JICA Research Institute

JICA-RI Working Paper

An empirical study on the poverty and employment of persons with disabilities in South Africa

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

Kengo Igei

No. 142

March 2017

JICA Research Institute

JICA Research Institute
10-5 Ichigaya Honmura-cho
Shinjuku-ku
Tokyo 162-8433 JAPAN
TEL: +81-3-3269-3374
FAX: +81-3-3269-2054

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

Kengo Igei*

Abstract

Disability and poverty are interconnected with each other. This entangled relationship and the complexity of disability itself have hampered our understanding of poverty among persons with disabilities. This paper attempts to estimate the more accurate gap in multidimensional poverty between persons with and without disabilities in South Africa using a matching method and large-scale household survey data. This paper also decomposes the gap in multidimensional poverty between persons with and without disabilities using a matching-based decomposition method, in which it is mathematically shown that the decomposition method embraces the average treatment effect on the treated. The results reveal that persons with disabilities are more deprived in multidimensional poverty than matched persons without disabilities, particularly in terms of the breadth of poverty. The gap between them is larger for the subgroups of persons with difficulties in intellectual functionings and with multiple difficulties, and among adult males, Africans, Coloureds, or residents in rural areas. While a large part of the gap is attributable to disability for the younger group, the gap for the older group is explained not only by disability but also other factors, indicating the existence of multiple discrimination in South Africa.

Keywords: Disability, Multidimensional poverty, South Africa, Matching, Decomposition analysis

* Research assistant, JICA Research Institute (Igei.Kengo@jica.go.jp)

This research was conducted through a JICA Research Institute project entitled “An Empirical Study on the Poverty and Employment of Persons with Disabilities in South Africa.” I would like to thank Ichiro Tambo, Yoichi Mine, Kumiko Makino, Aya Suzuki, Daisuke Sagiya, Ren Kamioka, and participants at the 2016 International Symposium hosted by ICED-LSHTM, the seminar at IDE-JETRO, the 17th Spring Conference of the JASID, the 2016 HDCA Annual Conference, the Hayami Conference 2016, the seminars in JICA, and all reviewers of an earlier version of this paper for their insightful suggestions and comments. All remaining errors are my own.

1. Introduction

Disability and poverty are no longer an agenda specific only to a human rights perspective, but are also being viewed from development perspectives. The United Nations Convention on the Rights of Persons with Disabilities, ratified by more than 160 countries, refers to the role of international cooperation in improving the living conditions of persons with disabilities in developing countries. WHO and World Bank (2011) estimated the prevalence rate of persons with disabilities among the global population aged 15 years and over as 15.6-19.4%, corresponding to 785-975 million of people in 2010, and showed that the rate was higher in lower income countries. In light of the cross-cutting nature of disability, the 2030 Agenda for Sustainable Development, adopted in September 2015, pays close attention to disability in the goals related to education, employment, inequality, and urban development. Thus, the international development community is increasingly aware of the importance of reducing poverty among persons with disabilities in this decade.

Under these circumstances, the empirical literature on disability and poverty has been expanding. For example, literature has explored effects of poverty on income or expenditure (Albert et al. 2015; Menon, Parish, and Rose 2014; Takasaki 2016), education (Lamichhane and Kawakatsu 2015), employment (Rischewski et al. 2008; Mitra and Sambamoorthi 2008; Mizunoya and Mitra 2013), multiple indicators (Filmer 2008; Mitra, Posarac, and Vick 2013; Mont and Nguyen 2011; Trani et al. 2015; Trani and Loeb 2012), and child poverty (Trani, Biggeri, and Mauro 2013; Trani and Cannings 2013). On the whole, these studies found that disability was significantly associated with each indicator. However, most of the existing studies did no more than simply compare persons with and without disabilities and examine the correlation between disability and each indicator.[1]

[1] As exceptions, Menon et al. (2014) applied an instrumental variable Wald estimator for the regression of disability status on the average monthly per capita expenditure in India to deal with the endogeneity problem of disability explained below. Takasaki (2016) considered landmine amputations in Cambodia as a disability caused by exogenous shock and evaluated the causal impacts of amputations on poverty

Disability is considered to be complicatedly entangled with poverty, as Groce et al. (2011, 1509) demonstrated "the need for more nuanced analysis that reflects the complex world within which poverty among persons with disabilities must be considered." This paper attempts to fill this research gap through three contributions to the literature on disability and poverty. The first contribution is the more precise estimation of the gap in multidimensional poverty conditions between persons with and without disabilities. It has long been recognized that disability may be a cause and a consequence of poverty; that is, persons with disabilities are more likely to fall into poverty, whereas the poorer are also more likely to have disabilities (Elwan 1999; Yeo and Moore 2003). Since in many instances persons with disabilities are already poor even before acquiring the disability, simple comparisons between persons with and without disabilities overestimate the impact of disability, which is known as the selection bias. To deal with this bias, it is necessary to strictly control for the difference in the pre-existing poverty conditions. This paper employs exact covariate matching, a method of impact evaluation, that compares a person with disabilities to those without disabilities who have the exact same observable characteristics as the person with disabilities.[2] However, it should be noted that the results of exact covariate matching cannot always be interpreted as causality because matching is based on observable characteristics and is not able to completely control for unobservable ones. By taking advantage of the large-scale data, this paper attempts to control for observable characteristics as much as possible to minimize the selection bias, but the influences of unobservable factors might be impossible to ignore. Therefore, the objective of this paper is to estimate the gap in multidimensional poverty conditions between persons with and without

by carefully selecting amputees due to landmine accidents and matching them with non-disabled adults within the same village.

[2] Similarly, Rischewski et al. (2008), Trani et al. (2015), and Trani and Loeb (2012) matched persons with and without disabilities based on age, gender, and location of residence. They conducted a case-control random survey in which they firstly sampled persons with disabilities and then, for each person with disabilities, found and interviewed those without disabilities who were the same years old, the same gender, and lived in the same area as the person with disabilities. While these studies controlled for other factors in advance, this paper does so ex post using secondary household data.

disabilities more accurately than existing studies, rather than to identify the causal impacts of disability on poverty.

The second contribution is the disaggregation of analysis by compounding factors: the personal and environmental factors other than disability such as type and severity of disabilities, age, gender, ethnic group, and location of residence. Some of the existing studies analyzed by subgroups based on the data composition and backgrounds of analyzed countries. As for the type of disability, persons with intellectual, mental or multiple disabilities are found to be more disadvantaged in terms of employment, multidimensional poverty, and child poverty (Mitra et al. 2013; Mizunoya and Mitra 2013; Trani and Cannings 2013; Trani et al. 2015; Trani and Loeb 2012). Only a few studies conducted the analyses by severity of disability and found significant correlations of severe disability with schooling and child poverty (Lamichhane and Kawakatsu 2015; Trani and Cannings 2013). As for the difference by gender, the results are mixed: some studies found girls and women to be more disadvantaged (Albert et al. 2015; Trani and Cannings 2013; Trani et al. 2015; Trani and Loeb 2012), whereas others found that men were more disadvantaged (Menon et al. 2014; Mitra et al. 2013; Mizunoya and Mitra 2013; Mont and Nguyen 2011). Examining differences between urban and rural residences, almost all studies found that persons with disabilities in the rural area face more disadvantages. One of the major obstacles for these subgroup analyses of disability and poverty is the small number of observations of persons with disabilities in the dataset. It is often the case that the number of persons with disabilities is limited to a few hundred at most. Dividing these observations into subgroups results in too few observations to conduct reliable analysis of the poverty for each subgroup. This might explain in part the mixed results surrounding disability type and gender, and the scarcity of analyses by severity of disability. The sample size of the data used in this paper is much larger than that of the existing studies, which enables a more reliable analysis of disability and poverty by compounding factors.

The third contribution of this paper is the use of decomposition analysis for the gap in multidimensional poverty conditions between persons with and without disabilities. The decomposition analysis, represented by the Blinder-Oaxaca decomposition, has been used to divide the gap in an outcome between two groups, e.g., the gender wage gap, into a part explained by the difference in observable factors of two groups except for group status, and a part not explained by the difference under the conditional independence and overlap assumptions (Fortin, Lemieux, and Firpo 2011). Then, the latter part is interpreted as the effect of difference in social status of the groups. Fortin et al. (2011) explained that the former and latter parts correspond to the selection bias and the treatment effects in the literature of impact evaluation, respectively. While impact evaluation methods usually focus only on the latter, it is the major interest of the decomposition analysis to examine the extent to which each part accounts for the total gap. This paper can contribute to a more comprehensive understanding about disability and poverty by estimating not only the effects of disability on poverty, but also the selection bias through the decomposition analysis. More specifically, this paper applies a matching-based decomposition method developed by Ñopo (2008) in which exact covariate matching is used. In the subsequent section explaining the statistical model of this decomposition method, I mathematically prove that the decomposed part not explained by observable factors is identical to the effects of disability estimated by exact covariate matching. To the best of my knowledge, this is the first study to conduct a decomposition analysis for disability and poverty and specify the relationship between the methods of impact evaluation and decomposition analysis.[3]

The remainder of this paper is organized as follows: Section 2 explains the conceptual framework of disability and poverty and the context of disability in South Africa. Section 3 introduces the data used in this paper and briefly describes the characteristics of persons with

[3] The decomposition analysis for the wage gap between persons with and without disabilities already exists, for example, the studies by Longhi, Nicoletti, and Platt (2012) in the United Kingdom and by Baldwin and Choe (2014) in the United States.

and without disabilities. Section 4 explains the empirical methods adopted in this paper and Section 5 shows the empirical results. Section 6 concludes with the implications of the findings.

2. Backgrounds

2.1 Conceptual framework of disability and poverty

Disability and poverty are conceptually close to each other. Similar to poverty, disability is considered to be "complex, dynamic, multidimensional, and contested" (WHO and World Bank 2011, 3). As poverty is not defined today as simply a low level of income or consumption, disability no longer simply refers to the loss of body structure or limitation of body function, i.e., impairment, in the prevailing social model of disability,. The social model of disability argues that disability does not belong to only persons with impairments, but to the social environment that restricts their opportunities to participate in society through physical, institutional, and attitudinal barriers (Barnes, Mercer, and Shakespeare 1999; Oliver 1996). In the view of the social model of disability, disability emerges out of the interaction between persons with impairments and environmental factors, and thus, disability is defined as the loss or limitation of participation in society and the resulting disadvantages imposed on persons with impairments. Defined in another way, disability can be conceptualized from the perspective of the capability approach, which is aligned with the social model of disability (Burchardt 2004; Mitra 2006; Trani et al. 2011). Sen (1999) regarded impairment as one of personal characteristics, and sometimes cited persons with impairments as the instance of the diversity of human beings in his explanation of the capability approach. In common with other personal characteristics, impairment interacts with other personal characteristics, available resources, and economic, social and cultural factors and affects the capability of persons with impairments. Mitra (2006, 241) stated that "[a]n impairment is a prerequisite to disability, but it is only one of the factors, along with the person's other characteristics (e.g., age, gender, race), the resources available, and

the environment, that lead to capability or functioning deprivation—in other words, to disability." Since poverty is also defined as the deprivation of basic capabilities in the capability approach, it can be said that disability is conceptually adjacent to poverty in the sense of the capability approach. Furthermore, applying the capability approach to disability requires us to control for personal and environmental factors in order to precisely assess the effect of disability on poverty and to disaggregate the analysis into subgroups categorized by these factors.

Disability and poverty are not only conceptually associated with each other, but also interconnected in such a way that one is a cause and consequence of the other. Yeo and Moore (2003) explain the two-way causality behind disability and poverty as follows: persons with impairments confront social barriers in the form of environmental, institutional, and attitudinal discrimination and are excluded from the education system, employment, community activities, basic health care, and access to limited resources such as food and clean water. Their income generating opportunities are restricted due to low skills and poor health, so they can fall into income poverty and further chronic poverty. Moreover, insufficient public support for treatment or rehabilitation costs is directly connected to income poverty. On the other hand, chronic poverty leads to limited access to education and health care, insufficient food, and poor sanitation and results in being forced to work in unsafe workplaces and live under unhygienic conditions, leading to malnutrition and poor health, which in turn increases the risk of acquiring impairments and chronic illness. In this way, persons with disabilities are more likely to fall into poverty, and at the same time, the poorer are more likely to receive impairments in their lives and be forced to face disabilities. The latter direction of causality matters when rigorously evaluating the impact of disability on poverty because persons with disabilities might be already poorer than those without disabilities even before receiving impairments.

2.2 Context of disability in South Africa

South Africa has been paying higher attention to disability as compared to other developing countries. The disability rights movement had been led by disabled activists and domestic disabled people's organizations since the 1980s in connection with the anti-apartheid movement (Howell, Chalklen, and Alberts 2006). As a result, the current constitution adopted after the democratization in 1994 stipulates the prohibition of discrimination based on disability as well as race or gender. The government ratified the United Nations Convention on the Rights of Persons with Disabilities in 2007 and promoted the preparation of laws and institutions related to disability in the areas of education, employment, and social securities. However, the disability policies in South Africa have been exposed to criticism from the public regarding their implementation, and their positive impacts on the lives of persons with disabilities have been questioned (Dube 2005). For example, Human Rights Watch (2015) reported the discriminatory enrollment decisions by schools for children with disabilities, the lack of accommodations for school facilities, and low-quality teaching to children with disabilities. In addition, the government settled the official goal for the employment rate of persons with disabilities in the public sector at 2% by 2005, though the goal has been not achieved and the average employment rate in the public sector was 0.39% in the fiscal year of 2012 (Government of South Africa 2015). Gooding and Marriot (2009) revealed problems in the disability grant program in South Africa such as complex and unaccountable systems leading to misunderstanding of the criteria, incorrect payments, delays of procedure, and physical inaccessibility to receive grants. In the systematic review of disability-related social protection programs in low- and middle-income countries by Banks et al. (2017), several papers verified the exclusion of persons with disabilities from the disability grant and care dependency grant programs, and their limited effects on poverty reduction in South Africa.

According to the population census in 2011, the share of persons with disabilities is 7.5% of the whole population aged above five years, corresponding to about 2.9 million people,

and they are found to be disadvantaged in education, employment, income, and so on (Statistics South Africa 2014). The conditions of lives of persons with disabilities in South Africa have been so far reported based on several national surveys and case studies in some regions (DSD, DWCPD, and UNICEF 2012; Graham et al. 2014; Graham and Ross 2016; Loeb et al. 2008; Moodley and Ross 2015). However, these studies mainly depend on descriptive, qualitative, or brief quantitative analysis, and thus the aforementioned analytical challenges—two-way causality between disability and poverty and the disaggregation of analysis—have not been tackled yet in the study in South Africa. In particular, as the influence of racial discrimination in the past seems still to persist in South Africa, it is necessary to examine how disability and race are related to each other when considering the poverty of persons with disabilities. In addition, Moodley and Graham (2015) and Maart et al. (2007) emphasized the need for further investigation in gender and regional differences in the lives of persons with disabilities in South Africa.

3. Data and descriptive analysis

This paper uses the 10% sample data of the South African census conducted in 2011 (Statistics South Africa 2015a). The sample size is 4,337,697 individuals within 1,194,122 households. The census asked about functional difficulties, based on the short set of questions developed by the United Nations Washington group on Disability Statistics. It covered six domains of functioning: seeing, hearing, communication, walking or climbing stairs, remembering or concentrating, and self-care such as washing, dressing, and feeding. Respondents were asked to respond to each condition for all household members aged above five years from the four choices in principle, “no difficulty,” “some difficulty,” “a lot difficulty,” and “cannot do at all.”[4]

[4] The survey asked about the difficulty in seeing or hearing when using an assistive device such as eyeglasses or a hearing aid. Household heads could refuse this question or answer “do not know” or “cannot yet be determined.” The rate of these invalid answers in the data is about 8% for all domains of functioning, except for self-care whose invalid rate is 15%.

Before conducting the census, Statistics South Africa confirmed the validity of these questions and the correctness of their wording in the context of South Africa using focus group discussion and pilot surveys (Schneider 2009; Schneider et al. 2009). As for the response of "some difficulty," Miller et al. (2010) cast doubt on the reliability of self-reporting on minor health problems, and for that reason Mitra et al. (2013) and Mizunoya and Mitra (2013) applied the response of "a lot difficulty" and anything more severe to the definition of the disability group. This paper follows this definition for each level of functioning and hereafter calls the difficulty levels of "a lot difficulty" and "cannot do at all" as moderate and severe difficulty, respectively. Persons without disabilities are also narrowly defined as those who do not have any difficulties with all six functionings by excluding those with at most "some difficulty" in any functionings. Those with "some difficulty" in any functionings at the most were dropped to remove the possibility of false positives, i.e., measurement error of persons with disabilities. Thus, the sample for the analysis consists of persons with a moderate or severe difficulty in at least one functioning and those without any difficulties for all six functionings.

The sample for analysis in this paper is persons aged 6 to 64, which was chosen by taking into account the ages for attending primary school (5-6) and compulsory education (7-15), and the working-ages (15-64) in South Africa. Then, children aged 6 to 14 who answered that they had difficulties in self-care were excluded because Statistics South Africa (2014) explicitly referred to the possibility of misunderstanding on the question of self-care by the respondent of the census. They may have indicated they have difficulties with self-care due to their age rather than to any impairments, which was the intention of the questionnaire.[5] To deal with this potential measurement error, children were dropped if they indicated a difficulty only in self-care. The resulting sample size for the analysis is 2,748,999, which includes 90,867 persons with moderate or severe difficulties in any functionings, or 3.3% of the total. This is lower than

[5] Before exclusions, 22,696 persons aged 6 to 64 reported a moderate or severe difficulty in self-care, 82.8% of whom are children aged 6 to 14. This was extremely biased in comparisons to other functionings.

the aforementioned ratio of 7.5% given by Statistics South Africa (2014) because they adopted a wider definition of a person with disabilities as someone with “some difficulty” in more than two functionings or a difficulty severer than “a lot difficulty” in at least one functioning.

Figure 1 illustrates the age distributions of persons with and without disabilities by gender. The age distribution of those without disabilities (hatched bars) forms the shape of pyramid, i.e., a relatively large share of the youth and decreasing share of older people, as is often observed in other countries. In contrast, the age distribution of those with disabilities (closed bars) shows a high prevalence of people in their mid-forties or older for both males and females, demonstrating that the probability of receiving impairments increases as people age. There is also a relatively high frequency of disabilities among children aged 6 to 8 because many children in that age range were reported to have difficulty in communicating. This may be attributable to misreporting due to the age, but these observations were kept for the analysis because to my knowledge there are no reports or arguments suggesting the possibility of misreporting.

Table 1 shows the share of persons with disabilities by type and severity of functional difficulties in each age group: 6-14, 15-24, 25-39, 40-54, and 55-64. The difficulties in seeing and remembering account for the large share for all age groups. The share of communication is high among children aged 6-14, that of self-care is high for those aged 15-24, and that of walking is high for the other older groups. The share of persons with moderate difficulties in seeing and walking is higher in the older groups, which is considered to be the influence of aging. In addition to six types of disabilities, this paper takes into account persons who have difficulties in multiple functionings; their share is about 20% for all age groups as shown at the bottom of the table.

Table 2 compares persons with disabilities and without disabilities across gender, race, and residence area by age groups. There are more males than females in the 6-14 age group for those with and without disabilities, and the former group incorporates relatively more males than

the latter group (the first and second columns). In contrast, persons with disabilities include relatively more females for the older groups, except for the 15-24 age group (the fifth to tenth columns). These results might be explained in part by the lag in the growth of boys relative to girls and by the influences of gender discrimination for women. Looking at race, the ratio of Africans is higher in persons with disabilities than persons without disabilities for all age groups, meaning that Africans are more represented in the former group. It is also notable that Whites are less represented among persons with disabilities. As for the area of residence, the rural area in South Africa is divided into the rural formal and tribal (or traditional) areas. The tribal area is defined as the area legally administered by tribal authorities, where almost all residents are Africans. Table 2 shows that the ratio of residents with disabilities in the urban area is lower than persons without disabilities. Instead, residents in the tribal area are more represented among persons with disabilities. Putting these results together, it can be said that those expected to face disadvantages related to gender, race, or place of residence are more likely to have disabilities in South Africa.

As illustrated so far, persons with disabilities apparently differ from those without disabilities in personal and environmental characteristics, and there seems to be a larger proportion of persons with disabilities from the more disadvantaged population. Without taking into account these issues, the simple comparison between persons with and without disabilities not only yields the mixed effects of disability and other factors, but also overestimates the impact of disability due to the self-selection bias. Additionally, there is much variation in type and severity of disability even within persons with disabilities. These findings underline the need to control for other factors in the analysis of disability and poverty and conduct the subgroup analyses.

4. Empirical methods

4.1 Model

The analysis in this paper utilizes the empirical methods from two strands of literature, impact evaluation and decomposition analysis. As explained in the Introduction section, exact covariate matching and Ñopo's (2008) matching-based decomposition are employed to control for and quantify the influences of pre-existing poverty conditions among persons with disabilities, that is, the selection bias. Although propensity score matching has been more frequently used than exact covariate matching in the literature of impact evaluation, I chose the latter mainly because I can clearly specify the relationship between impact evaluation and decomposition methods. This sub-section explains the model of matching-based decomposition developed by Ñopo (2008) and then proves that the part not explained by observable factors in the model corresponds to the average treatment effect on the treated estimated by exact covariate matching.

Ñopo's (2008) matching-based decomposition method has advantages over the conventional Blinder-Oaxaca decomposition in consideration of the difference in the supports of the distribution of observable factors for two groups of interest and the nonparametric estimation of each decomposed part. Specifically, he considered all samples including those in and out of common support and decomposed the gap into four parts: one part due to group status, another part due to observable factors other than group status, and the other two parts due to characteristics specific to each group.

Let Y and X denote the poverty conditions and the vector of observable characteristics of individuals, respectively, following Ñopo's (2008). The disability and non-disability groups are denoted by W_1 and W_0, the conditional cumulative distribution function for each group by $F_1(X)$ and $F_0(X)$, and the set of actually observed characteristics for each group by S_1 and S_0. By introducing the functions of the expected value of poverty conditional on disability status and other characteristics as $E[Y|W_1, X] = g_1(X)$ and $E[Y|W_0, X] = g_0(X)$, the expected value of

poverty of persons with and without disabilities can be written as $E[Y|W_1] = \int_{S_1} g_1(X)dF_1(X)$ and $E[Y|W_0] = \int_{S_0} g_0(X)dF_0(X)$. Then, the difference in poverty conditions between these two groups, $\Delta = E[Y|W_1] - E[Y|W_0]$, can be expanded by dividing each integral into two parts: the part evaluated at the common support, $C = S_1 \cap S_0$, and the part evaluated out of the common support:

$$\Delta = \int_{S_1} g_1(X)dF_1(X) - \int_{S_0} g_0(X)dF_0(X)$$

$$= \left[\int_C g_1(X)dF_1(X) + \int_{\bar{C}} g_1(X)dF_1(X)\right]$$

By defining the share of persons in each group located in the domain S as $\mu_1(S) = \int_S dF_1(X)$ and $\mu_0(S) = \int_S dF_0(X)$, the cumulative distribution function of each integral is rescaled by using the shares of persons in and out of the common support:

$$\Delta = \left[\int_C g_1(X)\frac{dF_1(X)}{\mu_1(C)}\right]\mu_1(C) + \left[\int_{\bar{C}} g_1(X)\frac{dF_1(X)}{\mu_1(\bar{C})}\right]\mu_1(\bar{C})$$

$$- \left[\int_C g_0(X)\frac{dF_0(X)}{\mu_0(C)}\right]\mu_0(C) - \left[\int_{\bar{C}} g_0(X)\frac{dF_0(X)}{\mu_0(\bar{C})}\right]\mu_0(\bar{C})$$

Then, replacing $\mu_1(C)$ with $1 - \mu_1(\bar{C})$ and $\mu_0(C)$ with $1 - \mu_0(\bar{C})$, the equation develops as follows:

$$\Delta = \int_C g_1(X)\frac{dF_1(X)}{\mu_1(C)} - \int_C g_0(X)\frac{dF_0(X)}{\mu_0(C)}$$

$$+ \left[\int_{\bar{C}} g_1(X)\frac{dF_1(X)}{\mu_1(\bar{C})} - \int_C g_1(X)\frac{dF_1(X)}{\mu_1(C)}\right]\mu_1(\bar{C})$$

$$+ \left[\int_C g_0(X)\frac{dF_0(X)}{\mu_0(C)} - \int_{\bar{C}} g_0(X)\frac{dF_0(X)}{\mu_0(\bar{C})}\right]\mu_0(\bar{C})$$

Lastly, by adding and subtracting the counterfactual of poverty conditions, $\int_C \ g_0(X)\frac{dF_1(X)}{\mu_1(C)}$, which means the hypothetical poverty conditions of persons with disabilities if they had not had disabilities, the equation can be expressed in the following way:

$$\Delta = \int_C \ [g_1(X) - g_0(X)]\frac{dF_1(X)}{\mu_1(C)} + \int_C \ g_0(X)\left[\frac{dF_1}{\mu_1(C)} - \frac{dF_0}{\mu_0(C)}\right](X)$$

$$+\left[\int_{\bar{C}} \ g_1(X)\frac{dF_1(X)}{\mu_1(\bar{C})} - \int_C \ g_1(X)\frac{dF_1(X)}{\mu_1(C)}\right]\mu_1(\bar{C})$$

$$+\left[\int_C \ g_0(X)\frac{dF_0(X)}{\mu_0(C)} - \int_{\bar{C}} \ g_0(X)\frac{dF_0(X)}{\mu_0(\bar{C})}\right]\mu_0(\bar{C})$$

which is expressed by following Ñopo's (2008) as

$$\Delta = \Delta_0 + \Delta_X + \Delta_w + \Delta_{w/o}$$

The first two terms are associated with the differences between the subgroups of disability and non-disability groups which share the observable characteristics, or in other words, the subgroups of individuals successfully matched with counterparts. The first term, Δ_0, is the difference in poverty conditions between persons with and without disabilities whose distributions of observable characteristics are that of persons with disabilities, which corresponds to $\overline{X_1}(\widehat{\beta_1} - \widehat{\beta_0})$ in the Blinder-Oaxaca decomposition. The second term, Δ_X, is the part of the gap deriving from the difference in the distribution of characteristics between persons with and without disabilities over the common support, which corresponds to $(\overline{X_1} - \overline{X_0})\widehat{\beta_0}$ in the Blinder-Oaxaca decomposition. The other two terms are added by Ñopo (2008) to the Blinder-Oaxaca decomposition, taking into account the difference in characteristics between matched and unmatched individuals within each group. The third term, Δ_w, is related to the influences of the characteristics specific to persons with disabilities that those without disabilities do not have, and the forth term, $\Delta_{w/o}$, is related to the influences of the characteristics specific to those without disabilities that those with disabilities do not possess. According to Ñopo (2008), the Blinder-Oaxaca decomposition is still appropriate if it restricts

the comparison of two groups in the common support. Otherwise, it overestimates Δ_0 due to implicitly assuming that the outcome function estimated based on the observed characteristics of a group is also valid at the out-of-support of the group.

Each term is estimated with the weighted averages of poverty conditions and the share of persons with and without disabilities out of the common support, without specifying the functional form of conditional poverty conditions, $g_1(X)$ and $g_0(X)$, which is another advantage of the matching-based decomposition. Specifically, Δ_0 is estimated by taking the difference of the weighted average of poverty conditions between persons with and without disabilities, evaluated at all combinations of covariates of persons with disabilities. Suppose that the number of covariates under consideration is *L* and that there are *K* combinations of values a person can take $(x_1, \dots, x_k, \dots, x_K)$, where x_k is an $1 \times L$ vector.[6] Define N_{1k} and N_{0k} as the number of persons with and without disabilities who take the *k*-th combination of covariates, x_k, and let $\delta_k = 1[N_{1k} > 0,\ N_{0k} > 0]$, which indicates whether or not the *k*-th combination of covariates is located in the common support. Lastly, define $\overline{Y_1^k}$ and $\overline{Y_0^k}$ as the average poverty conditions of persons with and without disabilities who take x_k. Then, Δ_0 can be estimated as follows:

$$\widehat{\Delta_0} = \frac{\sum_k \delta_k N_{1k} \left(\overline{Y_1^k} - \overline{Y_0^k}\right)}{\sum_k \delta_k N_{1k}}$$

where $\delta_k N_{1k}$ means the number of persons with disabilities in the common support who take x_k, and serves as weight when calculating the weighted average. Then, developing the term in the numerator as

$$\widehat{\Delta_0} = \frac{\sum_k \delta_k \left\{\sum_{i \in \{i|X_i = x_k\}} Y_{1i} - N_{1k}\overline{Y_0^k}\right\}}{\sum_k \delta_k N_{1k}}$$

[6] The notation in this part is based on Angrist (1998) which specified the model of exact covariate matching as explained below.

the term in parenthesis in the numerator can be further divided into N_{1k} terms which take the difference between the poverty conditions of a person with disabilities with $X_i = x_k$ and $\overline{Y_0^k}$. Therefore, each person with disabilities is compared with the average of multiple persons without disabilities who have exactly the same observable characteristics as him/herself, which is called one-to-many matching and is the reason why the method is termed matching-based decomposition. Similarly, the other three terms can be also estimated as the difference of weighted averages of poverty conditions. The standard error of the estimation of each part is computed using the bootstrap method based on 100 replicates.

While Ñopo (2008) conducted exact covariate matching to classify which individuals from two groups are located in or out of the common support, he did not relate his method with the estimation of average treatment effects. I show below that Ñopo's Δ_0 and the average treatment effect on the treated are actually the same, using the model of exact covariate matching introduced by Angrist (1998). First of all, two potential poverty conditions, Y_1 and Y_0, are defined as those when a person has an impairment and when a person does not, respectively. The actually observed poverty for each person is $Y = Y_1W_1 + Y_0W_0$, where W_1 and W_0 denote the disability and non-disability groups as defined above. Under this definition, the difference in average values of poverty conditions between persons with and without disabilities is

$$\begin{aligned} E[Y|W_1] - E[Y|W_0] &= E[Y_1|W_1] - E[Y_0|W_0] \\ &= E[Y_1 - Y_0|W_1] + \{E[Y_0|W_1] - E[Y_0|W_0]\} \end{aligned}$$

The first term is called the average treatment effect on the treated (hereafter, ATT), and one of the estimators of interest in the literature. The second term is called the selection bias, meaning the difference in the potential conditions between two groups. Under the assumption that people randomly acquire a disability, this term is equal to zero and ATT can be estimated by simply taking the difference between the average of poverty conditions for the two groups. However, such assumption seems to not be the case as discussed and confirmed by the descriptive analysis in the previous sections. For the estimation of ATT, exact covariate

matching depends on the conditional independence assumption of Rosenbaum and Rubin (1983) that disability status is independent of potential poverty conditions conditional on observable characteristics, which can be expressed as $(Y_1, Y_0) \perp\!\!\!\perp (W_1, W_0)|X$, where X is a vector of pre-determined covariates. Iterating $E[Y_1 - Y_0|W_1]$ over X yields

$$\Delta_{ATT} = E[Y_1 - Y_0|W_1] = E\{E[Y_1 - Y_0|W_1, X]|W_1\}$$
$$= E\{E[Y_1|W_1, X] - E[Y_0|W_1, X]|W_1\}$$

Since the second term is equal to $E[Y_0|X, W_0]$ under the conditional independence assumption,

$$\Delta_{ATT} = E\{E[Y_1|W_1, X] - E[Y_0|W_0, X]|W_1\}$$
$$= \int \{E[Y_1|W_1, X] - E[Y_0|W_0, X]\} dF_1^*(X)$$

where $dF_1^*(X)$ is the conditional cumulative distribution function of persons with disabilities over the common support. It should be noted that the final equation supposes that we can find persons without disabilities for all values of covariates of those with disabilities. To ensure this, the impact evaluation literature imposes an additional assumption, called the common support or overlap assumption, which is expressed either as $0 < \Pr(W_1|X) < 1$ or the weaker $\Pr(W_1|X) < 1$. Lastly, by the definition above, ATT can be re-expressed as

$$\Delta_{ATT} = \int_C [g_1(X) - g_0(X)]\, dF_1^*(X)$$

which is identical to Δ_0 in the matching-based decomposition model.

4.2 Procedure of exact covariate matching

Matching of persons with and without disabilities was conducted based on different sets of covariates for children and adults. I chose from the dataset the covariates for matching that are predetermined and fundamental characteristics, and considered to be associated with poverty. Children with disabilities were matched with those without disabilities who have the exact same

characteristics in respect to 10 variables: age, gender, race, main language in the household, municipality of residence, type of residence area, municipality of residence in 2001, province of birth place, education level of parents, and absence of father in the household. Similarly, adults with disabilities were matched with those without disabilities sharing the exact same characteristics in respect to nine variables: age, gender, race, main language in the household, municipality of residence, type of residence area, municipality of residence in 2001, province of birth place, and position in a household (a household head or not). As for the main language, there are 13 choices in the dataset including Zulu, Xhosa, Afrikaans, and so on. The municipalities in the dataset consist of eight metropolitan municipalities and 226 local municipalities, and each municipality can be further divided into three types of areas (urban, rural formal and/or tribal areas). The purpose of including the variables of municipality of residence in 2001 (the year of the previous census) and province of birth place is to control for the experience of domestic migration in the recent and distant past. I assumed that children born after 2001 had lived in 2001 in the same municipality as they did in 2011. The reason for using province level but not municipality level for birth place is only because the information on municipality of birth was excluded from the public dataset due to the privacy policy. The absence of a father in the household is used for matching because it has been discussed as one of the issues facing families in South Africa and is considered to have a negative economic and emotional influence on children (Richter, Chikovore, and Makusha 2010; Richter and Morrell 2006). In fact, about 70% of children aged 6-14 in the original 10% sample of the 2011 census do not have fathers within the same household, either because fathers live apart or have died. The education level of parents is divided into seven levels: no schooling, dropped out at primary school, completed primary school, dropped out at secondary school, completed secondary school, higher than secondary school, and other education. Since mothers play a primary role as a care-giver of children, especially in South Africa due to the frequent absence of fathers, and their education level is considered important for the wellbeing of children in the literature, I used

the education level of mothers for matching first, and used that of fathers if the information for a mother was not available. If both information for a father and a mother is missing. I used that of the household head.

As illustrated in the previous sub-section, one-to-many matching is conducted. When finding more than two counterparts who have the same characteristics as a person with disabilities to be matched, the average value of those counterparts was compared with that of the person with disabilities. As a result, 82.26% of children and 82.28% of adults with disabilities were successfully matched with those without disabilities. These matching rates seem to be adequately high by virtue of the large-scale data, taking into consideration that the matching rate between males and females based on four covariates was at most 60% in the application example of Ñopo (2008). In the following section, the gap in poverty between persons with and without disabilities is examined after matching, i.e., using only the sample in the common support. The sample in the out-of common support is used in the decomposition analysis to comprehensively investigate the observed gap between persons with and without disabilities.

4.3 Multidimensional poverty measures

In order to broadly compare the poverty conditions of persons with and without disabilities, this paper adopts the multidimensional poverty measures developed by Alkire and Foster (2011). Their method of estimation for multidimensional poverty has been utilized for the calculation of the Multidimensional Poverty Index (MPI) in the Human Development Report of United Nations Development Programme since 2010 (Alkire and Santos 2014). Although the dimensions and individual poverty indicators in this paper are not identical to those of MPI due to the limited availability of variables in the dataset, I follow the procedure summarized by Alkire and Foster (2011) to calculate the measures.

Their procedure begins with the choice of dimensions, the set of indicators in each dimension, the deprivation cutoff for each indicator to judge whether or not a person is deprived

in that indicator, and the relative weight for each indicator to compute the weighted average of deprivation in individual indicators, called the deprivation score. I prepared 10 indicators in three dimensions for children aged 6-14 and 11 indicators in four dimensions for adults aged 15-64, as shown in Table 3. These dimensions and indicators were selected based on the examples of Alkire and Santos (2014), Mitra et al. (2013) and Trani et al. (2015) and the availability of information in the dataset. Among others, I adopted labor market participation as an indicator for employment instead of unemployment used in the previous studies. Since South Africa has been long confronting high unemployment rate, persons with disabilities might be more likely to give up working even at the phase of searching for a job. While the disability grant program in South Africa may reduce the motivation of persons with disabilities to participate in the labor market, this indicator can be used to capture the deprivation in social participation. However, a person is defined as not deprived in this indicator if health reasons such as heavy impairments or pregnancy are the cause of no longer looking for a job, or if there are other reasons such as the respondent being a student, trainee, housewife, retiree, and so on. As for income, the census survey asked in intervals about each income of household members from all sources including disability grants. Following Statistics South Africa (2011), I allocated a specific value to each income range and computed household income per capita. I adopted the usage of internet as the indicator of access to information because the role of information and the problem of the digital divide seem to be increasingly important for poverty issues in developing countries, particularly in middle-income countries such as South Africa where the infrastructure for information and communication technology is being developed. The deprivation cutoff for each indication was determined based on the previous studies constructing the MPI in South Africa (Finn, Leibbrandt, and Woolard 2013; Oxford Poverty and Human Development Initiative 2011; Rogan 2016). The weight for each indicator was set in the same way as Alkire and Santos (2014) and Mitra et al. (2013) in which equal weight is given to each dimension, e.g.,

one third in the case of children, and then the weight is equally divided into each indicator, e.g., one sixth for the indicators of assets and monthly household income per capita for children.

Using the condition of deprivation in the *j*-th indicator for the *i*-th person (c_{ij}), and the relative weight for each indicator (w_j), the deprivation score for the *i*-th person is calculated as $c_i = \sum_{j=1}^{d} w_j c_{ij}$, where d is the number of indicators. Then, a person is determined to be multidimensionally poor if his/her derivation score exceeds the poverty cutoff, k:

$$q_i = \begin{cases} 1 & \text{if } c_i \geq k \\ 0 & \text{if } c_i < k \end{cases}$$

I fixed k at 0.4 in common with Mitra et al. (2013) and Trani et al. (2015). Thus, the first main measure of multidimensional poverty, the headcount ratio of the multidimensionally poor, can be introduced as $H = \sum q_i / N$. The second measure of multidimensional poverty is the average deprivation share calculated as $A = \sum q_i \, c_i / \sum q_i$, which corresponds to the average value of the deprivation score among the multidimensionally poor. While the headcount ratio is said to reflect the incidence or breadth of multidimensional poverty, the average deprivation share focuses on the intensity or depth of multidimensional poverty. The last but most important measure of multidimensional poverty, the adjusted headcount ratio, considers both aspects of multidimensional poverty, and is calculated as $M_0 = H \times A = \sum q_i \, c_i / N$.

5. Empirical results

5.1 Results of exact covariate matching

Table 4 compares the multidimensional poverty measures of persons with and without disabilities before and after exact covariate matching by age group. Before matching, all multidimensional poverty measures are higher in the disability group than in the non-disability group for all age categories (the third columns), and the gap between the two groups remains even after equalizing persons with and without disabilities in terms of other factors by matching (the sixth columns). The paired t-tests were conducted for the mean of difference in each

multidimensional poverty measure between disability and non-disability groups after matching. As a result, the gaps in all measures were statistically significant at the 1% level for all age categories. Since this seems to be mainly attributable to the statistical power enhanced by the large sample size, this section does not put much emphasis on the statistical significance of the gap reported in Table 4 and other tables. As compared to the headcount ratio, the gap in the average deprivation share is smaller even before matching, so it does not change much after matching, implying that the deprivation experienced by the poor is not affected by disability status and other controlled factors in the case of South Africa. The relatively smaller gap in average deprivation share between disability and non-disability groups was detected also in the case of Tunisia (Trani et al. 2015), and Mitra et al. (2013) found that the number of countries with a significant gap in the average deprivation share is smaller than those with a significant gap in the headcount ratio. Consequently, the gap in adjusted headcount ratio is mostly caused by the gap in headcount ratio. In other words, disability aggravates the conditions of multidimensional poverty in breadth rather than depth.

The adjusted headcount ratio after matching is the highest for the oldest group and the lowest for the youngest group among disability and non-disability groups (the fourth and fifth columns), whereas the gap between these groups is larger for the 25-39 and 40-54 age groups, i.e., the core working-age groups, and almost the same for the youngest and oldest groups (the sixth column). The relative size of the gap in adjusted headcount ratio is the largest for the 25-39 age group (0.070/0.144=48.8%), followed by the youngest group (0.042/0.105=40.0%), and is the lowest for the oldest group (0.045/0.325=13.7%).

Examining the headcount ratio before and after matching, the ratio of the disability group increases slightly after matching for all age groups (the first versus forth columns), and that of the non-disability group also increases, but relatively more sharply (the second versus fifth columns), which leads to the narrowed gap after matching (the third versus sixth columns). This is also true of the gap in the adjusted headcount ratio because the gap in the average

deprivation share does not change with matching. The fact that the headcount ratio of matched persons without disabilities is higher than the original ratio implies that those without disabilities sharing the observable characteristics of those with disabilities are more likely to be multidimensionally poor, and thus indicates a reverse causality from poverty to disability, i.e., that the poor are more likely to receive an impairment. Therefore, the narrowed gap after matching suggests that the matching method is controlling, at least partially, for this reversed causality.

In order to investigate the differences in the influences of disability more closely, Table 5 compared persons with and without disabilities after matching in each age group by indicator for the multidimensional poverty measures. For children with disabilities, as expected, the gap in the deprivation in school attendance is the largest among the indicators. The ratio of children with disabilities not attending school is more than twice as high as that of those without disabilities (the first versus second columns). The gaps in the other indicators of the household level are not large in comparison to school attendance, but the positive gaps consistently exist in all indicators (the third column). The covariates for parental characteristics used for the matching in this paper might not be able to completely remove the influences of household income on having children with disabilities. However, the gaps in household level indicators seem to imply that children with disabilities might experience household-level influences as a result of increased medical expenditures and decreased time for parents to work due to the care for them.

For adults with disabilities, the gaps in the indicators of the individual level—years of schooling and labor market status—are larger than in those of the household level in common with children. The ratio of the deprivation in years of schooling is lower in the younger age group, e.g., 16.2% for the 15-24 age disability group and 51.1% for the 55-64 age disability group, which demonstrates the long-run improvement of education levels of people in South Africa. On the other hand, the gap between disability and non-disability groups is larger in the

younger age group, e.g., 11.7 percentage points for the 15-24 age group and 5.2 percentage points for the 55-64 age group. This might indicate the emergence of children with disabilities left behind the trend. Here, it should be noted that current disability status might have less influence on education level, particularly among the elderly, because some persons with disabilities might have received impairments after graduating from school. Since the ratio of such persons is considered to be higher in the older age group, the gap in years of schooling between disability and non-disability groups is more greatly underestimated for the older age groups. As for labor market status, the gap is larger for the 25-39 and 40-54 age groups as compared to other younger and older age groups. The gap is the largest for the 40-54 age group in all indicators of the household level except for access to water, followed by the 25-39 age group, showing the larger influences of disability at the core working-age groups. These results are the reason for the larger gap in the adjusted headcount ratio for the 25-39 and 40-54 age groups found above. Although South Africa has the disability grant program, the findings of this paper suggest that the current system might not work well enough that the living conditions for persons with disabilities are guaranteed to be at the same level of those without disabilities.

5.2 Disaggregated analysis of the adjusted headcount ratio

Table 6 compares the adjusted headcount ratio by the subgroups of type and severity of disability. As for the type of disability, the gap in the adjusted headcount ratio is larger for persons with severe difficulties in communication, remembering, and multiple difficulties for all age groups. These results are similar to the findings of existing studies that persons with intellectual and multiple disabilities are more disadvantaged. The gap is also large for those in the 6-14 and 15-24 age groups with walking difficulties, and for those in the 25-39 and 40-54 age groups with self-care difficulties. Though not reported in this paper, the reason why difficulties in walking matter for multidimensional poverty of children is because they are strongly related to the deprivation in school attendance. The ratio of children not attending school is the highest, at

41.1%, for those with severe difficulties in walking, and the gap from those without disabilities is also the largest for this group, at 34.9 percentage points. This result indicates inaccessible transportation systems and insufficient reasonable accommodations in school facilities in South Africa. As for the severity of disabilities, both the gap and the ratio level itself are larger for persons with severe difficulties than those with moderate ones in most subgroups of age and type of disability. This can be more clearly detected for the younger group, e.g., this holds for all five types of disability for the 6-14 age group, and all types of disability except for self-care for the 15-24 age group. In contrast, the gap is larger for those with moderate difficulties in hearing, communication, and walking for the 40-54 age group and in communication and walking for the 55-64 age group. These results suggest that older persons with disabilities can cope with the severe difficulties better than younger persons.

Table 7 compares the adjusted headcount ratio by the subgroups of gender, race, and type of residence area. Regarding the gender difference in the gap, it is slightly larger for females in the 6-14 age group, whereas it is larger for males in the groups aged 15 and older. The former result is in line with Trani et al. (2013) and Trani and Cannings (2013) who report worse multidimensional poverty for girls with disabilities, and the latter is similar to Mitra et al. (2013) who show that the difference in adjusted head count ratio is larger for males with disabilities than females with disabilities in most of analyzed countries. It is also notable that the adjusted headcount ratio of females with disabilities is higher than males with disabilities in the 40-54 and 55-64 age groups (the tenth and thirteenth columns), and that this is also true of females and males without disabilities (the eleventh and fourteenth columns). These indicate that older women have been so far facing gender discrimination in South Africa. As a result, females with disabilities are the most multidimensionally deprived among the four groups divided by disability and gender status in these two age groups.

As for the racial difference, the gap is larger for Africans and Coloureds in all age groups, and the ratio itself of these two racial groups is much higher within the disability group. As

expected, even Africans and Coloureds without disabilities are more multidimensionally deprived (see the columns of non-disability groups in each age group), and disability additionally expands the gap in poverty conditions among the racial groups. The influences of past racial segregation in South Africa remain so large that Africans and Coloureds without disabilities are more multidimensionally deprived than Indians and Whites with disabilities. Furthermore, note that the gap between disability and non-disability groups is not statistically significant for Indian and White children, or White adults in the 40 or above aged groups (the third, twelfth, and fifteenth columns). Regarding the difference by type of residence area, the gap is higher in rural formal and tribal areas than urban areas for all age groups except the 55-64 age group, and the ratio itself of persons with disabilities is much higher in these areas for all age groups. In common with racial difference, the influences of residence area are so large that residents without disabilities in rural formal and tribal areas are more multidimensionally deprived than those with disabilities in urban area. Thus, the disadvantages stemming from racial discrimination and regional inequality still remain large in South Africa and lead to worse multidimensional poverty when interacting with disability.

Figure 2 shows the average adjusted headcount ratio of persons with disabilities and the gap in the average between persons with and without disabilities at the municipality level. Municipalities are categorized into the quintiles of the average of adjusted headcount ratio and the gap in the average. As depicted in panel (a), the municipalities with the higher adjusted headcount ratio concentrate in the area in the south coast of South Africa, the boundary between the Eastern Cape and KwaZulu-Natal provinces. On the other hand, as presented in panel (b), the municipalities with larger gaps are dispersed throughout the whole country with the gap being relatively higher in the Northern Cape and North West provinces in the center of the country, and the Mpumalanga province in the east. Thus, the poverty conditions of persons with disabilities and the gap between those without disabilities geographically differs. Since major observable factors are controlled for by matching within each municipality, this difference indicates the

existence of regional difference in physical or attitudinal barriers against persons with disabilities.

5.3 Results of Ñopo decomposition

Table 8 shows the results of Ñopo decomposition of the gap in adjusted headcount ratio between persons with and without disabilities. For the 6-14 and 15-24 age groups, about 73-76% of the observed gap is attributable to disability status, and 25-32% to the characteristics specific to persons without disabilities. Similarly, the part explained by disability status is large for the 25-39 age group at about 71%, though that by observable characteristics is also significant at about 28%. In contrast, the part explained by disability status is lower for the two oldest groups than the younger groups, whereas the contribution of other parts resulting from observable characteristics is larger. This difference in the influences of disability status by age group might be due to the following three reasons. Firstly, as a person is more likely to acquire an impairment at an older age as presented by Figure 1, a larger part of the living conditions of an older person could be determined before acquiring impairments by other characteristics such as gender, race, and place of residence. On the other hand, as younger persons with disabilities are not subject to other disadvantages for long periods of time, those influences are considered to be not as strong as the influence of disability for them. The second possible reason is associated with the causality from poverty to disability. Aforementioned, the disadvantaged are more likely to acquire impairments, and it is reasonable to assume that this tendency becomes stronger as a person ages due to the interaction with aging and the accumulation of experiences of social exclusion and discrimination. In fact, we observed in Table 2 that females, Africans, and residents in the tribal area are more represented in the older disability group. Thus, it could be said that the causality from poverty to disability is stronger for older groups than for younger groups. Lastly, the composition of type of disability differs by age group. As shown by Tables 1 and 6, the ratio of persons with moderate difficulties in seeing, walking, and remembering is

higher in older group, and these influences are found to be smaller. Consequently, the influences of disability are estimated as smaller for older groups, resulting in the lower significance of disability for the whole gap in poverty.

It is also notable that the gaps deriving from the difference in characteristics between matched and unmatched persons are consistently negative for persons with disabilities, and positive for those without disabilities. This tendency did not change even if the ratio of successful matching improved through relaxing the conditions of matching from the exact value of age to age categories such as 6-14, 15-19, 20-24, …, 60-64. By the definition of each term, this tendency means that matched persons are more multidimensionally deprived than unmatched ones. The fact that persons with and without disabilities in the common support are more deprived indicates that the variables used for matching and their combinations correctly reflected the poverty conditions in the context of South Africa. It can be also said that persons without disabilities who are dissimilar to those with disabilities are less deprived, implying that such non-disabled persons have the favorable characteristics. Interestingly, this is true of persons with disabilities: those dissimilar to persons without disabilities might be endowed with the advantageous personal and environmental characteristics. By comparing matched and unmatched persons, I detected that, irrespective of disability status and age group, the matching rate is lower in the urban and rural formal areas than the tribal area. As mentioned above, the residents in the tribal area are predominantly Africans. The other two areas are relatively more diversified in the population and so in these areas there seem to be persons with and without disabilities who are less deprived due to their advantageous characteristics.

6. Conclusions

Disability and poverty are complicatedly entangled with each other. In this paper, the matching and matching-based decomposition analyses were conducted to provide a more accurate

assessment of the gap in multidimensional poverty between persons with and without disabilities in South Africa. Through exact covariate matching, the gap in the headcount ratio between persons with and without disabilities is found to be larger than in the average deprivation share, showing that disability has larger influences on the breadth of poverty. Controlling for other factors, this analysis highlights the higher prevalence of persons with disabilities among the poor, which suggest the causality from poverty to disability. As for the gap by indicators, persons with disabilities are found to be more deprived in the individual-level indicators such as education and employment, and the deprivation in the household-level indicators are found to be larger for the core working-age (25-54) group of persons with disabilities. According to the subgroup analysis, persons with disabilities who are more largely affected by disability are those with difficulties in intellectual functionings and multiple difficulties, males aged 15 or older, Africans, Coloureds, and residents in rural formal or tribal areas. For Africans, Coloureds, and residents in rural formal or tribal areas, not only the gap, but also the level of multidimensional poverty itself is much higher than for other groups. This implies the disadvantages increased through interactions of disability with racial and regional difference, i.e., the existence of multiple discrimination. The matching-based decomposition analysis revealed that a large portion of the gap in poverty among younger groups can be explained by disability, whereas the gap among older groups can be explained by both disability and other observable factors. This difference by age groups seems to reflect the differences in experiences of gender and racial discrimination and regional disadvantages. Thus, it is reasonable to consider that poverty conditions previously existing before acquiring impairments have a larger influence on the lives of older people in South Africa.

It might be possible to draw several policy implications from the findings of this paper. Firstly, a comprehensive approach is necessary for improving the wellbeing of persons with disabilities, rather than just a disability-specific approach. The finding that persons with disabilities are more multidimensionally deprived than those without disabilities who have

almost similar characteristics highlights social barriers against persons with disabilities, suggesting the necessity of social policies. In addition, taking into account the results that persons with disabilities are even more deprived among Africans and Coloureds and residents in rural formal or tribal areas, the government should advance the mainstreaming of disability in existing policies promoting equity among racial groups and regions. Secondly, the disadvantages deriving from disability could differ within persons with disabilities by the type of difficulties, making it essential to pay more attention to who is more affected by disability, e.g., those with difficulties in intellectual functionings and multiple difficulties in South Africa, when building policies and legislation and providing social services. This paper also found that disabilities account for a large part of the gap in poverty between persons with and without disabilities for younger groups, which suggest that public policies to support youth with disabilities in education and employment could reduce the gap. Lastly, the possibility indicated by the analysis that the poor are more likely to have impairments seems to require not only coping with already existing disability, but promoting early detection and treatment of health problems among the poor through improving their access to medical and social security services.

Although this paper closely examined the poverty of persons with disabilities using novel empirical methods and large-scale data, there are several issues left behind for future research due to the limitation of the methods and data. Firstly, in order to evaluate the causal impact of disability by controlling for unobservable factors, we need other econometric methods such as the instrumental variable method utilizing the naturally occurring situation where a historical event or a natural or institutional condition is strongly associated with the likelihood of having impairments, but not directly associated with the poverty conditions. Secondly, since this paper depends on cross-sectional data, and since information about the timing and cause of having impairments is not available in the data, it is impossible to explore the dynamics of poverty of persons with disabilities and the coping strategies they and their family might have adopted including public social security services. Finally, the limited number of variables in the

data from the population census narrowed the coverage of the analysis of this paper with regard to type of disability and poverty indicator. For example, the South African census used in this paper does not have a specific question about mental health. Similarly, this paper could not investigate the poverty of persons with disabilities from the psychological perspective such as subjective well-being, hope, and self-esteem. Since mental conditions and subjective preference seem to be an important factor in decision-making across lifespans, examining these aspects would contribute to deepening our understanding of disability and poverty.

References

Albert, Jose Ramon, Soya Mori, Celia Reyes, Aubrey D. Tabuga, and Tatsufumi Yamagata. 2015. “Income Disparity among Persons with Disabilities, Assessed by Education and Sex: Accentuated Gender Difference Found in Metro Manila, the Philippines.” *Developing Economies* 53 (4): 289-302.

Alkire, Sabina, and James Foster. 2011. “Counting and Multidimensional Poverty Measurement.” *Journal of Public Economics* 95 (7–8): 476-87.

Alkire, Sabina, and Maria E. Santos. 2014. “Measuring Acute Poverty in the Developing World: Robustness and Scope of the Multidimensional Poverty Index.” *World Development* 59: 251–74.

Angrist, Joshua D. 1998. “Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants.” *Econometrica* 66 (2): 249-88.

Baldwin, Marjorie L. and Chung Choe. 2014. “Re-examining the Models Used to Estimate Disability-related Wage Discrimination.” *Applied Economics* 46 (12): 1393-408.

Banks, Lena Morgon, Rachel Mearkle, Islay Mactaggart, Matthew Walsham, Hannah Kuper, and Karl Blanchet. Forthcoming. “Disability and Social Protection Programmes in Low- and Middle-income Countries: A Systematic Review.” *Oxford Development Studies*.

Barnes, Colin, Geoffrey Mercer, and Tom Shakespeare. 1999. *Exploring Disability: A Sociological Introduction*. Cambridge: Polity Press.

Burchardt, Tania. 2004. “Capabilities and Disability: the Capabilities Framework and the Social Model of Disability.” *Disability and Society* 19 (7): 735–51.

DSD, DWCPD and UNICEF. 2012. *Children with Disabilities in South Africa: A Situation Analysis: 2001-2011*, Pretoria: Department of Social Development/Department of Women, Children and People with Disabilities/UNICEF.

Dube, Andrew K.. 2005. “The Role and Effectiveness of Disability Legislation in South Africa.” Research conducted for Disability Knowledge and Research, London: Department For International Development.

Elwan, Ann. 1999. “Poverty and Disability: A Survey of the Literature.” Social Protection Discussion Paper 9932. Washington, DC : World Bank.

Filmer, Deon. 2008. “Disability, Poverty and Schooling in Developing Countries: Results from 14 Household Surveys.” *World Bank Economic Review* 22 (1): 141–63.

Finn, Arden, Murray Leibbrandt, and Ingrid Woolard. 2013. “What Happened to Multidimensional Poverty in South Africa between 1993 and 2010?.” A Southern Africa Labour and Development Research Unit Working Paper Number 99. Cape Town: SALDRU, University of Cape Town.

Gooding, Kate, and Anna Marriot. 2009. “Including Persons with Disabilities in Social Cash Transfer Programmes in Developing Countries.” *Journal of International Development* 21: 685-98.

Government of South Africa. 2015. First Periodic Country Report to the United Nations on the Implementation of the Convention on the Rights of Persons with Disabilities in South Africa: Draft, http://www.gov.za/sites/www.gov.za/files/38802_gen445.pdf, Accessed July 31, 2016.

Graham, Lauren, Jacqueline Moodley, Zenobia Ismail, Edson Munsaka, Eleanor Ross, and Marguerite Schneider. 2014. *Poverty and disability in South Africa: Research report 2014*. Johannesburg: Centre for Social Development in Africa, University of Johannesburg.

Graham, Lauren, and Eleanor Ross. 2016. “Disparities in Quality of Life Among South Africans With and Without Disabilities.” *Social Indicators Research* 127 (2): 721-39.

Groce, Nora, Maria Kett, Raymond Lang, and Jean-Francois Trani. 2011. “Disability and Poverty: The Need for a More Nuanced Understanding of Implications for Development Policy and Practice.” *Third World Quarterly* 32 (8): 1493-513.

Fortin, Nicole, Thomas Lemieux, and Sergio Firpo. 2011. “Decomposition Methods in Economics.” In *Handbook of Labor Economics, Volumune 4, Part A*, edited by Orley Ashenfelter and David Card, 1-102. Amsterdam: North-Holland.

Howell, Colleen, Schuaib Chalklen, and Thomas Alberts. 2006. “A History of the Disability Rights Movement in South Africa,” In *Disability and social change: A South African agenda*, edited by Brian Watermeyer, Leslie Swartz, Theresa Lorenzo, Marguerite Schneider, and Mark Priestley, 46-84. Cape Town: Human Sciences Research Council Press.

Human Rights Watch. 2015. *Complicit in Exclusion: South Africa’s Failure to Guarantee an Inclusive Education for Children with Disabilities*. New York: Human Rights Watch.

Longhi, Simonetta, Cheti Nicoletti, and Lucinda Platt. 2012. “Interpreting Wage Gaps of Disabled Men: The Roles of Productivity and of Discrimination.” *Southern Economic Journal* 78 (3): 931–53.

Loeb, Mitchell E., Arne H. Eide, Jennifer Jelsma, Mzolisi ka Toni, and Soraya Maart. 2008. “Poverty and Disability in Eastern and Western Cape Provinces, South Africa.” *Disability and Society* 23 (4): 311-21.

Lamichhane, Kamal, and Yoshito Kawakatsu. 2015. “Disability and Determinants of Schooling: A Case from Bangladesh.” *International Journal of Educational Development* 40: 98-105.

Maart, Soraya, Arne H. Eide, Jennifer Jelsma, Mitchell E. Loeb, and Mzolisi Ka Toni. 2007. “Environmental Barriers Experienced by Urban and Rural Disabled People in South Africa.” *Disability and Society* 22 (4): 357–69.

Menon, Nidhiya, Susan L. Parish, and Roderick A. Rose. 2014. “The ‘State’ of Persons with Disabilities in India.” *Journal of Human Development and Capabilities* 15 (4): 391-412.

Miller, Kristen, Daniel Mont, Aaron Maitland, Barbara Altman, and Jennifer Madans. 2010. “Results of a Cross-national Structured Cognitive Interviewing Protocol to Test Measures of Disability.” *Quality and Quantity* 45 (4): 801-15.

Mitra, Sophie. 2006. “The Capability Approach and Disability.” *Journal of Disability Policy Studies* 16 (4): 236–47.

Mitra, Sophie, Aleksandra Posarac, and Brandon Vick. 2013. “Disability and Poverty in Developing Countries: A Multidimensional Study.” *World Development* 41 (1): 1-18.

Mitra, Sophie, and Usha Sambamoorthi. 2008. “Disability and the Rural Labor Market in India: Evidence for Males in Tamil Nadu.” *World Development* 36 (5): 934-52.

Mizunoya, Suguru, and Sophie Mitra. 2013. “Is There a Disability Gap in Employment Rates in Developing Countries?.” *World Development* 42 (1): 28-43.

Mont, Daniel, and Nguyen Viet Cuong. 2011. “Disability and Poverty in Vietnam.” *World Bank Economic Review* 25 (2): 323-59.

Moodley, Jacqueline, and Lauren Graham. 2015. “The Importance of Intersectionality in Disability and Gender Studies.” *Agenda: Empowering women for gender equity* 29 (2): 24-33.

Moodley, Jacqueline, and Eleanor Ross. 2015. “Inequities in Health Outcomes and Access to Health care in South Africa: A Comparison between Persons with and without Disabilities.” *Disability and Society* 30 (4): 630-44.

Ñopo, Hugo. 2008. “Matching as a Tool to Decompose Wage Gaps.” *Review of Economics and Statistics* 90 (2): 290–99.

Oliver, Michael. 1996. *Understanding disability: From theory to practice.* Basingstoke, Hampshire, UK: Palgrave Macmillan.

Oxford Poverty and Human Development Initiative. 2011. *Country briefing: South Africa: Multidimensional Poverty Index (MPI) at a glance*. Oxford: Oxford Department of International Development.

Palmer, Michael. 2011. “Disability and Poverty: A Conceptual Review.” *Journal of Disability Policy Studies* 21(4): 210-18.

Richter, Linda, Jeremiah Chikovore, and Tawanda Makusha. 2010. “The Status of Fatherhood and Fathering in South Africa.” *Childhood Education* 86 (6): 360–65.

Richter, Linda, and Robert Morrell. 2006. *Baba: Men and fatherhood in South Africa*. Cape Town: Human Sciences Research Council Press.
Rischewski, Dorothea, Hannah Kuper, Oluwarantimi Atijosan, Victoria Simms, Mireia Jofret-Bonet, Allen Foster, and Christopher Lavy. 2008. "Poverty and musculoskeletal impairment in Rwanda." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 102 (6): 608-17.
Rogan, Michael. 2016. "Gender and Multidimensional Poverty in South Africa: Applying the Global Multidimensional Poverty Index (MPI)." *Social Indicators Research* 126 (3): 987–1006.
Rosenbaum, Paul, and Donald Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70 (1): 41–55.
Sen, Amartya. 1999. *Development as freedom*. New York: Knopf.
Schneider, Marguerite. 2009. "The Difference a Word Makes: Responding to Questions on 'disability' and 'difficulty' in South Africa." *Disability and Rehabilitation* 31(1): 42-50.
Schneider, Marguerite, Princelle Dasappa, Neloufar Khan, and Azam Khan. 2009. "Measuring Disability in Censuses: The Case of South Africa." *Alter-European Journal of Disability Research* 3 (3): 245-65.
Statistics South Africa. 2011. *Census 2011 Metadata*. Pretoria: Statistics South Africa.
———. 2014. *Census 2011: Profile of persons with disabilities in South Africa*. Pretoria: Statistics South Africa.
———. 2015a. "South African Census 2011, 10% Sample (Version 1.2)." *DataFirst*. https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/485, Accessed July 31, 2016.
———. 2015b. *Methodological report on rebasing of national poverty lines and development on pilot provincial poverty lines: Technical report*. Pretoria: Statistics South Africa.
Takasaki, Yoshito. 2016. "Disability and Poverty: Evidence from Landmine Amputees in Cambodia." Paper presented at the 2nd Hitotsubashi Summer Institute, Tokyo, August 1-6, 2016.
Trani, Jean-Francois, Parul Bakhshi, Nicolò Bellanca, Mario Biggeri, and Francesca Marchetta. 2011. "Disabilities through the Capability Approach Lens: Implications for Public Policies." *ALTER European Journal of Disability Research* 5 (3): 143–57.
Trani, Jean-Francois, Parul Bakhshi, Sarah Myer Tlapek, Dominique Lopez, and Fiona Gall. 2015. "Disability and Poverty in Morocco and Tunisia: A Multidimensional Approach." *Journal of Human Development and Capabilities* 16 (4): 518-48.
Trani, Jean-Francois, Mario Biggeri, and Vincenzo Mauro. 2013. "The Multidimensionality of Child Poverty: Evidence from Afghanistan." *Social Indicators Research* 112 (2): 391-416.
Trani, Jean-Francois, and Tim I. Cannings. 2013. "Child Poverty in an Emergency and Conflict Context: A Multidimensional Profile and an Identification of the Poorest Children in Western Darfur." *World Development* 48: 48-70.
Trani, Jean-Francois, and Mitchell Loeb. 2012. "Poverty and Disability: A Vicious Circle? Evidence from Afghanistan and Zambia." *Journal of International Development* 24: S19-S52.
WHO and World Bank. 2011. *World Report on Disability*. Washington, DC : World Health Organization.
Yeo, Rebecca, and Karen Moore. 2003. "Including Disabled People in Poverty Reduction Work: 'Nothing About Us, Without Us'." *World Development* 31 (3): 571-90.

Table 1. Share of persons with disabilities by type and severity of difficulty in each age group

	Age				
	6-14	15-24	25-39	40-54	55-64
	(1)	(2)	(3)	(4)	(5)
Those with difficulties in (%)					
Seeing: moderate	21.2	30.7	36.0	50.2	51.0
severe	5.4	6.0	5.5	3.4	3.5
Hearing: moderate	13.2	12.2	12.4	10.9	12.5
severe	5.8	6.3	5.2	2.5	1.9
Communication: moderate	15.0	9.9	7.3	4.3	3.3
severe	11.9	8.1	5.7	2.3	1.7
Walking: moderate	6.3	8.1	13.2	18.1	22.8
severe	8.9	7.9	6.9	4.4	4.6
Remembering: moderate	30.2	16.5	15.8	17.7	20.8
severe	14.2	7.6	5.1	2.6	2.2
Self-care: moderate		9.7	7.6	5.8	6.0
severe		13.2	7.8	4.1	4.2
Multiple functionings	20.6	20.6	17.6	18.5	23.8

Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: Reported are the shares of persons with each difficulty within each age group.

Table 2: Characteristics of persons with and without disabilities in gender, race, and residence area in each age group

	Age: 6-14		Age: 15-24		Age: 25-39		Age: 40-54		Age: 55-64	
	PWD	Non-PWD	PWD	Non-PWD	PWD	Non-PWD	PWD	Non-PWD	PWD	Non-PWD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Gender (%)										
Male	53.1	50.5	50.0	49.8	47.7	49.2	40.3	47.2	40.0	46.1
Female	46.9	49.5	50.0	50.2	52.3	50.8	59.7	52.8	60.0	53.9
Race (%)										
African	90.5	84.0	87.4	84.5	85.3	80.9	82.9	71.8	81.4	65.3
Coloured	5.7	8.9	7.0	8.3	7.3	8.6	9.6	11.5	9.4	10.4
Indian	1.2	1.8	1.7	2.0	2.3	2.7	2.2	3.4	2.4	3.9
White	2.6	5.3	3.8	5.2	5.1	7.8	5.2	13.3	6.8	20.4
Residence area (%)										
Urban area	47.0	54.4	54.9	59.0	62.9	70.8	61.3	70.4	57.4	65.6
Rural formal area	3.4	3.5	3.5	3.6	4.1	4.1	4.5	4.2	4.4	4.1
Tribal area	49.5	42.1	41.7	37.4	33.0	25.1	34.2	25.4	38.3	30.3

Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported are the shares of persons with each characteristic within disability and non-disability groups by age group.

Table 3. Dimensions, indicators, deprivation cutoffs, and weight for multidimensional poverty measures

Dimension	Indicator	Deprivation cutoff	Weight for aged 6-14/aged >14
Education	School attendance: if aged 6-14	Not attended school	$\frac{1}{3}$ / -
	Years of schooling: if aged >14	Not completed 5 years of education	- / $\frac{1}{4}$
Employment	Labor market status: if aged >14	Not employed AND not "unemployed"[a]	- / $\frac{1}{4}$
Economic well-being	Assets	Own zero or only one of the "small assets" AND does not own a motorcar[b]	$\frac{1}{6}$ / $\frac{1}{8}$
	Household income	Monthly household income per capita is lower than 501 Rand[c]	$\frac{1}{6}$ / $\frac{1}{8}$
Living standard	Type of dwelling	Informal or traditional dwelling	$\frac{1}{21}$ / $\frac{1}{28}$
	Access to water	No access to piped water	$\frac{1}{21}$ / $\frac{1}{28}$
	Type of toilet	Not flush, chemical, pit, nor bucket latrine	$\frac{1}{21}$ / $\frac{1}{28}$
	Cooking fuel	Neither electricity, gas, nor paraffin	$\frac{1}{21}$ / $\frac{1}{28}$
	Heating fuel	Neither electricity, gas, nor paraffin	$\frac{1}{21}$ / $\frac{1}{28}$
	Type of lighting	Not electricity	$\frac{1}{21}$ / $\frac{1}{28}$
	Access to information	No access to internet	$\frac{1}{21}$ / $\frac{1}{28}$

Source: Author.

Note: a: A person is defined as "unemployed" if s/he is not employed, but searches for a job and is prepared to start to work if a job is offered. A person is defined as not deprived in this indicator if the reason for not searching for a job is health reasons, student, trainee, housewife, or being too old or young, or retirement. b: "Small assets" include refrigerator, electric/gas stove, vacuum cleaner, washing machine, computer, television, satellite television, DVD player, radio, telephone, cell phone. c: This criteria depends on the lower bound of national poverty line in 2011 (Statistics South Africa, 2015b).

Table 4. Comparison in multidimensional poverty measures between persons with and without disabilities before and after matching

	Before			After		
	PWD	Non-PWD	Gap Δ	Matched PWD	Matched non-PWD	Gap Δ_{ATT}
	(1)	(2)	(3)	(4)	(5)	(6)
Headcount ratio						
Age 6-14	0.258	0.164	0.094	0.264	0.198	0.066
15-24	0.482	0.378	0.105	0.497	0.425	0.072
25-39	0.364	0.208	0.157	0.375	0.268	0.107
40-54	0.461	0.264	0.197	0.471	0.375	0.096
55-64	0.586	0.395	0.191	0.604	0.534	0.070
Average deprivation share						
Age 6-14	0.559	0.529	0.030	0.559	0.533	0.026
15-24	0.542	0.501	0.041	0.542	0.503	0.039
25-39	0.569	0.525	0.044	0.571	0.522	0.050
40-54	0.594	0.566	0.028	0.597	0.570	0.028
55-64	0.611	0.599	0.012	0.613	0.605	0.008
Adjusted headcount ratio						
Age 6-14	0.144	0.087	0.058	0.147	0.105	0.042
15-24	0.261	0.189	0.072	0.269	0.215	0.055
25-39	0.207	0.109	0.098	0.214	0.144	0.070
40-54	0.274	0.149	0.125	0.281	0.219	0.062
55-64	0.358	0.237	0.121	0.370	0.325	0.045

Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported in the columns (1) and (2) are the values of each measure for disability and non-disability groups by five age groups, and those in the columns (3) are the difference in the values in the columns (1) and (2). Reported in the columns (4) and (5) are the values of each measure for matched persons with and without disabilities by five age groups, and those in the columns (6) are the difference in the values in the columns (4) and (5). All of the gaps Δ and Δ_{ATT} before and after matching were statistically significant at 1% level.

Table 5. Deprivation of matched persons with and without disabilities by indicator

	Age: 6-14			Age: 15-24			Age: 25-39			Age: 40-54			Age: 55-64		
	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Deprived in (%)															
School attendance	13.9	5.5	8.4												
Years of schooling				16.2	4.5	11.7	21.4	9.9	11.4	36.9	28.7	8.2	51.1	45.9	5.2
Labor market status				68.7	64.8	3.9	43.4	32.7	10.7	49.1	38.2	10.9	69.9	61.6	8.4
Assets	11.4	10.5	0.9	9.9	8.8	1.1	11.0	8.3	2.6	11.8	8.8	3.1	11.2	9.2	2.0
Household income	71.5	70.2	1.3	63.7	63.4	0.3^{ns}	53.9	51.9	2.0	55.2	52.3	2.9	50.3	50.7	-0.4^{ns}
Type of dwelling	27.8	26.5	1.3	25.3	24.3	1.1	26.3	24.0	2.3	25.2	22.2	3.0	23.8	22.4	1.3
Access to water	18.1	16.9	1.1	15.4	13.9	1.5	11.5	10.7	0.8	12.0	11.1	0.9	13.0	12.4	0.5
Type of toilet	11.8	10.5	1.3	10.2	8.6	1.6	9.1	7.7	1.4	9.4	7.5	1.8	9.2	7.6	1.5
Cooking fuel	32.0	29.8	2.2	25.4	23.1	2.3	19.6	16.6	3.0	20.9	17.8	3.1	23.3	21.2	2.0
Heating fuel	48.2	44.1	4.0	41.9	38.1	3.9	38.2	32.2	5.9	39.5	32.4	7.1	41.3	34.9	6.4
Type of lighting	20.2	19.1	1.1	17.6	16.2	1.4	17.4	14.9	2.5	17.1	14.7	2.4	16.0	14.3	1.7
Access to information	75.4	72.6	2.8	69.4	66.6	2.8	70.4	65.9	4.5	74.7	67.8	6.9	77.0	70.8	6.2

Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported in columns of each age group are the shares of matched persons with and without disabilities who are deprived in each indicator, and the differences in the shares between them. All of the gaps were statistically significant at 5% level except for the gap marked with "ns."

Table 6. Disaggregated analysis of adjusted headcount ratio of persons with and without disabilities by type and severity of difficulty

	Age: 6-14			Age: 15-24			Age: 25-39			Age: 40-54			Age: 55-64		
	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Seeing: moderate	.087	.079	.007[ns]	.198	.189	.009[ns]	.135	.122	.013	.230	.206	.024	.328	.307	.021
severe	.209	.146	.063	.305	.249	.056	.206	.152	.054	.283	.225	.059	.422	.323	.099
Hearing: moderate	.160	.123	.037	.292	.228	.064	.248	.155	.093	.325	.224	.101	.426	.338	.088
severe	.235	.143	.092	.335	.255	.080	.228	.163	.065	.318	.233	.086	.455	.342	.112
Communication: moderate	.192	.119	.072	.348	.222	.126	.363	.170	.193	.392	.236	.156	.452	.344	.108
severe	.235	.117	.118	.393	.232	.160	.345	.165	.180	.389	.244	.144	.429	.338	.091
Walking: moderate	.199	.112	.087	.292	.221	.071	.247	.155	.092	.328	.219	.109	.384	.323	.061
severe	.264	.112	.153	.347	.225	.122	.264	.149	.115	.308	.210	.098	.377	.318	.058
Remembering: moderate	.149	.103	.046	.343	.226	.117	.331	.180	.152	.394	.278	.116	.458	.386	.072
severe	.212	.106	.106	.383	.230	.153	.342	.164	.178	.385	.241	.144	.478	.349	.129
Self-care: moderate				.346	.237	.110	.318	.174	.144	.382	.240	.142	.447	.360	.087
severe				.329	.223	.106	.343	.163	.180	.384	.223	.161	.459	.353	.106
Multiple difficulties	.239	.119	.121	.381	.234	.148	.353	.174	.179	.380	.248	.132	.429	.354	.076

Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported in columns of each age group are the adjusted headcount ratios of matched persons with each difficulty and those without disabilities, and the differences in the ratios between them. All of the gaps were statistically significant at 1% level except for the gap marked with "ns."

Table 7. Disaggregated analysis of adjusted headcount ratio of persons with and without disabilities by gender, race, and residence area

	Age: 6-14			Age: 15-24			Age: 25-39			Age: 40-54			Age: 55-64		
	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap	PWD	Non-PWD	Gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Male	.145	.105	.040	.278	.215	.063	.218	.134	.084	.262	.182	.081	.345	.286	.059
Female	.151	.106	.045	.261	.213	.049	.211	.156	.056	.294	.243	.051	.386	.348	.038
African	.156	.111	.044	.289	.232	.057	.230	.160	.070	.309	.244	.065	.409	.362	.047
Coloured	.070	.043	.027	.155	.100	.055	.166	.072	.094	.187	.118	.069	.247	.183	.064
Indian	.030	.022	.009[ns]	.075	.036	.039	.066	.028	.038	.073	.044	.029	.125	.090	.035
White	.012	.017	-.004[ns]	.064	.020	.044	.035	.015	.020	.021	.015	.006[ns]	.023	.023	.0001[ns]
Urban area	.081	.049	.032	.169	.124	.045	.135	.077	.057	.184	.123	.061	.253	.197	.056
Rural formal area	.322	.244	.078	.359	.298	.061	.321	.231	.090	.413	.323	.090	.495	.465	.030[ns]
Tribal area	.197	.147	.049	.389	.320	.069	.350	.260	.089	.434	.370	.063	.521	.487	.034

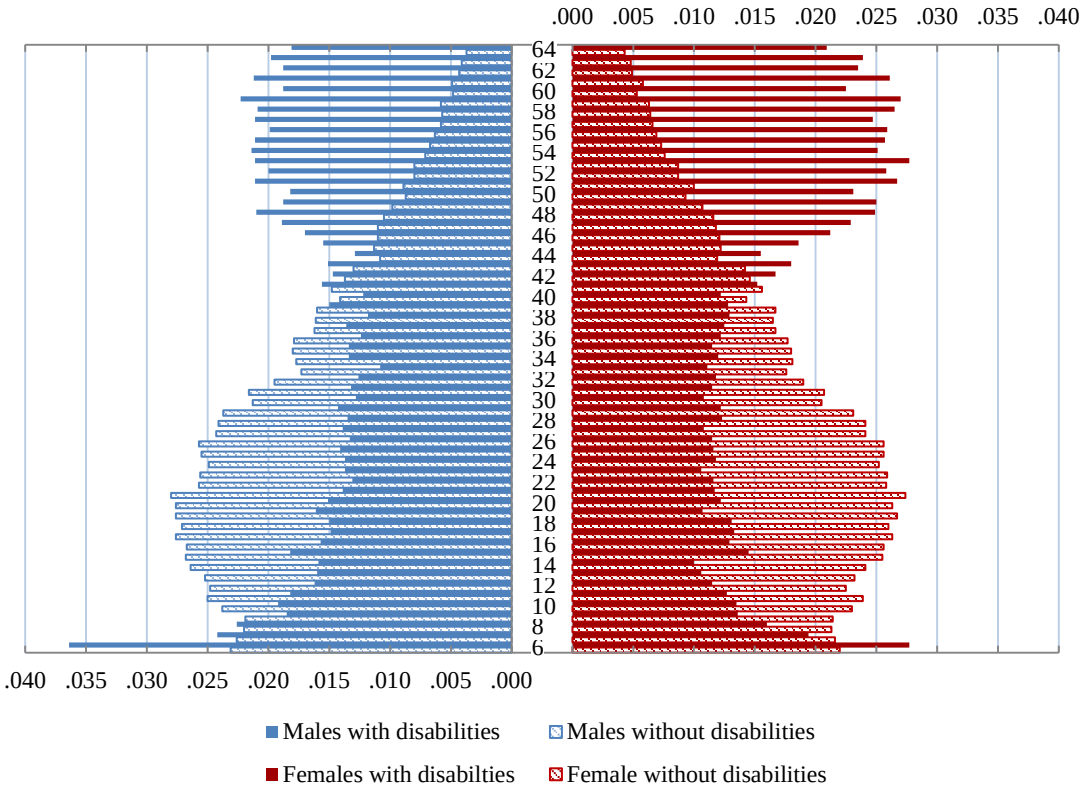
Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported in columns of each age group are the adjusted headcount ratios of matched persons with and without disabilities disaggregated by each characteristic, and the differences in the ratios between them. All of the gaps were statistically significant at 1% level except for the gap marked with "ns."

Table 8. Decomposition of the gap in adjusted headcount ratio between persons with and without disabilities

	Age: 6-14		Age: 15-24		Age: 25-39		Age: 40-54		Age: 55-64	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Total gap: Δ	.058		.072		.098		.125		.121	
$\Delta_0 = \Delta_{ATT}$	.042	73.2%	.055	75.9%	.070	71.4%	.062	50.1%	.045	36.9%
	(.002)		(.003)		(.003)		(.002)		(.003)	
Δ_X	.001	1.1%	.003	3.6%	.027	27.6%	.050	40.2%	.046	38.0%
	(.001)		(.001)		(.001)		(.001)		(.001)	
Δ_w	-.003	-5.5%	-.008	-11.5%	-.007	-7.1%	-.007	-5.9%	-.012	-10.1%
	(.001)		(.001)		(.001)		(.001)		(.001)	
$\Delta_{w/o}$	.018	31.1%	.023	31.9%	.008	8.0%	.019	15.5%	.043	35.3%
	(.0004)		(.0003)		(.0003)		(.0004)		(.001)	
Ratio of matched PWD	82.3%		88.2%		83.3%		81.8%		78.6%	
Ratio of matched non-PWD	31.1%		54.1%		40.9%		47.0%		51.1%	

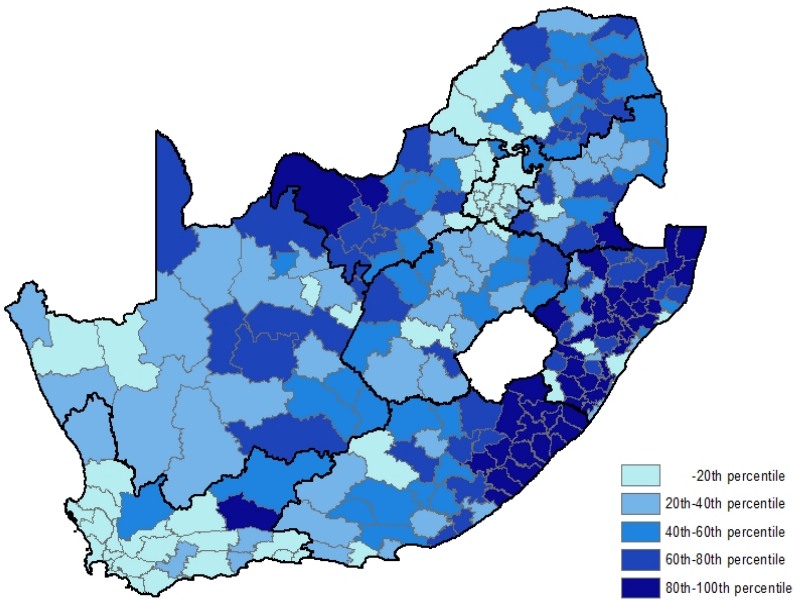
Source: Author's calculations using the 10% sample data of South African census in 2011.
Note: "PWD" stands for persons with disabilities. Reported in the odd-numbered columns are the total gaps in adjusted headcount ratio between persons with and without disabilities, the estimates of each decomposed part, and those in parentheses are standard errors estimated by the bootstrap method with 100 replicates. Reported in the even-numbered columns are the percentages of each decomposed part.

Figure 1. Age distribution of persons with and without disabilities by gender

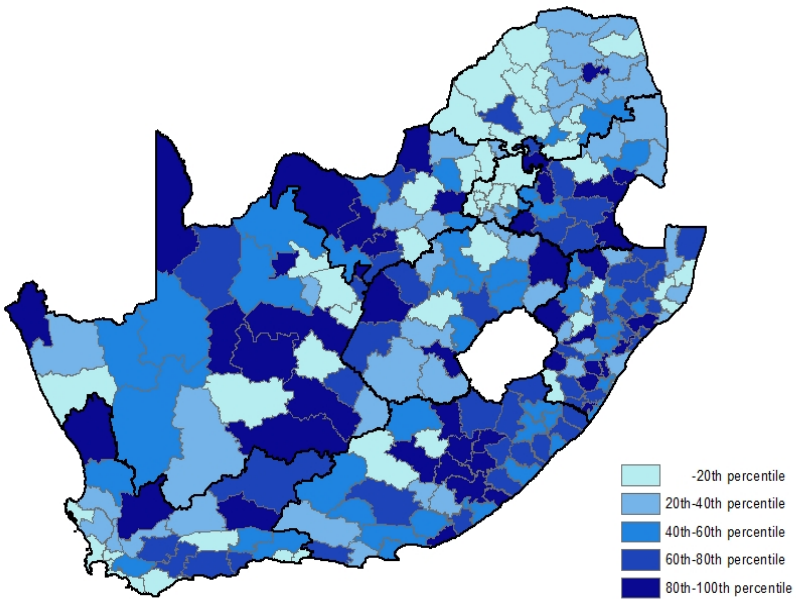


Source: Prepared by author using the 10% sample data of South African census in 2011.

Figure 2. Adjusted headcount ratio and its gap by municipalities



(a) Adjusted headcount ratio of persons with disabilities



(b) Gap in adjusted headcount ratio between persons with and without disabilities

Source: Prepared by author using the 10% sample data of South African census in 2011. The shapefile of the boundaries of municipalities was downloaded from http://www.demarcation.org.za/index.php/downloads/boundary-data/boundary-data-main-files/local-munics.

Abstract (in Japanese)

要約

障害と貧困は密接かつ複雑に関係していると考えられ、また障害自体複雑な概念であることから、障害と貧困の関係を解明することは容易ではない。本研究は、マッチング法と南アフリカの大規模家計データを用いて、障害者と非障害者の多元的貧困状態を比較し、その差をより精緻に推定することを目的としている。また、matching-based decomposition methodと呼ばれる手法により、両者の貧困状態の差を障害によって説明できる部分とそれ以外の要因で説明できる部分に分解した。その結果、障害以外の観測可能な要因をコントロールしたうえでも、障害者は非障害者に比べて、多元的貧困という観点でより不利な状況に置かれていることが確認された。両者の貧困状態の差は、知的障害や複数の障害を持っている人、成年男性、黒人、カラード、農村地域住民のグループでより顕著であった。また、両者の貧困状態の差は、年齢が低い層では主に障害によってその大部分を説明できるのに対して、年齢が高い層では障害だけでなく他の要因によっても説明されることが分かり、複合差別の存在が示唆される結果となった。