positive before 2007 and negative in 2008, though most of them are not statistically significant. This suggests that the probability for persons with disabilities to be

economically inactive, though not significantly, might have decreased in 2002-08. These results for being unemployed and economically inactive imply a weak trend that the employment status of persons with disabilities might have shifted from the latter to the former in 2002-08. In other words, persons with disabilities became more likely to enter and stay in the labor market as unemployed during these periods, whereas on average they tend to exit the labor market when they cannot obtain a job as shown in Table 5. In 2009-2015, most of the coefficients in the model of being employed are negative, though almost all of them are not statistically significant. This indicates a weak trend since 2009 that the probability for persons with disabilities to be employed might decrease. Since most of the coefficients in the model of being unemployed and economically inactive are less than 0.01 (the difference by 1 percentage point) in absolute terms, it is hard to infer any specific trend for the probability of persons with disabilities to have been unemployed and economically inactive during these periods.

5. Conclusions

This study dealt with the endogeneity bias of disability status in the estimation of the impact of disability on employment outcomes and examined the change in the effects of disability in South Africa over time by adopting a pseudo-panel approach. After checking the consistency of repeated cross-section surveys, regression analyses were separately run in 2002-08 and 2009-15. As a result, the effects of disability were found to be significantly negative for the probability of being employed, significantly positive for the probability of being economically inactive in both periods, and significantly positive for the probability of being unemployed in 2002-08. The comparison of these results to those of the conventional OLS regression revealed that disability effects were underestimated for being unemployed and economically inactive in 2002-08 and for being employed and economically inactive in 2009-15. This was probably due to the measurement errors in disability status. This study also found that the disability effect on being

economically inactive is larger than that on being unemployed, implying that persons with disabilities are less likely to be employed and more likely to exit from the labor market, but not look for jobs, if they are not employed. A subgroup analysis by race showed that this finding results from the disability effect for Africans, because the disability effects on being employed and economically inactive were statistically significant in both periods of 2002-08 and 2009-15 only for Africans. This difference in the disability effects by race implies the existence of double discrimination in South Africa.

Last but not least, this study could not confirm that the effect of disability on the probability of being employed was mitigated in both the periods of 2002-08 and 2009-15 after the South African government ratified the CRPD in 2007 and implemented several measures for the employment of persons with disabilities. Thus, it can be said that the South African government should implement further active measures for the employment of person with disabilities and re-consider the country's disability policies and legislation.

Other possible implications for the stakeholders in disability issues arising from this study, if any, are the effective use of secondary data including the disability question and further improvement in the data available for disability analysis. Statistical surveys including the disability question have begun to be increasingly conducted throughout the world and will be even more because of Target 17.18 of the Sustainable Development Goals. This study applied the pseudo-panel method to secondary repeated cross-section data in South Africa. It would also be possible to clarify the conditions of persons with disabilities in other countries as well by using similar existing secondary data and appropriate analytical methods (but with considerable caution on the data and methods used).

Through the pseudo-panel method, we confirmed that the employment conditions of persons with disabilities did not improve during 2002-2015 in South Africa after the country had ratified the CRPD and had established legislation and institutions for the employment of persons with disabilities. However, one of the limitations of this study is that it did not assess any specific

policies for the employment of persons with disabilities. Therefore, it is beyond the scope of this study to argue which employment policies for persons with disabilities have failed or should be reinforced. For future studies, it would be of great importance to assess the effectiveness of individual policies and interventions for the promotion of employment of persons with disabilities, particularly in the context of developing countries. In addition, the pseudo-panel method can deal only with the correlation of disability variable and the unobserved time-invariant individual effects as explained above. Thus, other possible problems related to time-varying omitted variables, unsystematic measurement errors, and reverse causality that cannot be captured by fixed effects could have affected the estimates of the disability effects obtained in this study. These problems should be addressed by future research through appropriate econometric methods such as the instrumental variable method.

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Table 1. Summary statistics of persons with disabilities between GHS 2002-08 and 2009-15

	GHS 2002-08 (1)	GHS 2009-15 (2)
(a) Basic characteristics		
Aged 25-29	9.8%	*9.4%*
30-34	*12.1%*	*9.3%*
35-39	13.2%	10.0%
40-44	14.4%	12.0%
45-49	15.9%	17.3%
50-54	17.9%	20.4%
55-59	16.7%	21.6%
Male	51.1%	43.3%
Race: African	77.2%	81.2%
Coloured	16.7%	11.6%
Indian	1.9%	2.1%
White	4.2%	5.1%
Married	44.4%	47.0%
Education: not completed primary school	56.4%	44.8%
primary school	35.3%	39.4%
secondary school or higher	8.3%	15.8%
Household size	3.42	4.41
Dwelling type: formal	74.1%	80.2%
traditional	16.0%	11.7%
informal	9.8%	7.8%
Living in urban areas	55.6%	60.9%
(b) Disability-related characteristics		
Suffer from illness/injury within a month	38.9%	31.6%[a]
Recipient of disability grant	56.8%	33.6%
Distance to health institution: <15 min.	28.4%	34.8%
15-29 min.	35.3%	39.2%
>30 min.	36.3%	26.0%
Observations	13,621	10,411

Source: Prepared by author using the General Household Survey 2002-2015.
Note: The sample is restricted to persons with disabilities aged from 25 to 59 years. The statistics other than age, gender, and race are age-adjusted by five-year age bands.
a: Based on the data of GHS 2008-13 due to no relevant variable in the GHS 2014-15.

Table 2. Cross-tabulation of the result of "disability" and "difficulty" definitions in the GHS 2011

		"Difficulty"[b]		
		Without	With	Total
"Disability"[a]	Without	35,069 (97.5%) [98.1%]	914 (2.5%) [62.0%]	35,983
	With	670 (54.5%) [1.9%]	560 (45.5%) [38.0%]	1,230
	Total	35,739	1,474	37,213

Source: Prepared by author using the General Household Survey 2011.
Note: The sample is restricted to those aged from 25 to 59 years. Those in parentheses are the proportions within the row of each cell, and those in brackets are the proportions within the column of each cell.
a: Persons who answered yes or no to the 'disability' question.
b: Persons who answered "a lot difficulty" or "cannot do at all" on any functionings or "some difficulty" for more than two functionings, or otherwise.

Table 3. Summary statistics of the sample of GHS 2011 by disability status based on "disability" and "difficulty" questions

	With "disability"[a]	With "difficulty"[b]	Without "disability" or "difficulty"
	(1)	(2)	(3)
(a) Basic characteristics			
Age	44.0	45.7	39.3
Male	55.3%	42.9%	45.6%
Race: African	78.7%	84.0%	77.1%
Coloured	15.2%	11.9%	12.0%
Indian	1.6%	0.9%	2.9%
White	4.5%	3.1%	7.9%
Married	33.4%	42.1%	50.0%
Education: not completed primary school	44.3%	42.5%	16.4%
completed primary school	41.5%	41.2%	43.7%
completed secondary school	13.8%	15.8%	39.4%
Household size	4.7	4.6	4.6
Dwelling type: formal	76.1%	78.4%	81.2%
traditional	16.5%	13.4%	8.7%
informal	6.1%	7.0%	8.8%
Living in urban areas	57.6%	59.3%	65.7%
(b) Disability-related characteristics			
Suffer from illness/injury within a month	25.1%	28.6%	10.5%
Recipient of disability grant	71.8%	37.4%	2.3%
Distance to health institution: <15 min.	33.5%	33.0%	39.6%
15-29 min.	38.9%	38.5%	40.8%
>30 min.	27.6%	28.5%	19.6%
(c) Employment status			
Employed	9.4%	27.4%	56.8%
Wage-workers among the employed	62.9%	78.2%	86.3%
Self-employed among the employed	28.4%	22.0%	13.7%
Unemployed	2.6%	6.0%	12.7%
Economically inactive	88.0%	66.6%	30.6%
Observations	1,230	1,474	35,069

Source: Prepared by author using the General Household Survey 2011.
Note: The sample is restricted to those aged from 25 to 59 years.
a: Persons who answered yes to the 'disability' question.
b: Persons who answered "a lot difficulty" or "cannot do at all" on any functionings or "some difficulty" for more than two functionings.

Table 4. Regression results of pooled OLS estimation

	Year 2002-08			Year 2009-15		
	Employed	Unemployed	Economically inactive	Employed	Unemployed	Economically inactive
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.366	-0.096	0.462	-0.198	-0.082	0.280
	(0.003)	(0.002)	(0.004)	(0.005)	(0.004)	(0.005)
Aged 30-34	0.112	-0.065	-0.047	0.097	-0.069	-0.028
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
35-39	0.178	-0.111	-0.067	0.153	-0.120	-0.033
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
40-44	0.208	-0.142	-0.066	0.183	-0.151	-0.032
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
45-49	0.209	-0.168	-0.041	0.190	-0.180	-0.010
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
50-54	0.166	-0.199	0.032	0.163	-0.221	0.058
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
55-59	0.083	-0.218	0.135	0.103	-0.263	0.160
	(0.004)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
Male	0.200	-0.004	-0.197	0.171	-0.044	-0.126
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
African	-0.088	0.107	-0.019	-0.053	0.090	-0.037
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Primary education	0.040	0.029	-0.070	0.079	0.014	-0.093
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Secondary education	0.197	-0.015	-0.182	0.272	-0.087	-0.185
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Urban	0.044	0.038	-0.082	0.110	-0.045	-0.065
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.354	0.173	0.472	0.225	0.415	0.359
	(0.005)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
N	276,026	276,026	276,026	253,195	253,195	253,195
R^2	0.146	0.066	0.174	0.142	0.087	0.145

Note: All coefficients are statistically significant at the 1% level. Reported in parentheses are robust standard errors. Province and survey-year dummies are included in all models, but not reported here.

Table 5. Regression results of WLS and FE estimation with pseudo-panels: Year 2002-08

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.367***	-0.306***	-0.134**	-0.182***	0.501***	0.488***
	(0.095)	(0.080)	(0.056)	(0.051)	(0.076)	(0.073)
Aged 30-34	0.054***	0.053***	-0.022***	-0.021***	-0.032***	-0.033***
	(0.009)	(0.010)	(0.006)	(0.006)	(0.006)	(0.007)
35-39	0.061***	0.073***	-0.019**	-0.021***	-0.041***	-0.052***
	(0.013)	(0.013)	(0.008)	(0.008)	(0.010)	(0.010)
40-44	0.043***	0.071***	-0.012	-0.016	-0.032**	-0.055***
	(0.017)	(0.017)	(0.011)	(0.010)	(0.013)	(0.014)
45-49	0.008	0.048**	0.005	-0.003	-0.013	-0.045**
	(0.022)	(0.021)	(0.013)	(0.011)	(0.017)	(0.018)
50-54	-0.049*	0.010	0.009	-0.005	0.041**	-0.006
	(0.026)	(0.026)	(0.016)	(0.013)	(0.021)	(0.021)
55-59	-0.140***	-0.064**	0.031*	0.009	0.109***	0.055**
	(0.031)	(0.031)	(0.018)	(0.015)	(0.025)	(0.025)
Primary education	0.270***	0.191***	-0.059*	-0.010	-0.211***	-0.181***
	(0.059)	(0.055)	(0.034)	(0.031)	(0.046)	(0.045)
Secondary education	0.358***	0.328***	-0.108**	-0.095***	-0.250***	-0.234***
	(0.066)	(0.064)	(0.042)	(0.035)	(0.054)	(0.056)
Urban	-0.126***	-0.170***	0.126***	0.133***	-0.000	0.037
	(0.046)	(0.047)	(0.029)	(0.024)	(0.037)	(0.039)
Constant	0.798***	0.594***	0.075*	0.111***	0.127**	0.296***
	(0.065)	(0.047)	(0.043)	(0.033)	(0.055)	(0.040)
N	919	919	919	919	919	919
R^2	0.956	0.403	0.956	0.481	0.966	0.575

Note: Reported in parentheses are robust standard errors. Province and survey-year dummies are included in all models, but not reported here. The WLS models control for cohort fixed effects. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 6. Regression results of WLS and FE estimation with pseudo-panels: Year 2009-15

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.291***	-0.274***	-0.034	-0.022	0.325***	0.295***
	(0.105)	(0.086)	(0.100)	(0.087)	(0.111)	(0.091)
Aged 30-34	0.039***	0.036***	-0.025***	-0.020**	-0.013*	-0.017*
	(0.007)	(0.009)	(0.009)	(0.009)	(0.007)	(0.010)
35-39	0.047***	0.050***	-0.029**	-0.022	-0.018	-0.028*
	(0.011)	(0.013)	(0.014)	(0.014)	(0.012)	(0.014)
40-44	0.043***	0.055***	-0.012	-0.008	-0.031*	-0.047**
	(0.014)	(0.017)	(0.018)	(0.017)	(0.016)	(0.019)
45-49	0.026	0.041*	0.006	0.008	-0.032	-0.049**
	(0.018)	(0.022)	(0.022)	(0.021)	(0.020)	(0.024)
50-54	-0.013	0.012	0.021	0.019	-0.008	-0.030
	(0.023)	(0.027)	(0.026)	(0.025)	(0.025)	(0.029)
55-59	-0.067**	-0.037	0.034	0.031	0.033	0.006
	(0.027)	(0.032)	(0.031)	(0.029)	(0.029)	(0.033)
Primary education	0.253***	0.244***	-0.186***	-0.202***	-0.068	-0.043
	(0.066)	(0.064)	(0.068)	(0.067)	(0.072)	(0.076)
Secondary education	0.463***	0.447***	-0.325***	-0.341***	-0.138*	-0.105
	(0.071)	(0.066)	(0.077)	(0.067)	(0.074)	(0.069)
Urban	0.325***	0.288***	-0.037	-0.024	-0.288***	-0.265***
	(0.063)	(0.066)	(0.069)	(0.063)	(0.067)	(0.061)
Constant	0.311***	0.093	0.283***	0.554***	0.406***	0.354***
	(0.074)	(0.079)	(0.081)	(0.071)	(0.079)	(0.077)
N	872	872	872	872	872	872
R^2	0.954	0.386	0.928	0.689	0.938	0.637

Note: Reported in parentheses are robust standard errors. Province and survey-year dummies are included in all models, but not reported here. The WLS models control for cohort fixed effects. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 7. Robustness check of regression results in 2009-15

	Employed			Unemployed			Economically inactive		
	Pooled OLS	WLS	FE	Pooled OLS	WLS	FE	Pooled OLS	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Year 2011-15									
Disability	-0.206***	-0.312**	-0.268**	-0.066***	-0.056	0.010	0.272***	0.369**	0.258*
	(0.006)	(0.137)	(0.122)	(0.004)	(0.093)	(0.094)	(0.006)	(0.163)	(0.146)
N	179,227	616	616	179,227	616	616	179,227	616	616
R^2	0.138	0.961	0.338	0.066	0.952	0.186	0.139	0.948	0.387
Panel B:									
Disability (broad)	-0.082***	-0.211***	-0.177***	-0.046***	0.167**	0.136**	0.128***	0.044	0.041
	(0.003)	(0.063)	(0.058)	(0.002)	(0.068)	(0.061)	(0.003)	(0.068)	(0.066)
N	253,195	872	872	253,195	872	872	253,195	872	872
R^2	0.138	0.954	0.387	0.087	0.929	0.691	0.136	0.937	0.632
Panel C:									
Disability (narrow)	-0.235***	-0.306***	-0.326***	-0.096***	-0.137	-0.111	0.331***	0.444***	0.437***
	(0.005)	(0.116)	(0.093)	(0.004)	(0.124)	(0.110)	(0.006)	(0.122)	(0.105)
N	253,195	872	872	253,195	872	872	253,195	872	872
R^2	0.141	0.954	0.387	0.087	0.929	0.689	0.144	0.938	0.64

Note: Reported are coefficients on the variables related to disability status in each regression model, and those in parentheses are robust standard errors. The specification of each regression model is the same as Tables 4 and 6. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 8. Effects of disability on employment outcomes by sub-samples

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
(a) Aged 25-39	-0.125	-0.147	-0.340**	-0.408***	0.466***	0.555***
(*N*=417)	(0.194)	(0.170)	(0.136)	(0.116)	(0.133)	(0.115)
(b) Aged 40-59	-0.182**	-0.155**	-0.172***	-0.167***	0.354***	0.322***
(*N*=502)	(0.086)	(0.072)	(0.053)	(0.048)	(0.084)	(0.076)
$\chi^2(1)$: (a)=(b)	0.072	0.002	1.324	3.974**	0.543	3.435*
(c) Males	-0.550***	-0.432***	-0.129	-0.202**	0.679***	0.634***
(*N*=454)	(0.141)	(0.124)	(0.088)	(0.081)	(0.102)	(0.096)
(d) Females	-0.261*	-0.201*	-0.068	-0.112*	0.329***	0.313***
(*N*=465)	(0.136)	(0.111)	(0.073)	(0.058)	(0.118)	(0.113)
$\chi^2(1)$: (c)=(d)	2.779*	2.445	0.386	1.008	6.236**	6.269**
(e) Africans	-0.543***	-0.509***	-0.009	-0.009	0.552***	0.518***
(*N*=490)	(0.137)	(0.118)	(0.076)	(0.077)	(0.108)	(0.101)
(f) Not Africans	-0.307***	-0.289***	-0.203***	-0.207***	0.510***	0.496***
(*N*=429)	(0.112)	(0.104)	(0.069)	(0.060)	(0.105)	(0.097)
$\chi^2(1)$: (e)=(f)	1.718	2.287	3.713*	5.503**	0.085	0.031
Panel B: Year 2009-15						
(g) Aged 25-39	-0.292	-0.149	-0.030	-0.037	0.321	0.186
(*N*=392)	(0.193)	(0.200)	(0.302)	(0.312)	(0.250)	(0.252)
(h) Aged 40-59	-0.247**	-0.259***	-0.047	-0.032	0.295**	0.291***
(*N*=480)	(0.105)	(0.085)	(0.094)	(0.081)	(0.117)	(0.098)
$\chi^2(1)$: (g)=(h)	0.044	0.376	0.003	0.001	0.010	0.246
(i) Males	-0.352**	-0.343***	0.019	0.008	0.333**	0.335***
(*N*=414)	(0.163)	(0.119)	(0.122)	(0.123)	(0.142)	(0.110)
(j) Females	-0.275**	-0.248*	-0.035	0.007	0.310*	0.241*
(*N*=458)	(0.137)	(0.129)	(0.136)	(0.115)	(0.162)	(0.136)
$\chi^2(1)$: (i)=(j)	0.174	0.313	0.110	0.000	0.015	0.282
(k) Africans	-0.297**	-0.268**	-0.026	-0.057	0.324**	0.325***
(*N*=490)	(0.147)	(0.123)	(0.135)	(0.110)	(0.155)	(0.117)
(l) Not Africans	-0.277**	-0.290***	0.079	0.086	0.198	0.204
(*N*=382)	(0.127)	(0.105)	(0.106)	(0.102)	(0.133)	(0.124)
$\chi^2(1)$: (k)=(l)	0.011	0.018	0.359	1.104	0.380	0.459

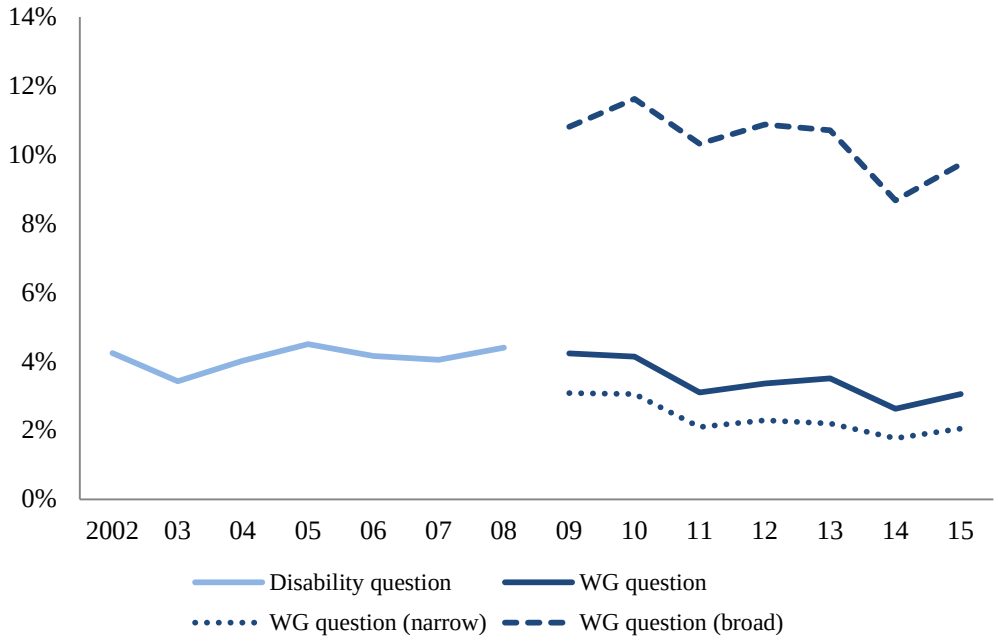
Note: Reported are coefficients on cohort-mean of disability status in the regression model for each sub-sample, and those in parentheses are robust standard errors. Specifications of all models are the same as Tables 5 and 6. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 9. Change in the effects of disability on employment outcomes over time

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
Disability * Year 2002	0.033	0.047*	-0.012	-0.016	-0.020	-0.032
	(0.027)	(0.024)	(0.012)	(0.013)	(0.023)	(0.020)
Disability * Year 2003	-0.017	0.001	-0.039**	-0.031*	0.057*	0.030
	(0.037)	(0.032)	(0.015)	(0.016)	(0.030)	(0.025)
Disability * Year 2004	-0.020	-0.011	-0.050***	-0.038***	0.071**	0.049*
	(0.034)	(0.030)	(0.013)	(0.012)	(0.030)	(0.025)
Disability * Year 2005	-0.011	0.005	-0.006	-0.015	0.017	0.011
	(0.024)	(0.017)	(0.011)	(0.011)	(0.020)	(0.018)
Disability * Year 2006	-0.000	0.016	-0.025**	-0.022**	0.025	0.006
	(0.025)	(0.019)	(0.010)	(0.009)	(0.022)	(0.016)
Disability * Year 2008	0.030	0.038*	0.007	0.003	-0.037	-0.041**
	(0.026)	(0.022)	(0.010)	(0.010)	(0.025)	(0.019)
N	162	162	162	162	162	162
R^2	0.980	0.688	0.993	0.740	0.990	0.796
Panel B: Year 2009-15						
Disability * Year 2010	-0.064*	-0.019				
	(0.037)	(0.023)				
Disability * Year 2011	-0.060	-0.022				
	(0.042)	(0.031)				
Disability * Year 2012	0.003	0.006	0.024	0.039	-0.045	-0.048
	(0.041)	(0.034)	(0.031)	(0.029)	(0.055)	(0.058)
Disability * Year 2013	-0.032	0.005	0.011	0.003	-0.018	-0.001
	(0.037)	(0.025)	(0.030)	(0.024)	(0.050)	(0.043)
Disability * Year 2014	-0.025	-0.013	-0.004	-0.003	-0.015	0.016
	(0.042)	(0.023)	(0.028)	(0.020)	(0.044)	(0.037)
Disability * Year 2015	-0.077	-0.061	0.001	-0.021	-0.010	0.076
	(0.048)	(0.039)	(0.032)	(0.025)	(0.056)	(0.055)
N	133	133	88	88	88	88
R^2	0.972	0.676	0.991	0.697	0.978	0.730

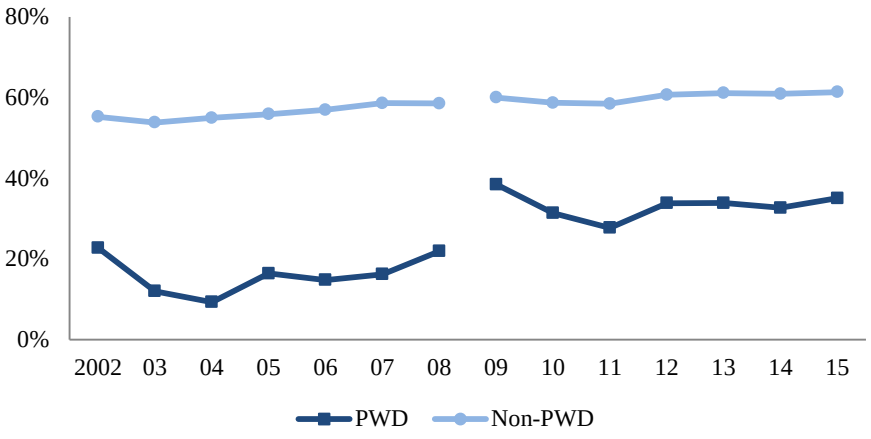
Note: Reported in parentheses are robust standard errors. Specifications of all models are those of Tables 5 and 6 plus the male and African dummy variables. The reference year is 2007 for the analyses in 2002-08, 2009 for the analyses of being employed in 2009-15, and 2011 for the analyses of being unemployed and economically inactive in 2009-15.
* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Figure 1. Proportion of persons with disabilities by time and definition

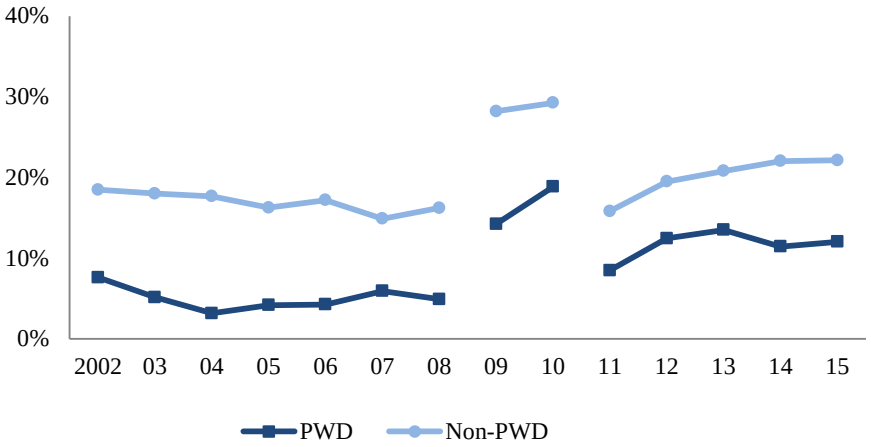


Source: Prepared by author using the General Household Survey from 2002 to 2015.
Note: Illustrated are the population proportions of persons with disabilities aged 25-59 years estimated by using the sampling weight of each survey. "WG" stands for the Washington Group.

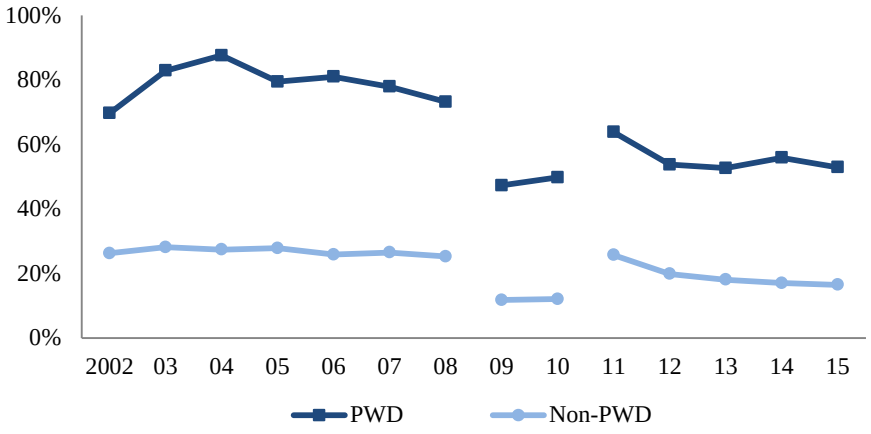
Figure 2. Employment status by disability status from 2002-2015



(a) Employed



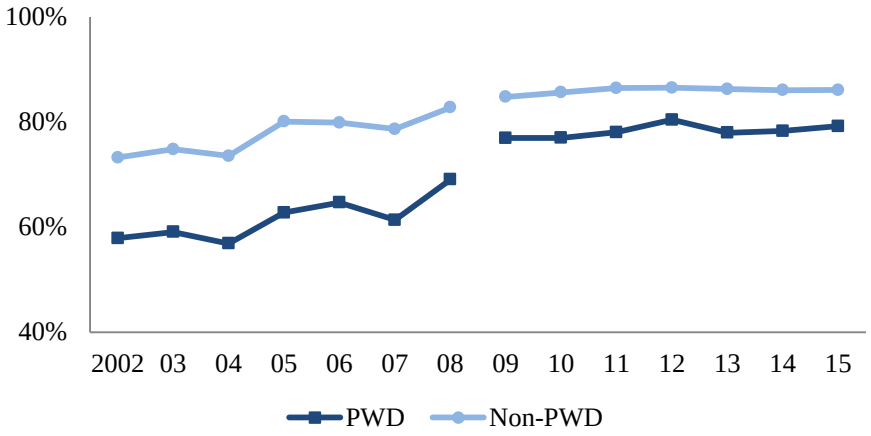
(b) Unemployed



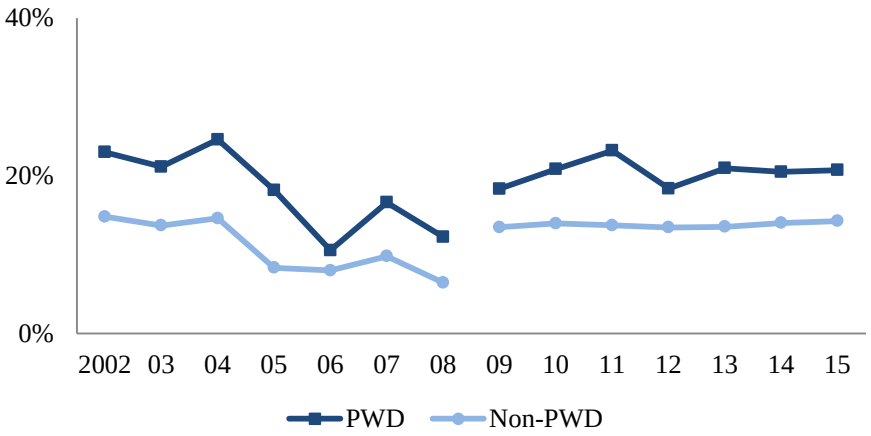
(c) Economically inactive

Source: Prepared by author using the General Household Survey from 2002 to 2015.
Note: Illustrated are the population means of each employment status of persons with or without disabilities aged 25-59 years. All means were estimated with the sampling weight of each survey. "PWD" stands for persons with disabilities.

Figure 3. Employment type of the employed by disability status from 2002-2015



(a) Wage-workers



(b) Self-employed

Source: Prepared by author using the General Household Survey from 2002 to 2015.
Note: Illustrated are the population means of each employment type of the employed with or without disabilities aged 25-59 years. All means were estimated with the sampling weight of each survey. "PWD" stands for persons with disabilities.

Appendix Table 1. Regression results of WLS and FE estimation with pseudo-panels: Year 2002-08 (full sample)

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.348***	-0.295***	-0.133***	-0.161***	0.481***	0.456***
	(0.087)	(0.075)	(0.051)	(0.045)	(0.069)	(0.066)
Aged 30-34	0.055***	0.054***	-0.023***	-0.021***	-0.032***	-0.033***
	(0.009)	(0.010)	(0.006)	(0.006)	(0.006)	(0.007)
35-39	0.063***	0.076***	-0.021**	-0.022***	-0.042***	-0.053***
	(0.013)	(0.013)	(0.008)	(0.008)	(0.010)	(0.010)
40-44	0.045***	0.072***	-0.012	-0.016	-0.033***	-0.056***
	(0.017)	(0.017)	(0.010)	(0.010)	(0.013)	(0.014)
45-49	0.011	0.050**	0.004	-0.005	-0.014	-0.045**
	(0.021)	(0.021)	(0.013)	(0.011)	(0.016)	(0.017)
50-54	-0.048*	0.013	0.008	-0.007	0.040**	-0.006
	(0.026)	(0.026)	(0.015)	(0.013)	(0.020)	(0.021)
55-59	-0.139***	-0.059*	0.030*	0.005	0.109***	0.054**
	(0.031)	(0.030)	(0.018)	(0.015)	(0.024)	(0.025)
Primary education	0.267***	0.194***	-0.056*	-0.010	-0.211***	-0.184***
	(0.056)	(0.056)	(0.032)	(0.029)	(0.044)	(0.046)
Secondary education	0.362***	0.333***	-0.110***	-0.097***	-0.252***	-0.236***
	(0.064)	(0.061)	(0.040)	(0.033)	(0.052)	(0.054)
Urban	-0.144***	-0.184***	0.137***	0.143***	0.008	0.041
	(0.044)	(0.048)	(0.028)	(0.025)	(0.035)	(0.038)
Constant	0.611***	0.577***	-0.021	0.105***	0.410***	0.318***
	(0.058)	(0.048)	(0.037)	(0.030)	(0.047)	(0.044)
N	980	980	980	980	980	980
R^2	0.956	0.388	0.956	0.453	0.966	0.565

Note: Reported in parentheses are robust standard errors. Province and survey-year dummies are included in all models, but not reported here. The WLS models control for cohort fixed effects. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Appendix Table 2. Regression results of WLS and FE estimation with pseudo-panels: Year 2009-15 (full sample)

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.301***	-0.309***	-0.013	0.030	0.314***	0.279***
	(0.096)	(0.091)	(0.093)	(0.082)	(0.100)	(0.088)
Aged 30-34	0.041***	0.042***	-0.028***	-0.026***	-0.013*	-0.017*
	(0.007)	(0.009)	(0.009)	(0.008)	(0.007)	(0.009)
35-39	0.049***	0.055***	-0.032**	-0.029**	-0.017	-0.026*
	(0.011)	(0.013)	(0.014)	(0.013)	(0.012)	(0.014)
40-44	0.047***	0.064***	-0.017	-0.018	-0.030*	-0.045**
	(0.014)	(0.017)	(0.018)	(0.017)	(0.016)	(0.019)
45-49	0.032*	0.056**	-0.000	-0.006	-0.031	-0.050**
	(0.018)	(0.022)	(0.022)	(0.021)	(0.020)	(0.023)
50-54	-0.007	0.027	0.016	0.008	-0.009	-0.035
	(0.022)	(0.027)	(0.026)	(0.024)	(0.024)	(0.028)
55-59	-0.065**	-0.025	0.031	0.022	0.034	0.004
	(0.027)	(0.032)	(0.030)	(0.028)	(0.028)	(0.033)
Primary education	0.242***	0.215***	-0.160**	-0.132**	-0.081	-0.083
	(0.061)	(0.062)	(0.064)	(0.064)	(0.067)	(0.070)
Secondary education	0.437***	0.409***	-0.282***	-0.250***	-0.155**	-0.159**
	(0.065)	(0.059)	(0.071)	(0.063)	(0.068)	(0.065)
Urban	0.306***	0.200***	-0.052	-0.031	-0.254***	-0.169***
	(0.061)	(0.070)	(0.064)	(0.059)	(0.063)	(0.060)
Constant	0.225***	0.210***	0.322***	0.460***	0.453***	0.330***
	(0.079)	(0.077)	(0.085)	(0.069)	(0.084)	(0.077)
N	980	980	980	980	980	980
R^2	0.952	0.327	0.927	0.642	0.936	0.603

Note: Reported in parentheses are robust standard errors. Province and survey-year dummies are included in all models, but not reported here. The WLS models control for cohort fixed effects. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Appendix Table 3. Effects of disability on employment outcomes by sub-samples (full sample)

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
(a) Aged 25-39	-0.103	-0.108	-0.362***	-0.449***	0.465***	0.557***
(*N*=420)	(0.192)	(0.163)	(0.135)	(0.102)	(0.131)	(0.112)
(b) Aged 40-59	-0.212***	-0.224***	-0.138***	-0.108**	0.350***	0.332***
(*N*=560)	(0.078)	(0.076)	(0.047)	(0.045)	(0.074)	(0.070)
$\chi^2(1)$: (a)=(b)	0.258	0.477	2.238	8.257***	0.577	3.640*
(c) Males	-0.542***	-0.448***	-0.126	-0.175**	0.667***	0.624***
(*N*=490)	(0.129)	(0.112)	(0.080)	(0.070)	(0.093)	(0.085)
(d) Females	-0.207*	-0.117	-0.084	-0.129***	0.291***	0.247***
(*N*=490)	(0.124)	(0.091)	(0.066)	(0.048)	(0.107)	(0.093)
$\chi^2(1)$: (c)=(d)	4.465**	6.449**	0.213	0.334	8.710***	11.89***
(e) Africans	-0.543***	-0.509***	-0.009	-0.009	0.552***	0.518***
(*N*=490)	(0.137)	(0.118)	(0.076)	(0.077)	(0.108)	(0.101)
(f) Not Africans	-0.327***	-0.318***	-0.144**	-0.132**	0.472***	0.450***
(*N*=490)	(0.095)	(0.090)	(0.059)	(0.053)	(0.085)	(0.080)
$\chi^2(1)$: (e)=(f)	1.345	1.923	1.709	2.407	0.295	0.341
Panel B: Year 2009-15						
(g) Aged 25-39	-0.285	-0.145	0.000	-0.004	0.284	0.150
(*N*=420)	(0.196)	(0.207)	(0.288)	(0.273)	(0.239)	(0.246)
(h) Aged 40-59	-0.272***	-0.325***	-0.017	0.048	0.289***	0.277***
(*N*=560)	(0.093)	(0.087)	(0.087)	(0.078)	(0.103)	(0.092)
$\chi^2(1)$: (g)=(h)	0.004	0.843	0.003	0.052	0.000	0.400
(i) Males	-0.393***	-0.435***	0.063	0.099	0.330***	0.336***
(*N*=490)	(0.142)	(0.132)	(0.107)	(0.100)	(0.122)	(0.117)
(j) Females	-0.276**	-0.238**	-0.061	-0.045	0.337**	0.282**
(*N*=490)	(0.131)	(0.114)	(0.132)	(0.116)	(0.154)	(0.135)
$\chi^2(1)$: (i)=(j)	0.470	1.536	0.653	1.156	0.002	0.106
(k) Africans	-0.297**	-0.268**	-0.026	-0.057	0.324**	0.325***
(*N*=490)	(0.147)	(0.123)	(0.135)	(0.110)	(0.155)	(0.117)
(l) Not Africans	-0.302***	-0.324***	0.100	0.119	0.202*	0.205*
(*N*=490)	(0.105)	(0.112)	(0.092)	(0.091)	(0.110)	(0.113)
$\chi^2(1)$: (k)=(l)	0.001	0.122	0.447	1.842	0.309	0.511

Note: Reported are coefficients on cohort-mean of disability status in the regression model for each sub-sample, and those in parentheses are robust standard errors. Specifications of all models are the same as Tables 5 and 6. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Appendix Table 4. Change in the effects of disability on employment outcomes (full sample)

	Employed		Unemployed		Economically inactive	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
Disability * Year 2002	0.041	0.055**	-0.017	-0.021*	-0.024	-0.034*
	(0.025)	(0.024)	(0.011)	(0.011)	(0.021)	(0.020)
Disability * Year 2003	-0.010	0.016	-0.038***	-0.029*	0.049*	0.013
	(0.035)	(0.031)	(0.014)	(0.014)	(0.028)	(0.026)
Disability * Year 2004	-0.010	0.002	-0.050***	-0.038***	0.060**	0.036
	(0.032)	(0.029)	(0.012)	(0.011)	(0.028)	(0.025)
Disability * Year 2005	-0.006	0.012	-0.008	-0.017	0.014	0.005
	(0.024)	(0.020)	(0.011)	(0.010)	(0.020)	(0.019)
Disability * Year 2006	0.004	0.020	-0.024**	-0.015*	0.020	-0.005
	(0.024)	(0.021)	(0.010)	(0.008)	(0.021)	(0.019)
Disability * Year 2008	0.036	0.043**	0.008	0.005	-0.044*	-0.049**
	(0.026)	(0.018)	(0.010)	(0.011)	(0.025)	(0.019)
N	172	172	172	172	172	172
R^2	0.980	0.668	0.993	0.711	0.990	0.758
Panel B: Year 2009-15						
Disability * Year 2010	-0.058*	-0.017				
	(0.031)	(0.031)				
Disability * Year 2011	-0.080**	-0.059**				
	(0.031)	(0.026)				
Disability * Year 2012	-0.017	-0.024	0.031	0.028	-0.073**	-0.056*
	(0.033)	(0.038)	(0.019)	(0.021)	(0.035)	(0.029)
Disability * Year 2013	-0.042	-0.020	0.013	0.021	-0.044	-0.059**
	(0.028)	(0.035)	(0.020)	(0.019)	(0.032)	(0.025)
Disability * Year 2014	-0.045	-0.034	-0.006	-0.021	-0.020	0.000
	(0.032)	(0.032)	(0.019)	(0.021)	(0.031)	(0.027)
Disability * Year 2015	-0.038	-0.023	-0.003	-0.012	-0.047	-0.013
	(0.036)	(0.034)	(0.021)	(0.016)	(0.037)	(0.024)
N	172	172	122	122	122	122
R^2	0.969	0.581	0.986	0.562	0.977	0.705

Note: Reported in parentheses are robust standard errors. Specifications of all models are the same as Tables 5 and 6 plus the male and African dummy variables. The reference year is 2007 for the analyses in 2002-08, 2009 for the analyses of being employed in 2009-15, and 2011 for the analyses of being unemployed and economically inactive in 2009-15. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Abstract (in Japanese)

要約

本研究では、疑似パネルデータアプローチを応用し、南アフリカにおいて障害が雇用に与える影響およびその影響の時間的な変化を推計した。活用したデータは 2002 年から 2015 年の各年のクロスセクションデータであり、障害の有無に関する質問の一貫性を考慮し、分析を 2002-08 年と 2009-15 年に分けて行った。その結果、両期間において雇用される確率および労働市場から退出する確率に対して障害が統計的に有意な影響を与えていることが分かった。これらの影響は従来の最小二乗法による分析では過小評価されており、これは障害の有無に関する測定誤差のためであると考えられる。また、障害が雇用に与える影響に有意な時間的変化は見られず、南アフリカにおける障害者雇用政策が障害者の雇用改善に貢献したという結果は確認されなかった。

キーワード: 障害、雇用、南アフリカ、疑似パネルデータアプローチ

JICA Research Institute

Working Papers from the same research project

"An Empirical Study on the Poverty and Employment of Persons with Disabilities in South Africa"

JICA-RI Working Paper No. 142

Untangling Disability and Poverty: A Matching Approach Using Large-scale Data in South Africa

Kengo Igei