博士論文

Disability, Poverty, and Employment in Developing Countries: An Econometric Analysis Using Household Survey Data in South Africa

（途上国における障害と貧困および雇用：南アフリカの世帯調査データを用いた計量分析）

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Chapter 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. 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. 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. 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 (Yamagata 2015; Menon, Parish, and Rose 2014; Takasaki 2016), education (Lamichhane and Kawakatsu 2015; Mizunoya, Mitra and Yamasaki 2016a), employment (Lamichhane 2015; Mitra and Sambamoorthi 2008; Mizunoya and Mitra 2013; Mizunoya, Yamasaki, and Mitra 2016b;

Rischewski et al. 2008), 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, though most of them did no more than simply compare persons with and without disabilities or examine the correlation between disability and each indicator.

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." 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, it is not straightforward to estimate the genuine impact of disability on poverty indictors without relevant econometric methods. In addition, disability itself is a complex concept. There has been no clear consensus on the definition of disability among researchers, aid practitioners, and persons with disabilities for long time. Although the internationally comparable question for disabilities survey, developed by by the United Nations

Washington Group on Disability Statistics, has been being adopted in national household surveys of many developed and developing countries (Altman and Rasch 2016), the problem about measurement of impairments still remains and can be a source of the bias in the estimation of the impact of disability.

The existing empirical studies on disability and poverty are considered to have not completely dealt with these analytical challenges about causal inference between disability and poverty and measurement error of impairments. The objective of this Ph.D. dissertation is to more accurately estimate the influences of disability on poverty and employment using the methods of applied micro-econometrics. This dissertation consists of two econometric analyses: matching and decomposition analyses on disability and multidimensional poverty and the pseudo-panel approach to the impacts of disability on employment. South Africa is selected as the subject country of this dissertation because the government has been paying higher attention to disability as compared to other developing countries, and I can obtain the data of nationally representative surveys that meet the requirement for each econometric analysis.

The first analyses compare multidimensional poverty conditions of persons with and without disabilities after controlling for other observable factors by exact covariate matching and decompose the gap between the two groups into the parts attributed to disability status and other

factors. By utilizing the large-scale data in these analyses, it became possible to compare persons with and without disabilities by subgroups such as age, gender, race, and the type of residence area. The second analyses estimate the impact of disability on employment with the pseudo-panel method that combine the cross-section surveys from 2002 to 2015. I also examine whether the impact of disability on employment was mitigated during these periods by several policies and measures of South African government. Through these analyses, I attempt to fill in the research gap in the literature on disability and contribute to the disability policies in South Africa by deriving possible policy implications from the findings.

This dissertation is structured as follows: Chapter 2 explains the background of this dissertation including the definition of disability and the conceptual framework of disability and poverty, and the context of disability in South Africa about the the disability-related laws and legislations and the poverty and employment conditions of persons with disabilities. Chapter 3 conducts the matching and decomposition analyses on multidimensional poverty of persons with disabilities. Chapter 4 examines the impact of disability on employment during 2002-2015. Chapter 5 summarizes the findings of this dissertation and concludes with the possible implications for policies and future research.

Chapter 2. Backgrounds

2.1. Definition of disability and conceptual framework of disability and poverty

Disability and poverty are conceptually close to each other. Similar to the issue of poverty, disability is considered to be “complex, dynamic, multidimensional, and contested” (WHO and World Bank, 2011: 3). As poverty does not simply mean the low level of income or consumption today, disability no longer simply means the loss of body structure or limitation of body function, i.e., impairment, since the social model of disability prevailed. The social model of disability argues that disability does not belong to only persons with impairments, but to 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 in 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. The social model of disability has its origin in a statement in 1976 by Union of the Physically Impaired Against Segregation, a disability rights organization in the United Kingdom. Afterwards, it affected the International Classification of Functioning, Disability and Health, established by the World Health Organization in 2001. The Preamble (e) of the Convention on the Rights of Persons with

Disabilities states that “disability results from the interaction between persons with impairments and attitudinal and environmental barriers.”

As another approach for the definition, disability is conceptualized from the perspective of the capability approach which has an affinity 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.

This dissertation adopts the definition by the social model of disability and the capability approach in that impairment is one of the personal characteristics and disability is social construct confronting persons with impairments. More specifically, the datasets used by the subsequent econometric analyses specify persons with difficulties in basic activities basically by the short set of questions of the Washington Group on Disability Statistics, a City Group under the United Nations Statistical Commission. This Group follows the social model of disability and aims at assessing the conditions of equalization of opportunities for persons with impairments in a country or community (Altman and Rasch 2016). For this purpose, the Group focused on the development of measures for the functional limitations in basic activities that can be used for the evaluation of equalization of opportunities by combining with other questions on social participation. As a result of several pilot surveys in multiple countries and discussion by experts, the Group has developed internationally comparable disability measures for six basic functionings such as seeing, hearing, and so on. However, the datasets used in this dissertation rely on self-report by respondents to the Washington Group questions so that the problem of measurement errors, i.e., the errors in counting as persons with impairments (inclusion errors) and not counting as them (exclusion errors), may emerge. Chapter 4 of this dissertation deals with this problem in more details.

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 face social barriers in the form of environmental, institutional and attitudinal discrimination and are excluded from education system, labor market, community activities, basic health care, and access to limited resource such as food and clean water. Their income generating opportunities are restricted due to low skills and poor health, and 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 at unsafe workplaces and live under unhygienic conditions with malnutrition and poor health, which 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 is more likely to receive impairments in their lives and be forced to face disabilities. The latter direction of causality matters when evaluating rigorously the impact of disability on poverty because persons with disabilities might be already poorer than those without disabilities even before receiving impairments.

2.2. Empirical studies on disability and poverty in developing countries

Responding to the recent increase in the demand for the evidence on disability and poverty in developing countries, some papers have been quantitatively analyzing the influences of disability on several outcomes in some countries or areas. Table 2-1 summarizes the main empirical studies on the influences of disability in developing countries and categorizes them by the examined outcome. Basically, all of the papers in Table 2-1 found the significantly negative effects of disability on each outcome.

First of all, regarding the methodologies, most of existing studies did no more than simply compare persons with and without disabilities or examine the correlation between disability and each indicator with conventional regression models. Thus, it seems to be highly possible that their finding might be biased due to the two-way causality between disability and poverty and the measurement error of impairments as discussed in the previous section. As one of the exceptions, Menon et al. (2014) coped with the endogeneity problem of disability by using an instrumental variable Wald estimator for the regression of disability status on the average monthly per capita expenditure at the district level in India. As another approach, 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 in order to control for factors that can affect both of disability and

poverty. They conducted a case-control random survey in which they firstly sampled persons with disabilities and then found and interviewed those without disabilities who are the same years old, the same gender, and live in the same area as the sampled person with disabilities. Similarly, Takasaki (2016) considered landmine amputations caused by exogenous shock in Cambodia and evaluated the causal impacts of amputations on poverty and employment by carefully selecting amputees due to landmine accidents and matching them with non-disabled adults within the village based on age, gender, education, and location of residence.

Some of the papers examine the effects of disability by subgroup, depending on each data composition and backgrounds of analyzed countries. The columns (3)-(7) of Table 2-1 report the subgroups that are found to be more deprived among persons with disabilities in each paper, and "n.s." means that the paper did not find significant difference in the effects of disability by the subgroup. The blank cell indicates that the paper did not examine the difference by the factor in the influences of disability. 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. Only a few studies performed the analyses by severity of disability and found significant association of severe disability with schooling and child poverty, and Trani et al. (2015) found that persons with moderate difficulties are poorer in terms of multiple poverty indicators than

those with severe difficulties. Similarly, the effects of disability by age were examined by a few studies, and the division by age seems to be so rough that it is difficult to derive insightful implications from the results. As for the gender difference, the results are mixed: girls and women are found to be more disadvantaged in some studies, whereas others found that men were more disadvantaged. As for the regional difference, almost all studies found that persons with disabilities in the rural area face more disadvantages in compared to the urban area. 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 hundreds at most. Even if dividing this into subgroups, the number of observations of each subgroup is too small to carry out the reliable analysis. This might explain in part the mixed results about gender difference and the scarcity of analyses by severity of disability and age.

The similarity among the papers in Table 2.1 is that all of them are based on the cross-section survey data. With a cross-section survey data, we can understand the relationship as of a specific time between disability and several poverty indicator in a country or a study site, but cannot know whether the relationship is in the process of being strengthened or weakened. Understanding the dynamics of the poverty of persons with disabilities itself must be insightful as

Groce et al. (2011) argued, but more important is assessing whether or not their poverty conditions are improved over time because many countries are making large efforts to diminish their disadvantages. While there are some studies on disability using the panel data in developed countries, e.g., those on disability and employment reviewed by Jones (2008), few studies are available in developing countries mostly due to the scarcity of the panel data including the disability question.

2.3. Context of disability in South Africa

2.3.1. Laws and legislations for disability

South African government has been addressing disability issues since the Apartheid, though their main schemes used to be the provision of social grant and rehabilitation and habilitation services without sufficient consideration of social inclusion of persons with disabilities (Government of South Africa 2016). Since 1980s, the social movement for the rights of persons with disabilities has been increasingly active together with the movement against the Apartheid regime (Howell, Chalklen, and Alberts 2006). Section 9 of the Constitution adopted after democratization explicitly prohibits the discrimination based on disability status as well as on race and gender, and the Promotion of Equality and Prevention of Unfair Discrimination Act was legislated in 2000 to

validate this clause. Among others, the White Paper on an Integrated National Disability Strategy published in 1997 follows the concept of social model of disability and advocates “an integration of disability issues in all government development strategies, planning and programmes” (Office of the Deputy President 1997). In 2007, South African government ratified the United Nations Convention on the Rights of Persons with Disabilities and internationally manifested their commitment to the protection and realization of rights of persons with disabilities. Additionally, the latest national plan of South Africa, the National Development Plan 2030 launched in 2012, emphasizes the efforts to guarantee the access of persons with disabilities to quality education and employment, in particular, skill development programs and equal opportunities for employment (National Planning Commission 2012, p.42).

Regarding employment of persons with disabilities, in 1995, South Africa government set the target that persons with disabilities should account for 2% of the total number of the public service personnel (Department of Public Service and Administration 1995). Similarly, the Expanded Public Works Programme, which provides the unemployed with the opportunities of temporary work in the infrastructure, non-state, environment, culture, or social sectors, aims to allocate 2% of the total work opportunities to those with disabilities. In terms of the legislation, the Employment Equity Act established in 1998 refers to Africans, women, and persons with

disabilities as "designated groups," prohibits unfair discrimination against these groups, and obligates employers to take affirmative action measures such as elimination of employment barriers and provision of reasonable accommodation for these groups. The purpose of this Act is clarified in Section 2 as "to achieve equity in the workplace" or "to ensure their [designated groups'] equitable representation in all occupational categories and levels in the workforce," which means to reach a state of employment in which the share of workers from the designated groups in the workplace reflects that of the whole population of South Africa. "Designated employers," defined in the Act as those who employs 50 or more people or have annual turnover above the prescribed criteria, and those in the public sector, have duties to prepare and carry out a plan to attain the employment equity in each workplace and submit a report about the employees' profile, movement, and skills development at several occupational levels every year.[1] Additionally, to support employers in hiring persons with disabilities, Department of Labour issued "Code of Good Practice on Key Aspects on the Employment of People with Disabilities" in 2002 and "Technical Assistance Guidelines on the Employment of People with Disabilities" in 2007.

Among others, the program strongly related to the poverty and employment of persons with disabilities in South Africa is the disability grant program. South Africa has the social security

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

system such as child support grant, care dependency grant, foster child grant, war veteran grant and old-age grant. To receive the disability grant and grant-in-aid, persons with disabilities must meet the requirements such as age cutoffs of 18 to 59 years old, being unemployed for a period of six or more months, earning and value of assets being less than a prescribed value depending on marital status, and taking a medical examination about the body or mental conditions.[2] The maximum amount of the disability grant is 1,600 South African Rands per month (about 120 US Dollars) as of June 2017, which is the same as care dependency grant, war veteran grant and old-age grant. 0 to 17 years aged children with disabilities and 60 years or above aged with disabilities receive the care dependency grant and the old-age grant, respectively.

However, the disability policies in South Africa has been exposed to criticism about the implementation from the public, and the effectiveness on the lives of persons with disabilities has been questioned (Dube, 2005). For example, Human Rights Watch (2015) reported the discriminatory decisions by schools about the enrollment of children with disabilities, the lack of accommodation for school facilities, and low-quality teaching to children with disabilities. Gooding and Marriot (2009) demonstrated the problems in the disability grant program in South Africa such as complex and unaccountable systems leading to misunderstanding of the criteria, incorrect

[2] The details of the requirements and procedures are available from the following website: http://www.gov.za/services/social-benefits/disability-grant (accessed on May 22, 2017).

payment, and delay of procedure, and physical inaccessibility to receive the grant. In the systematic review of Banks et al. (2017) on disability-related social protection programs in low- and middle-income countries, 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.

The original deadline of the 2% target for employment of persons with disabilities in the public service was by 2005, but was eventually postponed to March 2013. According to the first periodic country report to the CRPD drafted in 2015, the share of employees with disabilities in the public service is 0.39% in 2012/13, and only 20 national and provincial departments out of 153 reached the target (Government of South Africa 2015). The report also shows that the Expanded Public Works Programme could create 17,854 work opportunities for persons with disabilities between April 2009 and June 2013, but it amounts to only 0.44% of the total. Moreover, the annual report summarizing the employment equity conditions based on the reports of employers reveals that the share of employees with disabilities is 1.1% in the private sector in 2014/15 (Commission for Employment Equity 2015). Since the prevalence rate of persons with disabilities in South Africa is around 3-10% in 2015 as shown below, it can be said that they are underrepresented in the workplace of the private sector. According to this report, the upward trend can be observed for the

share of employees with disabilities in several occupational levels from 2010 to 2014, but the slope of trend is quite gentle.

2.3.2. Empirical studies on persons with disabilities 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 the descriptive, qualitative, or brief quantitative analysis, and thus the aforementioned analytical challenges, two-way causality between disability and poverty and the subgroup analysis, have not been tackled yet in the study in South Africa. In particular, as the influence of racial discrimination in the past seem to still remain prominent 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.

The gap in employment status between persons with and without disabilities in South Africa has so far been confirmed by the existing studies using a different dataset. Graham et al. (2014) found from the first wave of the National Income Dynamics Study in 2008 that the employment rate is lower for persons with disabilities than those without disabilities (39% versus 46%) and the rate of being economically inactive is higher for those with disabilities (47% versus 34%). According to the population census in 2011, while there is no large difference in employment status between persons with and without disabilities when using the disability status index, the employment rate is evidently lower for person with severe difficulties than those without difficulties when comparing both by disability type (Statistics South Africa 2014). The gap in the employment rate between persons with and without disabilities in South Africa is remarkably large in comparison to other countries. WHO and World Bank (2011) reported that the employment ratio, defined as the employment rate of persons with disabilities divided by the employment rate of overall population, was the lowest in South Africa (0.30≈12.4%/41.1%) among selected countries including developed and developing countries. Mizunoya and Mitra (2013) also computed the employment ratio for 15 developing countries countries using the World Health Survey data in

2003. As a result, the employment ratio of all countries exceeded 0.4. Although we need to interpret these findings with caution on the difference in the data, the definition of disability, and the year of survey by country, it seems to be true that there exists a large gap in the employment status between persons with and without disabilities in South Africa.

2.4. Research questions of dissertation

The objective of this dissertation is to deepen our understanding about disability and derive policy implications from the findings of the analyses by providing more robust estimates on the effects of disability on poverty and employment that consider endogeneity issue in estimation. In this chapter, I reviewed the theoretical and empirical literature on disability and the background of South Africa about disability, poverty and employment, through which I clarified the research gap that this dissertation could fill in. Specifically, Chapter 3 attempts to answer the following research questions on disability and poverty:

Q3-1. How much are the effects of disability on multidimensional poverty and its indicators remaining after equalizing persons with and without disabilities in other factors?

Q3-2. What is the difference in the effects of disability on multidimensional poverty by type

and severity of functional limitations, age, gender, race, and type of residence area?

Q3-3. How much do disability and other observable factors explain the gap in multidimensional poverty between persons with and without disabilities?

Chapter 4 deals with the following research questions on disability and employment:

Q4-1. How much are the effects of disability on employment outcomes after coping with endogeneity of disability?

Q4-2. What is the difference in the effects of disability on employment outcomes by gender and race?

Q4-3. Are the effects of disability on employment outcomes mitigated during 2002-2015?

Chapter 3. Untangling Disability and Poverty: A Matching Approach Using Large-scale Data in South Africa

3.1. Introduction

Disability and poverty are interconnected with each other, and the entangled relationship and the complexity of disability itself have hampered our understanding of poverty of persons with disabilities as discussed in the previous chapter. In order to clarify the relationship between disability and poverty, it is necessary to conduct the more detailed quantitative analysis as stated by Groce et al. (2011) cited above. This chapter aims to more closely examine the relationship between disability and poverty by using econometric methods not ever adopted in the literature and a much larger-scale household survey data than that of the existing studies. This chapter focuses on multidimensional poverty measures as the target outcome affected by disability, taking into account the broad scope of the impacts of disability on daily lives of people.

First of all, this chapter precisely estimates the gap in multidimensional poverty conditions between persons with and without disabilities. Aforementioned, since it is highly possible that the poorer people is more likely to be born with impairments or acquire them afterwards, simple comparison between persons with and without disabilities overestimates the genuine 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 chapter employs one of the methods of impact evaluation, exact covariate matching, which compares a person with disabilities to those without disabilities who have the exactly same observable characteristics as the person with disabilities. As reviewed in Chapter 2, Rischewski et al. (2008), Trani et al. (2015), and Trani and Loeb (2012) sampled the pairs of persons with and without disabilities who shared the characteristics of age, gender, and location of residence in their own case-control random survey. Takasaki (2016) examined the impacts of landmine amputations on poverty and employment in Cambodia with the nearest neighbor matching based on age, gender, education, and location of residence. While the former group of Rischewski et al. (2008) and others pre-controlled for other factors when determining the sample of their surveys, this chapter controls for them after the data was collected as well as Takasaki (2016).

However, it should be noted that the results of exact covariate matching cannot be always interpreted as the causality because matching based on observable characteristics is not able to completely control for unobservable ones. By taking advantage of the large-scale data, this chapter controls for observable characteristics as much as possible to minimize the selection bias, but the influences of unobservable factors might be unignorable. Therefore, this chapter estimates the effects of disability on multidimensional poverty after more strictly controlling for other observable

factors in compared to most of the existing studies, rather than the causal impacts of disability on poverty.

Secondly, this chapter explores the difference in the effects of disability on multidimensional poverty by type and severity of functional limitations, age, gender, race, and type of residence area. As discussed in the previous chapter, disability is expected to interact with other factors, which is called “the compounding factors” by Groce et al. (2011) and the magnitude of the effects of disability is determined in the end. While some of the existing studies conducted subgroup analyses, there seems to be still room for further analyses to accumulate our knowledge about the effects of disability, particularly in terms of severity of disability, age, and gender. This chapter overcomes the problem of small number of observations for persons with disabilities in a dataset using a much larger household survey data than those of the existing studies and attempts a more reliable analysis by several compounding factors.

Last but not least, this chapter decomposes the gap in multidimensional poverty between persons with and without disabilities into the parts deriving from disability and other observable factors. Aforementioned, as two-way causality exists between disability and poverty, I believe that quantifying not only the effects of disability on poverty, but also the effects of reverse causality from poverty to disability leads to more comprehensive understanding about disability and poverty.

While the first analysis in this chapter is related only to the former, the third analysis investigates how much each disability and other observable factors account for the total gap in multidimensional poverty between persons with and without disabilities with the decomposition method. Specifically, I adopts a matching-based decomposition method developed by Ñopo (2008) in which exact covariate matching is used. In the subsequent section on the statistical model of this decomposition method, I mathematically confirm that a decomposed part for disability status is identical to the effects of disability estimated by exact covariate matching. To the best of my knowledge, this is the first study to apply the decomposition analysis to disability and poverty and explicitly relate the methods of impact evaluation and decomposition analysis.[3]

The remainder of this chapter is organized as follows: Section 2 introduces the data used in this chapter and briefly describes the characteristics of sample for the analysis. Section 3 explains the empirical methods adopted in this chapter and Section 4 shows the empirical results. Section 5 concludes with the implications of the findings.

3.2. Data and descriptive analysis

This chapter uses the 10% sample data of South African census in 2011 (Statistics South Africa,

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

2015a). The sample size is 4,337,697 individuals within 1,194,122 households. The census asked about the 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 answer each condition of all household members aged above five years from the four choices, "no difficulty," "some difficulty," "a lot difficulty," and "cannot do at all" in principle.[4] Before implementing the census, Statistics South Africa confirmed the validity of these questions and the correctness of their words in the context of South Africa through focus group discussion and pilot surveys (Schneider, 2009; Schneider et al. 2009). As for the response of "some difficulty," Miller et al. (2010) casted doubt on the reliability of self-report about minor health problems, and for that reason Mitra et al. (2013) and Mizunoya and Mitra (2013) used the difficulties severer than "a lot difficulty" for the definition of disability group. This chapter follows this definition for each functioning and hereafter calls the difficulty level 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 for all six functionings. Those with "some difficulty" in any functionings at the most

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

were dropped to remove the possibility of false positives, i.e., measurement error about having difficulties. Thus, the sample for the analysis consists of persons with a moderate or severe difficulty in at least a functioning and those without any difficulties for all six functionings.

The sample for analysis in this chapter is persons aged 6 to 64 by taking into accounts the ages of starting to attend primary school (5-6), 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 by the respondent of the census on the question of self-care. They may have answered having difficulties in self-care due to the age of children, and not due to impairments, which was the intention of the questionnaire.[5] To deal with this potential measurement error, children were dropped if they have 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, 3.3% of the total. This is lower than the aforementioned ratio of Statistics South Africa (2014), 7.5%, because they adopted a wider definition of disability group that is a "some difficulty" in more than two functionings or a difficulty severer than "a lot difficulty" in at least a functioning.

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

Figure 3-1 illustrates each age distribution 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 often observed in other countries. In contrast, as for the age distribution of those with disabilities (closed bars), the prevalence of people in the mid-forties or older is high for both males and females, showing that the probability to receive impairments increases as people ages. The reason why the frequency of children aged 6 to 8 is relatively high for those with disabilities is because many children aged those years were reported to have the difficulty in communication. This may be attributable to the misreporting about the difficulty related to being too young, but these observations were kept for the analysis because to my knowledge there are no reports or arguments mentioning to the possibility of misreporting.

Table 3-1 shows the share of persons with disabilities by type and severity of functional difficulties in each age group of 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 15-24 aged group, 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 as the influences of aging. In addition to

six types of disabilities, this chapter 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 3-2 compares persons with disabilities and without disabilities in gender, race, and residence area by age groups. As for gender, the ratio of males is higher than females in both 6-14 aged persons with and without disabilities, whereas the former group incorporates relatively more males than the latter group (the first and second columns). In contrast, persons with disabilities incorporate relatively more females for the older groups except for 15-24 age group (the fifth to tenth columns). These 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. As for race, the ratio of Africans is higher in persons with disabilities than those without disabilities for all age groups, meaning that Africans are more representative for the former group. It is also remarkable that Whites is less representative in persons with disabilities for all age groups. 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 and almost all of residents are Africans. Table 3-2 shows that the residents in the tribal area are more representative in persons with disabilities. These results seem to be suggestive of the reversed causality from poverty to disability, i.e., those expected to face the existing disadvantages is more likely to have disabilities

in South Africa.

As illustrated so far, persons with disabilities are apparently different from those without disabilities in personal and environmental characteristics, and there seem to be selection from the more disadvantaged population to the disability group. In addition, there is variation in type and severity of disability even within persons with disabilities. These findings underline the need to deal with the possible selection bias in the analysis of disability and poverty, and to conduct the subgroup analyses.

3.3. Empirical methods

3.3.1. Model

The empirical analysis in this chapter 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 (2008)'s matching-based decomposition are employed to control for and quantify the influences of other observable factors of of persons with disabilities, or their pre-existing poverty conditions, that is, the selection bias. Although propensity score matching has been more frequently used in the literature of impact evaluation than exact covariate matching, I chose the latter mainly because, by using it, the relationship between impact evaluation and

decomposition methods can be clearly specified as shown below. 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 in observable factors 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) argued that the former and latter parts correspond to the selection bias and the treatment effects in the literature of impact evaluation, respectively. This sub-section shows Ñopo (2008)'s model of the matching-based decomposition and shows that the part not explained by observable factors in the decomposition model corresponds to the average treatment effect on the treated estimated by exact covariate matching.

Ñopo (2008)'s matching-based decomposition method has the 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 nonparametric estimation of each decomposed part. Specifically, he considered all samples including both of 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, by following the notation of Ñopo (2008). The disability and non-disability groups are denoted by as W_1 and W_0, the conditional cumulative distribution function for each group by as $F_1(X)$ and $F_0(X)$, and the set of actually observed characteristics for each group by as S_1 and S_0. By introducing the functions of expected value of poverty conditional on disability status and other characteristics as $g_1(X) = E[Y|W_1, X]$ and $g_0(X) = E[Y|W_0, X]$ 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:

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

$$= \int_{C} g_1(X)dF_1(X) + \int_{\bar{C}} g_1(X)dF_1(X) - \left[\int_{C} g_0(X)dF_0(X) + \int_{\bar{C}} g_0(X)dF_0(X)\right]$$

By defining the share of persons 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 decomposition 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 have disabilities, the decomposition 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 the notation of Ñopo (2008) as

$$\Delta = \Delta_0 + \Delta_X + \Delta_{\text{PWD}} + \Delta_{NPWD}$$

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 the counterpart. The first term, Δ_0 indicates the comparison of persons with disabilities against those without disabilities who have the same observable characteristics of those with disabilities because the cumulative distribution function of those with disabilities are used in the integral. This term 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_{PWD}, is related to the influences of the characteristics specific to persons with disabilities that those without disabilities does not have, and the forth term, Δ_{NPWD}, is related to the influences of the characteristics specific to those without disabilities that those with disabilities does 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.

While Ñopo (2008) used exact covariate matching to classify which individuals of two groups are located in or out of the common support, he did not relate his method with the method of impact evaluation. 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 one 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

$$E[Y|W_1] - E[Y|W_0] = E[Y_1|W_1] - E[Y_0|W_0]$$

$$= E[Y_1 - Y_0|W_1] + \{E[Y_0|W_1] - E[Y_0|W_0]\}$$

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. If people randomly acquire a disability, this term is equal to zero and ATT can be estimated by simply taking the difference of average of poverty conditions of two groups. However, it seems to be not the case as discussed above and

confirmed by the descriptive analysis in the previous section. 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. By iterating $E[Y_1 - Y_0|W_1]$ over X,

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

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 is assumed behind the final equation that the distributions of covariates of persons with and without disabilities sufficiently overlap, or in other words, that we can find a sufficient number of persons without disabilities who take the same values of covariates as those with disabilities. This is called the common support or overlap assumption which is expressed as $0 < \Pr(W_1|X) < 1$. Lastly, by using the definitions of $g_1(X) = E[Y_1|W_1, X]$ and $g_0(X) = E[Y_0|W_0, X]$ and the common support assumption, the following equation can be introduced:

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

which is identical to Δ_0 in the matching-based decomposition model. Aforementioned, Fortin et al.

(2011) explained the relationship between the methods of impact evaluation and decomposition. To my knowledge, this is the first time to explicitly show that the former corresponds to a term of the latter, though only in the case of exact covariate matching.

All terms of the matching-based decomposition is estimated with the weighted averages of poverty conditions and the share of persons with and without disabilities out of the common support. Thus, it is not necessary to specify the functional forms of conditional poverty conditions, $g_1(X)$ and $g_0(X)$, and estimate them, 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 combination of covariates of persons with disabilities. Suppose that the number of covariates under consideration is *L*, and that *K* combinations of values a person can take, $\{x_1, \dots, x_k, \dots, x_K\}$, are constructed from the L covariates, where x_k is a $L \times 1$ vector. Define N_{1k} and N_{0k} as the number of persons with and without disabilities who take the *k*-th combination of covariates $X_i = x_k$, 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 $X_i = x_k$. 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 $\delta_k N_{1k}$ plays the role as weight when calculating the weighted average. Similarly, the other three terms can be also estimated as the difference of weighted averages of poverty conditions. As for the estimation of standard errors of all parts, I adopted the bootstrap method based on 100 replicates.

In fact, $\widehat{\Delta_0}$ above is developed as

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

The term in parenthesis in the numerator can be further divided into N_{1k} terms of $(Y_{1i} - \overline{Y_0^k})$ which is the difference between the poverty conditions of a person with disabilities with $X_i = x_k$ and $\overline{Y_0^k}$. This means that the poverty of conditions each person with disabilities is compared with the average conditions of multiple persons without disabilities who have the exactly same characteristics as him/herself, which is called as one-to-many matching. Therefore, I adopt one-to-many matching in exact covariate matching for the consistency with the matched-based decomposition.

3.3.2. Procedure of exact covariate matching

Persons with and without disabilities was matched based on different sets of covariates for children aged 6-14 and adults aged 15-64. I chose the covariates for matching from the dataset as those that

are predetermined, fundamental characteristics, and considered to be associated with poverty. Children with disabilities were matched with those without disabilities who have the exactly same characteristics in respect of 10 variables: age, gender, population group, main language in the household, municipality of residence, type of residence area, municipality of residence in 2001, province of birth place, absence of father in the household, and education level of parents. Similarly, adults with disabilities were matched with those without disabilities sharing the exactly same characteristics in respect of nine variables: age, gender, population group, 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 such as 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 area (urban, rural formal and/or tribal areas). The purpose of including municipalities 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 that in 2011. The reason of using province level but not municipality level for birth place is just because the information of municipality of birth was excluded from the

public dataset for the privacy policy. The father absence in the household is used for matching because it has been discussed as one of the issues about family in South Africa and considered to have the negative influences on the lives of children economically and emotionally (Richter, Chikovore, and Makusha, 2010; Richter and Morrell, 2006). In fact, about 70% of children in the original 10% sample of the 2011 census do not have fathers within the same household due to living apart or death. The education level of parents is measured by 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 father absence, and their education level is considered important for the wellbeing of children in the literature, I used the education level of mothers for matching at first, and used that of fathers if the information of a mother is not available. If both information of a father and a mother is missing. I used that of the household head.

As explained in the previous sub-section, one-to-many matching was 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 with disabilities were successfully matched with those

without disabilities and so were 82.28% of adults with 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.

3.3.3. Multidimensional poverty measures

In order to broadly compare the poverty conditions of persons with and without disabilities, this chapter 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 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 adopted by this chapter is not identical to those of MPI due to the availability of variables in the dataset, I follow the procedure to calculate the multidimensional poverty measures summarized by Alkire and Foster (2011).

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, called the deprivation score. I prepared 10 indicators in three dimensions for children and 11 indicators in four dimensions for adults as shown by Table 3-3. These dimensions and indicators were selected by basically following Alkire and Santos (2014), Mitra et al. (2013), and Trani et al. (2015), and the availability of variables in the dataset. Among others, I adopted the 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 are considered 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 the reason for not searching for a job is health reasons such as heavy impairments and pregnancy, including other reasons such as student, trainee, housewife, retirement, and so on. As for household income per capita, each household member's total income from all sources including disability grant was summed up and divided by the number of household members. In addition, I adopted the usage of

internet as the indicator of access to information because the role of information and the problem of digital divide seem to increasingly have the importance for the poverty issues in developing countries, particularly in the middle-income countries such as South Africa where the infrastructure for information and communication technology has be being developed. The deprivation cutoff for each indication was determined, depending 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:

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

The first main measure of multidimensional poverty, the headcount ratio of the multidimensionally poor, can be computed 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 (*H*) is said to reflect the incidence or breadth of multidimensional poverty, the average deprivation share (*A*) means the intensity or depth of multidimensional poverty. The last but the most important measure of multidimensional poverty, the adjusted headcount ratio, is calculated as $M_0 = H \times A = \sum q_i \, c_i / N$, which represent both breadth and depth aspects of multidimensional poverty.

These multidimensional poverty measures can vary by the choice of the poverty cutoff (*k*). Alkire and Foster (2011, p. 483) argue that its choice is a normative issue because it reflects "a judgement regarding the maximally acceptable multiplicity of deprivations." Although they refer to the role of the empirical research in determining the appropriate poverty cutoff, to my knowledge, such a study have not ever been conducted in the context of South Africa. The studies on the MPI of South Africa, Finn et al. (2013), Oxford Poverty and Human Development Initiative (2011), and Rogan (2016), adopt the cutoff of the international standard, 0.33, and alternatively use 0.2-0.33 and 0.5 as the cutoff capturing the population vulnerable to poverty and in severe poverty, respectively. The studies on the multidimensional poverty of persons with disabilities in developing countries, Mitra et al. (2013) and Trani et al. (2015), set the cutoff at 0.4 in their main analyses and confirm the sensitivity of the findings using multiple values of the cutoff. Since the analyses in this

chapter are closer to the latter disability studies than the former MPI studies, I firstly fix k at 0.4 for the main analyses and then examine the sensitivity of results of exact covariate matching and decomposition analysis.

3.4. Empirical results

3.4.1. Results of exact covariate matching

Table 3-4 compares the multidimensional poverty measures of persons with and without disabilities before and after 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 two groups remains even after equalizing persons with and without disabilities in terms of other factors (the sixth columns). The t-tests were undertaken for the mean of difference in each multidimensional poverty measure between disability and non-disability groups before and after matching. As a result, all of the gaps were statistically significant at 1% level. Since this seems to be mainly attributable to the statistical power enhanced by the large sample size, this chapter does not put much emphasis on the statistical significance of the results reported in Table 3-4 and other tables. In compared to the headcount ratio, the gap in average deprivation share is smaller even before matching so that it does not change much after matching.

This implies that disability status is not related much to the depth of deprivation of the multidimensional poor in the case of South Africa. In other words, disability is found to aggravate the conditions of multidimensional poverty more in light of breadth. 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 significant gap in average deprivation share is smaller than those with significant gap in headcount ratio. Consequently, the gap in adjusted headcount ratio is found to be mostly caused by the gap in headcount ratio.

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

Examining the headcount ratio before and after matching, the ratio of non-disability group more sharply increases (the second and fifth columns) than that of disability group (the first and

forth columns), which is the main reason of the narrowed gap after matching (the third and 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 through matching. The fact that the headcount ratio of matched persons without disabilities is higher than the ratio before matching means that persons without disabilities sharing the observable characteristics with those with disabilities are more likely to be multidimensionally poor. Put differently, persons with disabilities possess the disadvantageous characteristics other than disability. Actually, Table 3-2 confirmed that Africans and the residents in the tribal area are more representative for the disability group. Therefore, the finding of higher headcount ratio of matched persons without disabilities indicates that matching succeeded to control for the effects of other factors.

In order to investigate the difference in the influences of disability more closely, Table 3-5 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 the school attendance is the largest among other indicators. The ratio of children with disabilities not attending school is more than twice as high as that of those without disabilities (the first and second columns), which results in the large gap in the adjusted headcount ratio between children with and without disabilities. The gaps in the other indicators of the household level are

not large in compared to school attendance, but the positive gaps consistently exist in all indicators (the third column). The covariates about parental characteristics used for the matching in this chapter 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 have the household-level influences through increasing medical expenditures and decreasing 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 group, e.g., 16.2% for 15-24 age disability group and 51.1% for 55-64 age disability group, which demonstrates the long-run improvement of education levels in South Africa. On the other hand, the gap between disability and non-disability groups is larger in the younger group, e.g., 11.7 percentage points for 15-24 age group and 5.2 percentage points for 55-64 age group. This might indicate the emergence of children with disabilities left behind in the nation-wide trend. Here, it should be noted that current disability status might have less influence on education level, particularly of the elderly, because some persons with disabilities might have received impairments after the graduation from school. In that case, the causality works from education level to disability, but not

from disability to education level. Since the ratio of such persons is considered to be higher in the older group, the genuine impact of disability seems to be smaller than the estimates here. As for labor market status, the gap is larger for 25-39 and 40-54 age groups in compared to other younger and older groups. The gap is the largest for 40-54 age group in all indicators of the household level except for access to water, followed by 25-39 age group, showing the larger influences of disability at the core working-age groups. These results are the reason of the larger gap in the adjusted headcount ratio for 25-39 and 40-54 age groups found above. Although South Africa has the disability grant program as mentioned above, the findings of this chapter suggest that the current system might not work so well that the living conditions for persons with disabilities are guaranteed at the same level of those without disabilities.

3.4.2. Subgroup analysis of the adjusted headcount ratio

Table 3-6 compares the adjusted headcount ratio by the subgroups of type and severity of disability. As for 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 the existing studies in that persons with intellectual and multiple disabilities are more disadvantaged. The gap is also large for those with walking

difficulties for 6-14 and 15-24 age groups, and for those with self-care difficulties for 25-39 and 40-54 age groups. The reason why the difficulties in walking matter for multidimensional poverty of children is because it is strongly related to the deprivation in school attendance, though not reported in this chapter. The ratio of children not attending school is the highest for those with severe difficulties in walking, 41.1%, and the gap from those without disabilities is also the largest for them, 34.9 percentage points. This seems to result from inaccessible transportation system and insufficient reasonable accommodations in school facilities that Human Rights Watch (2015) criticized. As for severity of disability, 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 6-14 age group and all types of disability except for self-care for 15-24 age group. In contrast, the gap is larger for those with moderate difficulties in hearing, communication, and walking for 40-54 age group and in communication and walking for 55-64 age group. These results suggest that older persons with disabilities could cope with the severe difficulties better than younger persons do.

Table 3-7 compares the adjusted headcount ratio by the subgroups of gender, population group, and type of residence area. Regarding the gender difference in the gap, it is slightly larger

for females of 6-14 age group, whereas it is for males of 15 or above age groups. The former result is common to Trani et al (2013) and Trani and Cannings (2013) reporting worse multidimensional poverty of girls with disabilities, and the latter is common to Mitra et al. (2013) showing 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 remarkable that the adjusted headcount ratio of females with disabilities is higher than males with disabilities in 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 might 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 the disability and gender status in these two 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, Africans and Coloureds are more multidimensionally deprived even without disabilities (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 and Whites in the 40 or above aged groups (the third, twelfth, and fifteenth columns). These might imply that children and older persons with disabilities in these groups could be supported well by their families and those around them.

Regarding the difference by type of residence area, the gap is higher in rural informal and tribal areas than urban area for all age groups except for 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 type of residence area are so large that residents without disabilities in rural informal and tribal areas are more multidimensionally deprived than those with disabilities in urban area. Thus, the disadvantages deriving from regional inequality still remains large in South Africa and leads to worse multidimensional poverty through interacting with disability.

3.4.3. Results of Ñopo's decomposition

Table 3-8 shows the results of Ñopo decomposition of the gap in adjusted headcount ratio between persons with and without disabilities. For 6-14 and 15-24 age groups, about more than 70% of the observed gap is attributable to disability status, and about 30% is to the characteristics specific to

persons without disabilities in those age groups. Similarly, the part explained by disability status is large for 25-39 age group, about 71%, though that by observable characteristics is also unignorable, about 28%. In contrast, the part explained by disability status is lower for the two oldest groups than 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 derive from the following three reasons. Firstly, as a person is more likely to acquire an impairment at higher ages as presented by Figure 3-1, a larger part of the living conditions of older persons could be determined before having 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 time, their influences are considered to be not as strong as disability. The second possible reason is associated with the causality from poverty to disability. Aforementioned, the disadvantaged is 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 3-2 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. The ratio of

persons with moderate difficulties in seeing is higher in older group as shown by Table 3-1, and the influences are found to be smaller as shown by Table 3-6. Consequently, the influences of disability are estimated as smaller for older groups, resulting in less significance of disability for the whole poverty gap.

It is also remarkable 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. By the definition of each term, this means that matched persons are more multidimensionally deprived than unmatched ones in both groups. Putting differently, those with more disadvantageous characteristics were matched within each group. This result 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. It can be said that persons without disabilities 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 well-endowed with the personal and environmental characteristics. By comparing matched and unmatched persons, I detected that, irrespective of disability status and age groups, 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 basically Africans. The other two areas are relatively more diversified in the population and so that in these areas there seem to be persons with and without disabilities who are less deprived due to their advantageous characteristics.

3.4.4. Sensitivity checks of the results

The multidimensional poverty measures used in the analyses above depend on the arbitrary choice of the poverty cutoff, k=0.4. This subsection checks the sensitivity of the results of exact covariate matching and Ñopo's decomposition analysis by different values of the poverty cutoffs. Figure 3-2 shows the adjusted headcount ratios of matched persons with and without disabilities using the poverty cutoffs from 0.1 to 0.9 by age groups. As illustrated, the size of the gap in the adjusted headcount ratios in the cases of k<0.4 is not different much from that with k=0.4 in all age groups. The size of the gap becomes smaller when k exceeds 0.6 for the youngest and oldest age groups (6-14 and 55-64) and 0.7 for the other middle age groups (15-24, 25-39, and 40-54). Therefore, the results of the matching analysis in this chapter are found to be robust with the poverty cutoffs smaller than and close to the originally used one. The robustness of the results is maintained for the "severe poverty" (k=0.5) defined by the MPI studies cited above, but not in the case of the extremely severe poverty (k>0.6 or 0.7). This implies that the effects of disability become small in

the absolute terms in the latter case. Rogan (2016) conducted the similar sensitivity analysis for the estimation of the MPI in South Africa and found that the gender difference in the MPI disappeared when k exceeds 0.5. Although the dataset and indicators used for the calculation of multidimensional poverty are different between this chapter and Rogan (2016), it still can be said that the the effects of disability on severe multidimensional poverty may be larger than those of gender.

Figure 3-3 presents each percentage of four terms of Ñopo's decomposition analysis using the poverty cutoffs from 0.1 to 0.9 by age groups. On the whole, the tendency found by the decomposition with k=0.4 in the previous sub-section can be confirmed in the cases of other values of k. For the two youngest groups, disability status is the major factor explaining the gap in adjusted headcount ratio between persons with and without disabilities, represented by the proportions of Δ_0. For these groups, the importance of disability status increases when k increases, that is, the examined multidimensional poverty becomes more severe. For 25-39 age group, in addition to disability status, the difference in observable characteristics over the common support (Δ_X) accounts for a large share. For the two oldest groups, the proportions of Δ_0 are lower than those of younger groups and the other three terms related to observable characteristics over and out of the common support explains a large part of the gap in adjusted headcount ratio. Moreover, it is

also confirmed that Δ_{PWD} is consistently negative and Δ_{NPWD} is consistently positive regardless of the values of poverty cutoff and age groups. Therefore, it can be said that while the absolute size of the effect of disability is smaller in the case of extremely severe poverty as shown by Figure 3-2, the relative size of the effect of disability does not differ by severity of multidimensional poverty,

3.5. Conclusions of chapter

This chapter estimated the more accurate gap in multidimensional poverty between persons with and without disabilities in South Africa through the matching and decomposition analyses. As a result of exact covariate matching analysis, I found that the gap in multidimensional poverty between persons with and without disabilities still remains after strictly controlling for other factors. Additionally, the gap in the headcount ratio between persons with and without disabilities is found to be larger than in average deprivation share, implying that disability has larger influences on the prevalence of poverty rather than the depth. 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 above, Africans, Coloureds, and residents in rural informal or tribal areas. Especially, for Africans, Coloureds, and residents in rural informal or tribal areas, not only the gap, but also the level of multidimensional poverty itself is much higher than other groups. This implies the disadvantages increased by the interaction of disability, race, and regional inequality, 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 difference in experience of gender and racial discrimination and regional disadvantages. 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. In fact, the descriptive analysis showed that the prevalence of persons with disabilities is higher among those considered disadvantaged in South Africa, which suggest the reversed causality from poverty to disability.

It might be possible to draw several policy implications from the findings of this chapter. Firstly, comprehensive approach is necessary for improving the wellbeing of persons with disabilities, but not just 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, appealing the necessity of social change. In addition, taking into account the results that persons with disabilities are even more deprived among Africans and Coloureds and residents in rural informal 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 so that it is essential to pay more attention to who is more affected by disability when building the policies and legislation and providing the social services, e.g., those with difficulties in intellectual functionings and multiple difficulties in South Africa. This chapter also found that disability account for a large part of the gap in poverty between persons with and without disabilities for younger groups, South African government should make efforts to support the youth with disabilities in education and employment. Lastly, the the possibility indicated by the analysis that the poor is more likely to have impairments seems to require not only coping with disability already existing, but also promoting early detection and treatment of health problems of the poor through improving their access to medical and social security services.

Chapter 4. Are the Effects of Disability on Employment Mitigated during 2002-2015 in South Africa?: A Pseudo-panel Approach

4.1. Introduction

Engaging in a work is the essential economic activity to make a decent livelihood and one of the most important ways to participate into the society for all people including those with disabilities. To ensure the opportunity of persons with disabilities to work on an equal basis with those without disabilities, the United Nations Convention on the Rights of Persons with Disabilities (CRPD) was adopted in 2006, and has been ratified by more than 160 countries as of 2017. After and even before the CRPD, many countries have adopted several types of measures such as laws and regulations against disability-based discrimination and for reasonable accommodation of people with disabilities at the workplace, the quota for the employment of persons with disabilities in the private and public organizations, sheltered employment, vocational rehabilitation and training, and programs to change the attitudes toward them (WHO and World Bank 2011). However, it is still questionable whether these measures contributed to the improvement of employment of persons with disabilities, and the empirical studies examining their effects are limited, particularly those in developing countries.[6]

[6] Some studies examine the effects of anti-discrimination law for person with disabilities, represented

The number of empirical studies on the employment of persons with disabilities in developing countries has been increasing as reviewed in Chapter 2. The existing studies consistently found the negative relationship between disability and employment conditions in many developing countries. However, most of them do not correct for the endogeneity of disability variable so that their estimates might be biased. This could be caused by omitted variables correlated to disability status, simultaneity of disability and employment, and/or measurement error of disability status. In addition, while their findings based on the cross-section survey can be considered as a snapshot of the conditions at a point in time in a specific country, it remains unknown whether the conditions have improved or worsened.

The best way to cope with these issues is to examine the transition of the employment conditions of persons with disabilities using a panel data, and estimate panel-data models incorporating individual fixed effects. However, the panel household survey data is not often available in developing countries, and even less so for surveys that include the questions about disability.[7] Therefore, this chapter adopts the pseudo-panel or synthetic panel method originating

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by Americans with Disabilities Act, on employment in the U.S. and U.K. (Acemoglu and Angrist 2001; DeLeire 2000; Jones 2009). See Jones (2008) for the review of the literature in developed countries.

[7] As one of the exceptions, the national representative panel household survey, the National Income Dynamics Study (NIDS), has been being implemented by the South African Labour and Development Research Unit of the University of Cape Town. It covers four years as of writing this paper (2008, 2010/11, 2012, and 2014/15) and has so far contributed to the empirical studies on the dynamics of several issues in South Africa. Although it includes the question about disability based on WHO's International Classification of Functioning, Disability and Health, it has the following limitations in the questionnaires and dataset so that this paper abandoned using it. Firstly, the disability type considered in the questionnaire is limited to sight, hearing, and mobility, and intellectual impairments are not

in Deaton (1985). In the case of the absence of a panel data, he proposed to construct a pseudo-panel data from repeated cross-section surveys in which the unit of the analysis is cohorts incorporating individuals with the same characteristics, e.g., age cohorts, and to estimate fixed effect models in order to obtain a consistent estimator of an endogenous variable of interest. Since a seminal work by Deaton (1985), the pseudo-panel method was refined and extended by subsequent papers (Devereux 2007; Moffitt 1993; Verbeek and Nijman 1992, 1993), and has been widely applied, e.g., to the analysis on income and consumption (Antman and McKenzie 2007; Banks, Blundell, and Brugiavini 2001; Deaton and Paxson, 1994), returns to education (Himaz and Aturupane 2016; Warunsiri and McNown 2010), and early marriage (Delprato, Akyeampong, and Dunne 2017). In the literature on disability, Jones (2009) estimated the employment effect of Disability Discrimination Act in England by combining the pseudo-panel method with the difference in difference model.

This chapter utilizes a series of an annual national representative survey in South Africa from 2002 to 2015, called the General Household Survey, implemented by the Statistics South Africa. First of all, the consistency of this survey from 2002 to 2015 is confirmed in the following

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incorporated. Additionally, the comparison in the disability status of samples between the first wave (2008) and the second wave (2010/11) yielded puzzling results (Graham et al. 2014). For example, only 32% of persons defined as disabled at the first wave remained disabled at the second wave. Regarding this result, the authors indicated the possibility of inconsistency of self-reporting about disability across time. Another advantage of using repeated cross-section survey data instead of the NIDS is that it is possible to extend the periods of analysis to 2002-2015 as explained below.

section. As the question on disability status was changed in the survey 2009, this chapter analyzes surveys between 2002 and 2008 and between 2009 and 2015 separately. I apply the pseudo-panel method to the datasets in both periods, and attempts to consistently estimate the effects of disability on employment outcomes. Further, I also examine whether the effects of disability on employment outcomes have changed over time.

The remainder of this chapter is organized as follows: Section 2 introduces the data used by this study and discusses the consistency of the data, particularly about the disability status. Section 3 explains the pseudo-panel method and shows the regression results. Section 4 concludes with the implications of the findings.

4.2. Data and descriptive analysis

The analysis of this chapter depends on a series of national representative surveys, called the General Household Survey (GHS) undertaken by the Statistics South Africa (Stats SA) every year since 2002. The used data is those of GHS open to the public as of writing this, that is, GHS from 2002 to 2015.[8] Each sample size of GHS ranges from about 65,000 to 94,000, and that of individuals at the core of working-age (25-59) does from about 31,000 to 42,000. The

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

comparability of the statistics across GHS in different years is considered to be high because all GHS adopted the basically same sampling design, the two-stage stratified sampling, with a few changes of the master sample and Stats SA updated the micro data of GHS 2002-11 including the new weights in 2012 to improve the comparability. The questionnaire has been slightly changed depending on the interest of the government at that time, but the questions on the demographic characteristics, education, employment, and some household characteristics are the same or manageable so as to make the responses consistent across different years.

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

Group on Disability Statistics. Specifically, the GHS 2009-15 begins with "I am now going to ask about the general functioning of persons within the household" [emphasis added], and asks "Does … [each household member] have difficulty in doing any of the following?." The choices for the type of difficulty are "Seeing," "Hearing," "Remembering and concentrating,"[9] "With self-care, such as washing or dressing," and "In communicating in his/her usual language including sign language." Basically four choices for the degree of each difficulty are provided: "No difficulty," "Some difficulty," "A lot difficulty," and "Cannot do at all" while allowing the responses of "Do not know" or "Cannot yet be determined," and refuse to respond.

The purposes behind these two disability questions are different and so is what each question measures. The disability question in the GHS 2002-08 defines disabilities as participation limitations within or outside home that last six months or more due to the body or mind conditions, and asks whether such disabilities exist for each household member at the timing of the survey. Altman and Rasch (2016), referring to a similar question in the U.S. 2013 National Health Interview Survey, argues that this type of question is suitable for monitoring the participation limitations, but not for identifying persons who may be at risk of the limitations in different environments even if they are not currently limited. The Washington Group (WG) questions used

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

in the GHS 2009-15 is appropriate for both. According to Altman and Rasch (2016), the purpose of the WG disability measures is to assess equalization of opportunities, which is consistent with the purposes of the World Programme of Action concerning Disabled Persons adopted by the United Nations in 1982 and the United Nations Convention on the Rights of Persons with Disabilities adopted in 2006. As the approach for the assessment of opportunity equalization, the WG separated the questions on functional limitations of body or mental and on participation in several activities in a country or community to be examined, and prepared for the questions on the difficulties in six basic functionings specified above. In addition, four choices of response from “No difficulty” to “Cannot do at all” were prepared for the WG questions so that we can find more widely those who may be at risk of participation limitations. In summary, the WG questions can be used to capture persons with difficulties in body or mental functionings who may be exposed to the possibility of being limited in participation in the society and those who are actually limited through combining with other questions on participation. Therefore, it can be considered that the WG questions, i.e., the GHS 2009-15 questions, are more inclusive measures of disability than the GHS 2002-08 question.

The difference in the wording of disability question and choices of response can have a large influence on the responses. Compared to “difficulty,” the term “disabilities” in the GHS

2002-08 question may give respondents conventional prejudice against disability, leading to a bias in the response. In 2006, Professor Marguerite Schneider and Stats SA carried out the research for the revision of disability question in the South African census in 2011 (Schneider 2009; Schneider et al. 2009; Statistics South Africa 2006). Schneider (2009) found from the focus group discussion that the participants had negative impression about disability, and were less likely to self-identity as disabled when the question including the term "disabled" or "disability" was used than when the WG question was used. The similar result was obtained from the quantitative survey in that the WG question yielded a higher proportion of persons with difficulties than the "disability" question (Schneider et al. 2009). In addition to negative image related to the term "disability," Schneider et al. (2009) states that four choices of response for the WG question led the respondents to be less conscious of identifying themselves as disabled than yes/no response to "disability" question. As a result, the WG question was adopted as the disability question of the census in 2011, and the use of the term "disability" was avoided in the questionnaire by changing the heading of the section related to disability from "Disability" to "Health and functioning" (Schneider 2016). Similarly, the term "disability" was not used in the health section of the questionnaire of the GHS 2009-15.

The following examines the comparability of persons with disabilities defined by each disability question in GHS 2002-08 and 2009-15. Figure 4-1 illustrates the population proportion of

persons with disabilities in the population aged from 25 to 59 years from 2002 to 2015. The population proportion in each year was estimated by using the sampling weight contained in each GHS dataset. Three definitions for persons with disabilities based on the WG question are used in 2009-15. This chapter adopts the definition used in most of the literature and the report based on the GHS of each year published by Stats SA, i.e., those who chose “A lot difficulty” or “Cannot do at all” for at least one functioning specified above or “Some difficulty” for two or more functionings. As other definitions, I use the wide definition meaning “Some difficulty,” “A lot difficulty,” or “Cannot do at all” for at least one functioning, and the narrow one meaning “A lot difficulty,” or “Cannot do at all” for at least one functioning. During 2002-08, the proportion of persons with disabilities does not change, taking about 4% throughout the whole periods. During 2009-15, the proportion from the adopted definition takes a similar value to that in 2002-08, though slightly decreasing over time. Among three definitions in 2009-15, there appears to be the least discontinuity between the proportion in 2008 and that in 2009 from the adopted definition, which may seemingly guarantee the consistency of disability questions in GHS 2002-08 and 2009-15.

Table 4-1 describes persons with disabilities in GHS 2002-08 and 2009-15 in terms of disability-related and other basic characteristics. Persons with disabilities in 2002-08 are more likely to experience of any illnesses or injuries within a month before the survey and receive

disability grant than those in 2009-15. To receive the disability grant in South Africa, applicants are required to be unemployed for a period of six or more months, earn less and have assets worth less than a prescribed value depending on marital status, and take a medical examination about the body or mental conditions. Thus, they seem to be in more serious difficulties, which is consistent with the definition, i.e., they self-reported as their activities being limited due to body or mental conditions. In addition, persons with disabilities in 2002-08 are more likely to live in the area where it takes more than 30 minutes to visit the nearest health institution. This suggests that the remoteness from health institutions may hamper early detection or treatment of health problems and medical rehabilitation and lead to worsening the conditions of body or mental. Among other characteristics, the education level of persons with disabilities in 2002-08 is lower, i.e., lower proportions of those who completed primary, secondary school, or higher education, implying both possibilities that the opportunity of schooling was limited due to congenital impairments and that the low level of education caused working at unsafe environments or insufficient earnings for the payment to medical services, resulting in acquiring impairments. Although most of these differences in the profile of persons with disabilities derive from the differences of the disability questions, it is also considered to be possible that the composition of persons with disabilities might change over time because of the reinforcement of policies against disability after ratifying the

CRPD reviewed in the previous section or resulting social changes in attitudes toward them. In fact, South African Social Security Agency (2016) reported that the number of recipients of disability grant constantly decreased from 1.423 million in 2006/07 to 1.086 million in 2015/16.

To confirm the effects of the difference in disability questions more directly, I use the GHS 2011 in which both questions were used.[10] Among 37,213 sample individuals aged from 25 to 59 years, 1,230 people are defined as having "disabilities" according to the disability question (3.3% of the total), and 1,474 people are defined as having "difficulty" according to the WG question (4.0% of the total). Table 4-2 reports the result of cross-tabulation of these two definitions. The results of these definitions are the same for almost all of individuals (95.7%=(35,069+560)/37,213). However, more than half of persons with "disability" are defined as those WITHOUT "difficulty" (670/1,230), and about 60% of those with "difficulty" are defined as those WITHOUT "disability" (914/1,474). The existence of the former group can be attributed to the facts that the disability question mentions the type of difficulties more vaguely than the WG question, e.g., "physical" or "intellectual" condition, and refers to a psychological condition not contained in the WG question. The existence of the latter group is understandable because not all of persons with "difficulty" are limited in their activities. Table 4-3 shows the summary statistics of persons with "disability," those

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

with “difficulty,” and those without “disability” or “difficulty.” The proportion of the recipient of disability grant is the highest for those with “disability,” and as a result of the requirement for disability grant, so is the proportion of not economically active persons. There is no large difference in the experience of illnesses or injuries, the distance to health institution and other basic characteristics between those with “disability” and “difficulty.” For reference, those without “disability” or “difficulty” are less likely to suffer from illnesses or injuries, and more likely to live in the area closer to health institutions, be employed and economically active in compared to other two disability groups. They are more likely to be Whites and have higher education level, indicating the strong correlation between disability and poverty. Therefore, since the disability and WG questions are confirmed to capture different type of individuals basically in a way corresponding to each purpose, their definitions is not compatible between the GHS 2002-08 and 2009-15.

Figure 4-2 illustrates the employment status and type by disability status across the periods of the analysis. Similar to Figure 4-1, presented are the population means of indicators in each year estimated with the sampling weight of each GHS. The panel (a) shows the time change in three employment status (economically active, employed, and unemployed) of persons with and without disabilities. Following the official definition of unemployment in South Africa, the unemployed

means the condition of being not employed, being willing to work, and taking actions to find jobs. People who do not work for the reason of students, housewives, retirement, and serious health conditions are not counted as unemployed. Economically active persons are defined as either employed or unemployed. The questions to measure employed persons in the GHS were slightly changed since 2009 so that they are comparable only within the GHS 2002-08 or within the GHS 2009-15 and not across these periods. The questions to measure unemployed persons were slightly changed twice, in 2009 and 2011, so that they are consistent either in the GHS 2002-08, in the GHS 2009-10, or in the GHS 2011-15.

As shown in the panel (a), throughout 2002 to 2008, the proportion of economically active persons is much lower for those with disabilities (10-30%) than those without disabilities (about 70%), and so is the the proportion of employed persons (10-20% and about 60%, respectively). The proportion of unemployed persons is lower for those with disabilities than those without disabilities, possibly indicating that those with disabilities tend to discontinue looking for jobs and resign themselves to being economically inactive if they lose jobs. The similar tendency can be found throughout 2009 to 2015. Although it appears that the proportions of active and employed persons with disabilities increased from 2002-08 to 2009-15, this seems to result from the difference of their definition as confirmed above. Within each periods 2002-08 or 2009-15, the improvement of

the proportions of active and employed persons with disabilities cannot be confirmed. It is also notable that the proportions of active and unemployed persons sharply declined in 2011 regardless of with or without disabilities, whereas the proportion of employed persons constantly changes. This can be attributed in part to the change in the questions to identify unemployed persons in 2011. Thus, to keep the consistency of the variable in 2009-2015, I decided to put the main focus of the analysis on the effects of disability on the aspect of being employed, rather than unemployed.

The panel (b) presents the proportions of employed persons by type of employment in each population of those with and without disabilities. The questions on the type of employment are consistent either in the GHS 2002-08 or in the GHS 2009-15. In both periods, employed persons consist of those with payment (wage workers or self-employed) and without payment, for example, helping family business.[11] As with the employment status in the panel (a), there are large gaps in the proportions of persons employed with payment and wage workers between persons with and without disabilities in both periods of 2002-08 and 2009-15. It turns out that most of employed with payment is wage workers for both persons with and without disabilities, and that the proportion of self-employed are not different between them. Again, the difference in each proportion between 2002-08 and 2009-15 is considered to be due to the difference in the disability definition, and any

[11] In the GHS 2002-08, there are the questions asking about farmers, construction or repair work, and fisheries or hunters of animals. All of them are classified as wage workers in this analysis.

improvement of the proportions of persons employed with payment and wage workers cannot be found for both those with and without disabilities.

4.3. Regression analysis

4.3.1. Regression models

Aforementioned, simple regression analysis may yield biased estimates of the effects of disability on employment because of the endogeneity of disabilities. To deal with this problem, this chapter applies the pseudo-panel or synthetic panel method. I begin to explain the method by considering a following linear probability model with individual fixed effects:

$$E_{it} = \beta D_{it} + x_{it}'\gamma + \delta_t + \alpha_i + u_{it},\ i = 1, \dots, N,\ t = 1, \dots, T \quad (4\text{-}1)$$

where E_{it} is a dummy variable on employment outcome, D_{it} is a dummy variable on disability status of an individual i at t-th cross-section survey, and x_{it} is a vector of other explanatory variables. It should be noted here that the same individual may or may not appear again across surveys, so i does not take from 1 to N for each survey.

Now the disability variable D_{it} may be endogenous to the model. It occurs when D_{it} is correlated with unobserved individual fixed effects or time-variant error term, i.e., α_i or u_{it} in the equation (4-1). The correlation of D_{it} with α_i or u_{it} violates one of the fundamental

assumptions for the unbiasedness of the conventional Ordinary Least Squares (OLS), and makes the estimate of β by OLS inconsistent. The direction of the bias depends on the reasons of the endogeneity, and the following three reasons can be raised in the case of the analysis in this chapter. The first reason is the correlation between disability status and uncontrolled or unobservable individual heterogeneity incorporated in the error term, so-called the omitted variable. For instance, current disability status may be negatively correlated to non-cognitive ability or social network with others not measurable with the available variables in the GHS datasets, i.e., persons with congenital impairments might have lost the opportunity to enhance such ability enough or create social network due to being excluded from the education system or the community activities. Since it is reasonable to assume $\beta < 0$, the negative correlation between disability status and the error term overestimates of the effects of disability. The second reason is the simultaneity of disability and employment status or the two-way causality between the two. While the interest of this chapter is related the causality from disability status to employment outcomes, employment status can have a negative influence on disability status, for instance, the unemployed is more likely to acquire any impairments due to the lack of money to pay to the medical treatment and medicines or to purchase nutritious food. In general, the direction of the simultaneity bias is too complicated to pre-determine.[12] The last reason is the measurement error in the disability variable. As discussed in

[12] According to Wooldridge (2009, p.552), in a simplified case, the direction of the bias depends on

the previous section, the influence of the measurement error may not be ignorable for both disability and WG questions. The former question can underestimate the true number of persons with disabilities due to the negative image against "disability," i.e., the possibility of the exclusion error. On the other hand, the latter question can overestimate the true number of persons with disabilities because of its inclusiveness, i.e., the possibility of the inclusion error. Such measurement error in an explanatory variable is known to yield the so-called attenuation bias, that is, the OLS estimates biased towards zero, meaning the underestimation of the effects of disability (Wooldridge 2009, p.320). Therefore, the direction of the bias from the endogeneity of disability cannot be determined before the analysis.

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

$$\bar{E}_{ct} = \beta \bar{D}_{ct} + \bar{x'}_{ct}\gamma + \delta_t + \bar{\alpha}_{ct} + \bar{u}_{ct},\ c = 1, \dots, C,\ t = 1, \dots, T \qquad (4\text{-}2)$$

where $\bar{E}_{ct}$, $\bar{D}_{ct}$, and $\bar{x'}_{ct}$ are the means of each variable for *c*-th cohort in the survey year *t*. Considering cohorts as the unit of analysis, the analysis corresponds to that based on $C \times T$ panel data. There is a concern here: $\bar{D}_{ct}$ is likely to be correlated with $\bar{\alpha}_{ct}$ or $\bar{u}_{ct}$ because D_{it} is correlated with α_i or u_{it} in the equation (4-1). Following the existing studies, I assume that

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$\alpha_2/(1-\alpha_1\alpha_2)$, where α_1 corresponds to the effects of disability on employment, and α_2 does to the effects of employment on disability. Since both α_1 and α_2 takes between 0 and -1 in the analysis of this chapter, the sign of this term is negative, indicating the downward bias.

D_{it} is correlated only with the time-invariant individual fixed effects, α_i. Therefore, the pseudo-panel analysis in this chapter may be subject to the endogeneity bias resulting from the correlation of D_{it} with the time-specific unobserved individual factor, u_{it}, which is a limitation of the pseudo-panel analysis. If it is possible to replace $\bar{\alpha}_{ct}$ with α_c, the equation (4-2) can be estimated by the conventional panel data methods, but instead the deviation of $\bar{\alpha}_{ct}$ from the true cohort effect over time, $\bar{\alpha}_{ct}-\alpha_c$, matters. Regarding this, Verbeek and Nijman (1992, 1993) show that the estimation bias from the deviation $\bar{\alpha}_{ct}-\alpha_c$ can be ignored if cohorts are based on more than 100 observations. As most of existing pseudo-panel studies adopt this criteria, I follow them and rewrite the final regression model as

$$\bar{E}_{ct} = \beta \bar{D}_{ct} + \bar{x'}_{ct}\gamma + \delta_t + \alpha_c + \bar{u}_{ct} \quad (4\text{-}3)$$

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

The cohorts are constructed based on year of birth, gender, and race (African or not) within each GHS dataset. Since the population of interest in this chapter is the core working-age in South Africa (25-59 years), the size of the full sample of cohorts is 1,960, i.e., the product of 35 year-of-birth cohorts, two gender types, two racial types, and 14 years of GHS. The average and median number of observations in constructed cohorts is 270 and 191.5. In the following regression, I dropped 169 cohorts with the size less than 100, 8.6% of the total number of cohorts, to meet the condition of the pseudo-panel analysis specified by Verbeek and Nijman (1992, 1993). Although not reported in this chapter, I conducted the same analysis with the full sample including these cohorts. Since the results are similar to those shown below in terms of the statistical significance of coefficients as reported in the Appendix Tables 1-3, the influences of dropping some cohorts seem to be ignorable.

This chapter uses three employment outcomes as a dependent variable: economically active, employed, and employed with payment. To keep the consistency in variables across GHS of different years, explanatory variables other than disability status are limited to the level of completed education, residence of the urban areas, and the province of residence. The periods of the data are divided into 2002-08 and 2009-15 for all regression in this chapter because of the difference in the definition of persons with disabilities. Before the pseudo-panel regression, the

original model (4-1) was estimated with the pooled OLS regression method for the reference, using the same dependent and independent variables. After the estimation of basic pseudo-panel model (4-3), the heterogenous effects of disability in terms of gender and race are examined by splitting the sample of cohorts by gender or race (African or not) and running the WLS and FE regressions for each sub-sample.

In order to explore the change in the effects of disability over years, this chapter adopts an alternative way to construct the cohorts and an alternative regression model by following Jones (2009). The cohorts are constructed based on year of birth and disability status. As the number of persons with disabilities in each GHS data are small, three year intervals are adopted for year of birth, i.e., 1943-45, 1946-48, …, 1988-90, to ensure the sufficient size of each cohort. As a result, 344 cohorts (12-13 year-of-birth cohorts, 2 types of disability status, and 14 years of GHS) are constructed, and 295 cohorts are used for the analysis after dropping cohorts with the size less than 100. Again, the regression results are found to be not sensitive to this change in the sample, though not reported in this chapter. The regression model is changed as follows:

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

The reference year is set to 2007, the year when South African government ratified the CRPD, for the analysis in 2002-08 and 2009 for the analysis in 2009-15, respectively.

4.3.2. Regression results

Table 4-4 shows the results of pooled OLS regression of three employment outcomes by the periods 2002-08 and 2009-15. All coefficients are statistically significant at the 1% level, which can be attributed to the large size of aggregated sample. Disability status is negatively significant in all models and larger for all employment outcomes in 2002-08 than in 2009-15, which is consistent with the difference in the disability questions. In both periods, the magnitude of the coefficient is larger for the probability of being economically active than the probability of being employed and employed with payment. In 2002-08, its magnitudes are larger for all employment outcomes than those on male, African, education levels, and urban dummies, whereas in 2009-15 its magnitudes are also larger than or comparably large to these variables. As discussed above, however, the results should be interpreted with caution because these estimates are subject to the bias from the endogeneity of disability status.

Table 4-5 presents the regression results of WLS and FE estimation with cohort panel data. The panel A reports that both WLS and FE estimation yields the significantly negative coefficients on disability status on three employment outcomes in 2002-08. The magnitude of the coefficients are the largest for the probability of being economically active among three outcomes, implying

that the disability question on activity limitations in the GHS 2002-08 captures well the aspect of exclusion from the labor market. As the magnitude of the coefficients are larger than those obtained by pooled OLS estimation in Table 4-4, it can be considered that they are underestimated with the pooled OLS estimation possibly due to the measurement error bias.

Similarly, the effects of disability in 2009-15 are significantly negative for all employment outcomes in both WLS and FE estimation as shown in the panel B. As expected, the effects in 2009-15 are smaller than those in 2002-08. It can be confirmed again that the pooled OLS estimation underestimates the effects of disability. These findings from the analysis in 2009-15 imply that even after ratifying the CRPD a large gap in the labor market partition and employment still exists between persons with and without disabilities in South Africa.

It should be noted that there is less variation in the effects in 2009-15 among three employment outcomes, around 30 percentage points. Since the economically active population consists of the employed and unemployed by definition, minor differences in the effects of disability between the probability of being economically active and being employed indicate that the decrease in the probability of the former is mostly attributed to the decrease in the latter. This indirectly suggests that disability status may not affect the probability of being unemployed, which means that persons with disabilities may choose to exit from the labor market (i.e., become

economically inactive), but not look for jobs, if they are not employed. The disability grant system in South Africa might discourage persons with disabilities to continue to search jobs. In fact, the pooled sample of GHS 2009-15 reveals that 56.5% of economically inactive persons with disabilities are receiving the disability grant, and that the disability grant recipients are much less likely to take any actions for searching jobs, that is, are more likely to be categorized as unemployed than non-recipients (4.3% versus 33.8%). In addition, since the employed consists of those employed with and without payment by the definition, small differences in the effects of disability between the probability of being employed and being employed with payment indicate that the decrease in the probability of the former is mostly due to the decrease in the latter. Putting the results above, it can be said that the disability status decreases the employment with payment, and this effect appears again in the probability of being employed and economically active.

Table 4-6 shows the results of the subgroup analysis of the disability effects by gender and race. Reported are only the coefficients on disability variable in each regression for sub-sample. In 2002-08 (the panel A), the magnitudes of coefficients are larger for males than females except for the probability of being employed, and for African than non-African. In particular, the difference in the coefficients for all outcomes is large between African and non-African, which can be considered as the evidence of the double discrimination. In 2009-15 (the panel B), the effects of

disability are larger for males than for females except for the WLS estimates for the probability of being economically active. The finding that the effects of disability on employment outcomes are larger for males in most of regression results in Table 4-6 is also obtained in other low-income and high-income countries (Mizunoya and Mitra 2013; Mizunoya et al. 2016; WHO and World Bank 2011, Table 8.2). The racial difference in the effects of disability exists in 2009-15 for the probability of being economically active and employed with payment, but much smaller than in 2002-08. Although the results in 2002-08 and 2009-15 cannot be directly compared, at least it can be said that the racial difference in the effects of disability seems to have become smaller relative to the previous periods.

Lastly, the estimation results on the change in the effects of disability over time are reported in Table 4-7. The panel A and B presents the divergence in the effect of disability in each year from that in 2007 and 2009, respectively. Almost all of the coefficients in both panels are not statistically significant at the 10% level, indicating no systematic change in the effects of disability on labor market outcomes. Some of coefficients related to year 2006 and 2008, i.e., just before and after ratification of the CRPD, shows negative and positive signs respectively, implying the improvement of employment outcomes of persons with disabilities, but not significant. In the latest year, 2015, the probabilities for persons with disabilities to being employed and employed with

payment significantly worsen in compared to those in 2009. Therefore, the analysis of this chapter reveals that the employment conditions of persons with disabilities did not improve even after ratifying the CRPD.

4.4. Conclusions of chapter

This chapter dealt with the endogeneity bias of disability status in the estimation of the impact of disability on employment outcomes and examined the change in the effects of disability in South Africa over time by adopting a pseudo-panel approach. After the consistency of repeated cross-section surveys were checked, this chapter separately ran the regression analysis in 2002-08 and 2009-15. As a result, disability status are found to significantly negatively affect the probabilities of being economically active, employed, and employed with payment in both periods 2002-08 and 2009-15. The comparison of these results to those of the conventional method revealed that the disability effects were underestimated possibly due to the measurement error of disability status. The findings from the regression in 2009-15 revealed that disability decreases the probability of being employed, but not that of being unemployed, suggesting that persons with disabilities may not remain at the labor market, that is, become economically inactive, if they are not employed. The subgroup analyses revealed that the effects of disability on most of employment

outcomes are found to be larger for males and Africans than females and non-Africans in both periods 2002-08 and 2009-15. This racial difference in the effects of disability implies the existence of double discrimination. In addition, it could not be confirmed that the effects of disability on employment outcomes mitigated in 2002-08 and 2009-15 due to several measures of South African government for persons with disabilities. Although the findings in this chapter are not those based on the true panel data, and the pseudo-panel method depends on the assumption about the correlation of disability variable and the unobserved individual effects, it can be said that South African government is required to implement further active measures for the employment of person with disabilities and re-consider disability policies and legislations.

Chapter 5. Conclusions

Disability and poverty are complicatedly entangled with each other, and disability itself is the complex concept. The objective of this dissertation is to deepen our understanding about disability and derive policy implications from the findings of the analyses by providing more robust estimates on the effects of disability on poverty and employment that consider endogeneity issue in estimation. To achieve it, I selected South Africa as a subject country of analysis because of high awareness of the government about disability and the availability of data suitable for the analyses of this dissertation. Chapter 3 examined the relationship between disability and multidimensional poverty and Chapter 4 did the impact of disability on employment outcomes by applying the econometric methods developed and used in other literature to the different dataset of nationally representative surveys.

Chapter 3 addressed three research questions: Q3-1 (the effects of disability on multidimensional poverty), Q3-2 (the difference in the effects of disability on multidimensional poverty by subgroups), and Q3-3 (the proportions of the gap in multidimensional poverty between persons with and without disabilities explained by disability and other observable factors). As for Q3-1, I found through the matching analyses that the gap in the headcount ratio between persons with and without disabilities is significantly large and that disability has larger influences in terms

of the breadth of poverty rather than the depth. I also confirmed that the prevalence of persons with disabilities is higher among those considered disadvantaged in South Africa as expected from the causality from poverty to disability. As for Q3-2, the subgroup analyses revealed that persons with disabilities who are more largely affected by disability are those with difficulties in intellectual functionings and multiple difficulties, males aged 15 or above, Africans, Coloureds, and residents in rural informal or tribal areas. The findings for Africans, Coloureds, and residents in rural informal or tribal areas indicate the existence of multiple discrimination. As for Q3-3, the matching-based decomposition analysis showed that the gap in poverty among older groups can be explained equally by disability and other observable factors. This implies that poverty conditions previously existing before acquiring impairments have a larger influence on the lives of older people in South Africa.

The first contribution of the analyses in Chapter 3 to the literature is that observable factors related to disability and poverty were strictly controlled for by applying exact covariate matching. Secondly, I conducted more reliable subgroup analyses with sufficient number of observations in each subgroup based on much larger-scale household survey data than those of the existing studies. Last but not least, using a matching-based decomposition method, I quantitatively divided the total gap in poverty between persons with and without disabilities to the part attributed to the disability

status and the one to other observable factors. I believe that it is meaningful to specify each size of these parts that are entangled due to two-way causality between disability and poverty.

Chapter 4 was involved with the following research questions: Q4-1 (the effects of disability on employment outcomes), Q4-2 (the difference in the effects of disability on employment outcomes by subgroups), and Q4-3 (the change in the effects of disability on employment outcomes over time). To answer these questions, I adopted the pseudo-panel method to eliminate the endogeneity bias of a disability variable. As a result, I found that disability status significantly negatively affects the probabilities of being economically active, employed, and employed with payment in both periods 2002-08 and 2009-15, and that the disability impacts were underestimated possibly due to the measurement error of disability variable. In 2009-15, disability is found to decrease the probability of being employed rather than that of being unemployed, implying that persons with disabilities may not remain at the labor market, that is, become economically inactive, if they are not employed. As for Q4-2, the effects of disability on most of employment outcomes are found to be larger for males and Africans than females and non-Africans in both periods 2002-08 and 2009-15. This racial difference in the effects of disability implies the existence of double discrimination. As for Q4-3, it could not be confirmed that the effects of disability on employment outcomes mitigated in 2002-08 and 2009-15 due to several measures of

South African government for persons with disabilities.

The main contribution of Chapter 4 to the literature is to deal with the endogeneity of disability status in the regression analysis of employment. More specifically, Chapter 4 removed the endogeneity bias from the unobservable individual fixed effects by applying the pseudo-panel method to 14-years household survey data. In addition, this dissertation investigated whether or not the effect of disability changed over time in the periods of the analysis. To my knowledge, this is the first attempt in the literature on the employment effect of disability in developing countries.

Regarding policy implications of the findings above, Chapter 3 mentioned the necessity to adopt the comprehensive approach for disability issues, to take into consideration the difference in the disadvantages among persons with disabilities, and to break off the relationship from poverty to disability through early detection and treatment of health problems of the poor. South African government is prepared for the disability issues in terms of laws and legislations as reviewed in Chapter 2, but it was shown through the analyses in Chapter 4 that the adverse effects of disability on employment were not mitigated in 2002-15, even after ratification of the CRPD. The government is required to reinforce the implementation of current measures and facilitate further active measures for the employment of person with disabilities. Another policy implication applicable to other countries as well is the further use of the secondary data to clarify the conditions

of persons with disabilities. The availability of data including the disability question has been improving and will be even more because of the Target 17.18 of the Sustainable Development Goals that states the increase in data disaggregated by disability status as well as income and gender. Although the data itself does not show genuine disadvantages related to disability enough, it will become possible by combining the data with appropriate methods, and I believe that this dissertation can be counted as one of such efforts.

While this dissertation closely examined the poverty and employment of persons with disabilities with novel empirical methods and datasets, there are several issues left behind for future research due to the methodological and data limitations. Firstly, in order to evaluate the causal impact of disability by controlling for unobservable factors, we can adopt 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 dissertation depends on cross-sectional datasets, 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 chapter with regard to type of

disability and poverty indicator. Although the Washington group short set of disability questions is usable and cost-effective, it does not have a specific question about mental health. Similarly, this dissertation 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 their decision making across the lifespan, examining these aspects contributes to deepening our understanding of disability and poverty.

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Table 2-1. Main empirical studies on the influences of disability in developing countries

(1) Paper by outcome	(2) Country	(3)Type of disability	(4) Severity of disability	(5) Age/Children /Adults	(6) Gender	(7) Residence area
On income/expenditures/assets						
Yamagata (2015)	Philippines	Cognitive			Females	
Filmer (2008)	13 countries			Adults (aged 20-50)		
Menon et al. (2014)	India			Children(aged<18)	Males	Urban
Mont & Nguyen (2011)	Vietnam				n.s.	Rural
Takasaki (2016)	Cambodia					
On education						
Filmer (2008)	13 countries					
Lamichhane & Kawakatsu (2015)	Bangladesh		Severe		n.s.	
Mizunoya et al. (2016a)	15 countries				Males (3 countries) Females (1 country)	Urban (1 country) Rural (3 countries)
Reyes (2015)	Philippines	Hearing			n.s.	Rural
Rischewski et al. (2008)	Rwanda					
Trani & Loeb (2012)	Afghanistan, Zambia	n.s.			Females	Rural
On employment/wage						
Lamichhane (2015)	Cambodia, Bangladesh, Nepal, Philippines,	Physical (Nepal, Philippines) Hearing, Multiple (Philippines)	Severe (Bangladesh)	Younger (Bangladesh, Nepal) n.s. (Cambodia, Philippines)	Females (all countries)	
Mitra & Sambamoorthi (2008)	India	Walk, communication				
Mitra & Sambamoorthi (2008)	India	n.s.	n.s.			
Mizunoya & Mitra (2013)	15 countries	Multiple			Males	
Mizunoya et al. (2016b)	Vietnam				Males	
Rischewski et al. (2008)	Rwanda					
Trani & Loeb (2012)	Afghanistan, Zambia	Cognitive, mental, multiple			Females (Afghanistan)	Rural
On multiple poverty indicators						
Mitra et al. (2013)	15 countries	Multiple		Older(aged>40)	Males	
Trani et al. (2015)	Morocco, Tunisia	Intellectual, mental, multiple	Moderate	Working-age (aged 18-65)	Girls, Women	Rural
Trani et al. (2013) (child poverty)	Afghanistan					
Trani & Cannings (2013) (child poverty)	Sudan	Intellectual, multiple	Severe	Younger (aged 5-9)	Girls	

Source: Prepared by author. Note: The columns (3)-(7) report the subgroups that are found to be more deprived among persons with disabilities in the paper. “n.s.” means the no significant difference by the factor found in the paper. The blank cell means that the paper does not examine the difference in the influences of disability by the factor.

Table 3-1. Share of persons with disabilities by type and severity of difficulty among disability 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
Number of observations	14,400	12,224	16,967	26,682	20,594

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 3-2. 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
Number of obs.	14,400	555,054	12,224	702,168	16,967	809,162	26,682	444,276	20,594	147,472

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 in each age group.

Table 3-3. 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 standards	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	$\frac{1}{21}$ / $\frac{1}{28}$

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 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 3-4. 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 of persons with and without disabilities in each age group, 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 of matched persons with and without disabilities by in each age group, and those in the columns (6) are the difference in the values in the columns (4) and (5). All of the gaps before and after matching were statistically significant at 1% level.

Table 3-5. 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†	53.9	51.9	2.0	55.2	52.3	2.9	50.3	50.7	-0.4†
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 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 "†."

Table 3-6. Subgroup 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†	.198	.189	.009†	.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 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 "†."

Table 3-7. Subgroup 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†	.075	.036	.039	.066	.028	.038	.073	.044	.029	.125	.090	.035
White	.012	.017	-.004†	.064	.020	.044	.035	.015	.020	.021	.015	.006†	.023	.023	.0001†
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†
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 are the adjusted headcount ratios of matched persons with and without disabilities categorized 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 "†."

Table 3-8. 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_{PWD}	-.003	-5.5%	-.008	-11.5%	-.007	-7.1%	-.007	-5.9%	-.012	-10.1%
	(.001)		(.001)		(.001)		(.001)		(.001)	
Δ_{NPWD}	.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 accounts for the total gap.

Table 4-1. Summary statistics of persons with disabilities between GHS 2002-08 and 2009-15

	GHS 2002-08 (1)	GHS 2009-15 (2)
(a) Disability-related characteristics		
Suffer from illness/injury within a month	37.2%	30.2%[a]
Recipient of disability grant	55.4%	34.0%
Distance to health institution: <15 min.	28.3%	35.3%
15-29 min.	34.8%	38.8%
>30 min.	36.9%	25.9%
(b) Basic characteristics		
Age	43.8	45.4
Male	51.1%	43.3%
Race: African	77.2%	81.3%
Coloured	16.7%	11.6%
Indian	1.9%	2.1%
White	4.2%	5.1%
Married	39.0%	42.4%
Education: not completed primary school	52.6%	40.7%
primary school	37.0%	40.6%
secondary school or higher	10.4%	18.7%
Household size	3.5	4.5
Dwelling type: formal	73.5%	79.6%
traditional	16.2%	11.9%
informal	10.2%	8.1%
In urban areas	55.1%	60.6%
Observations	13,621	10,411

Source: Prepared by author using the General Household Survey 2002-2015.
Note: The sample is restricted to persons with disabilities aged from 25 to 59 years.
a: Based on the data of GHS 2008-13 due to no relevant variable in the GHS 2014-15.

Table 4-2. Cross-tabulation of the result of "disability" and "difficulty" definitions in the GHS 2011

		"Difficulty"[b]		
		Without	With	Total
"Disability"[a]	Without	35,069	914	35,983
	With	670	560	1,230
	Total	35,739	1,474	37,213

Source: Prepared by author using the General Household Survey 2011.
Note: The sample is restricted to those aged from 25 to 59 years.
a: Persons who answered yes or no to the 'disability' question.
b: Persons who answered "a lot difficulty" or "cannot do at all" to any functionings or "some difficulty" for more than two functionings, or otherwise.

Table 4-3. Summary statistics of the sample of GHS 2011 by disability status based on "disability" and "difficulty" questions

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

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

Table 4-4. Regression results of pooled OLS estimation

	Year 2002-08			Year 2009-15		
	Active	Employed	Employed with payment	Active	Employed	Employed with payment
	(1)	(2)	(3)	(4)	(5)	(6)
Disability	-0.467	-0.372	-0.317	-0.286	-0.206	-0.207
	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)
Age	-0.003	0.005	0.004	-0.004	0.005	0.005
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Male	0.196	0.199	0.261	0.126	0.171	0.171
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
African	0.017	-0.091	-0.126	0.036	-0.052	-0.052
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Education: primary	0.069	0.040	0.072	0.098	0.087	0.087
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Education: secondary	0.179	0.195	0.270	0.191	0.283	0.280
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Urban	0.085	0.048	0.037	0.066	0.110	0.110
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.659	0.307	0.215	0.779	0.147	0.125
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
N	276,026	276,026	276,026	253,195	253,195	253,195
R^2	0.163	0.131	0.183	0.134	0.132	0.130

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

Table 4-5. Regression results of WLS and FE estimation with pseudo-panels

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
Disability	-0.678***	-0.621***	-0.593***	-0.461***	-0.581***	-0.466***
	(0.088)	(0.080)	(0.112)	(0.087)	(0.103)	(0.082)
Education: primary	0.284***	0.233***	0.352***	0.243***	0.352***	0.268***
	(0.051)	(0.054)	(0.066)	(0.062)	(0.061)	(0.058)
Education: secondary	0.263***	0.265***	0.372***	0.367***	0.439***	0.435***
	(0.061)	(0.070)	(0.077)	(0.077)	(0.071)	(0.066)
Urban	0.086**	0.033	-0.006	-0.078	-0.025	-0.092*
	(0.043)	(0.046)	(0.056)	(0.056)	(0.052)	(0.051)
Constant	0.764***	0.671***	0.657***	0.558***	0.496***	0.435***
	(0.057)	(0.050)	(0.068)	(0.056)	(0.065)	(0.055)
N	919	919	919	919	919	919
R^2	0.955	0.466	0.940	0.231	0.961	0.303
Panel B: Year 2009-15						
Disability	-0.312***	-0.281***	-0.300***	-0.291***	-0.305***	-0.285***
	(0.117)	(0.097)	(0.114)	(0.097)	(0.113)	(0.099)
Education: primary	0.050	0.037	0.201***	0.217***	0.218***	0.243***
	(0.075)	(0.077)	(0.074)	(0.068)	(0.074)	(0.069)
Education: secondary	0.142*	0.116*	0.457***	0.455***	0.465***	0.470***
	(0.075)	(0.069)	(0.077)	(0.070)	(0.076)	(0.070)
Urban	0.329***	0.290***	0.422***	0.335***	0.419***	0.343***
	(0.069)	(0.063)	(0.070)	(0.074)	(0.070)	(0.076)
Constant	0.535***	0.643***	0.191***	0.078	0.181**	0.045
	(0.073)	(0.075)	(0.073)	(0.083)	(0.073)	(0.084)
N	872	872	872	872	872	872
R^2	0.934	0.613	0.945	0.296	0.946	0.315

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

Table 4-6. Effects of disability on employment outcomes by sub-samples

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
(i) Male only	-0.704***	-0.665***	-0.540***	-0.434***	-0.582***	-0.496***
	(0.124)	(0.100)	(0.167)	(0.117)	(0.162)	(0.106)
(ii) Female only	-0.623***	-0.549***	-0.626***	-0.479***	-0.538***	-0.401***
	(0.130)	(0.121)	(0.156)	(0.121)	(0.133)	(0.122)
(iii) African only	-0.815***	-0.777***	-0.889***	-0.842***	-0.855***	-0.808***
	(0.124)	(0.119)	(0.160)	(0.146)	(0.150)	(0.142)
(iv) Non-African only	-0.563***	-0.545***	-0.361***	-0.339***	-0.343***	-0.339***
	(0.113)	(0.105)	(0.119)	(0.109)	(0.108)	(0.100)
Panel B: Year 2009-15						
(i) Male only	-0.303**	-0.323***	-0.341*	-0.367***	-0.348*	-0.386***
	(0.151)	(0.118)	(0.178)	(0.127)	(0.179)	(0.136)
(ii) Female only	-0.324**	-0.240	-0.300**	-0.268*	-0.301**	-0.248
	(0.164)	(0.145)	(0.150)	(0.154)	(0.148)	(0.150)
(iii) African only	-0.300*	-0.289***	-0.272*	-0.241*	-0.295*	-0.268**
	(0.160)	(0.109)	(0.159)	(0.127)	(0.157)	(0.131)
(iv) Non-African only	-0.199	-0.205	-0.282**	-0.302**	-0.240*	-0.265*
	(0.139)	(0.148)	(0.137)	(0.145)	(0.141)	(0.148)

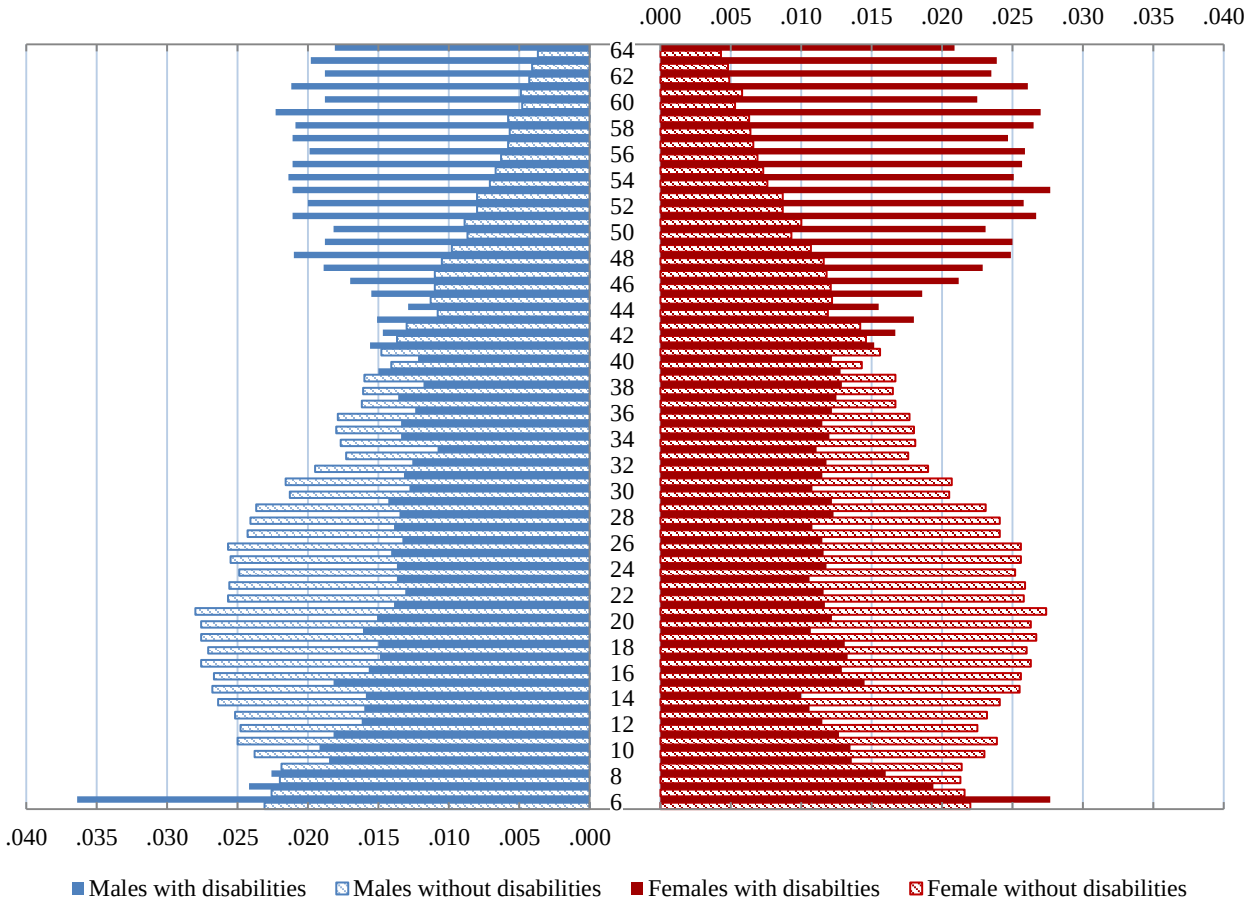
Note: Reported are coefficients on cohort-mean of disability status in the regression model for each sub-sample, and those in parentheses are robust standard errors. Specifications of all models are the same as Table 4-5. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 4-7. Change in the effects of disability on employment outcomes

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08 (Reference year=2007)						
Disability * Year 2002	0.012	0.026	0.021	0.040	0.006	0.031
	(0.025)	(0.026)	(0.032)	(0.031)	(0.029)	(0.029)
Disability * Year 2003	-0.054	-0.025	-0.017	0.004	-0.012	-0.003
	(0.036)	(0.024)	(0.047)	(0.032)	(0.046)	(0.030)
Disability * Year 2004	-0.072**	-0.046*	-0.026	-0.011	-0.015	-0.013
	(0.035)	(0.025)	(0.042)	(0.031)	(0.040)	(0.028)
Disability * Year 2005	-0.033	-0.014	-0.030	-0.001	-0.036	0.000
	(0.023)	(0.019)	(0.029)	(0.020)	(0.028)	(0.020)
Disability * Year 2006	-0.047*	-0.007	-0.027	0.011	-0.028	0.004
	(0.025)	(0.018)	(0.030)	(0.019)	(0.030)	(0.018)
Disability * Year 2008	0.021	0.032	0.007	0.026	-0.009	0.018
	(0.029)	(0.019)	(0.031)	(0.021)	(0.028)	(0.018)
N	162	162	162	162	162	162
R^2	0.982	0.749	0.960	0.589	0.954	0.531
Panel B: Year 2009-15 (Reference year=2009)						
Disability * Year 2010	-0.023	-0.021	-0.075	-0.019	-0.063	-0.000
	(0.042)	(0.030)	(0.061)	(0.030)	(0.062)	(0.030)
Disability * Year 2011	0.017	0.004	-0.061	-0.036	-0.052	-0.019
	(0.053)	(0.056)	(0.055)	(0.033)	(0.056)	(0.033)
Disability * Year 2012	0.049	0.028	-0.010	-0.022	-0.006	-0.009
	(0.048)	(0.029)	(0.060)	(0.035)	(0.060)	(0.036)
Disability * Year 2013	0.042	0.042	-0.052	-0.016	-0.044	0.001
	(0.052)	(0.045)	(0.058)	(0.034)	(0.060)	(0.035)
Disability * Year 2014	0.010	-0.004	-0.067	-0.047	-0.063	-0.033
	(0.048)	(0.036)	(0.062)	(0.031)	(0.062)	(0.035)
Disability * Year 2015	-0.011	-0.052	-0.157**	-0.108**	-0.139*	-0.078*
	(0.060)	(0.040)	(0.079)	(0.040)	(0.079)	(0.041)
N	133	133	133	133	133	133
R^2	0.973	0.737	0.938	0.385	0.939	0.359

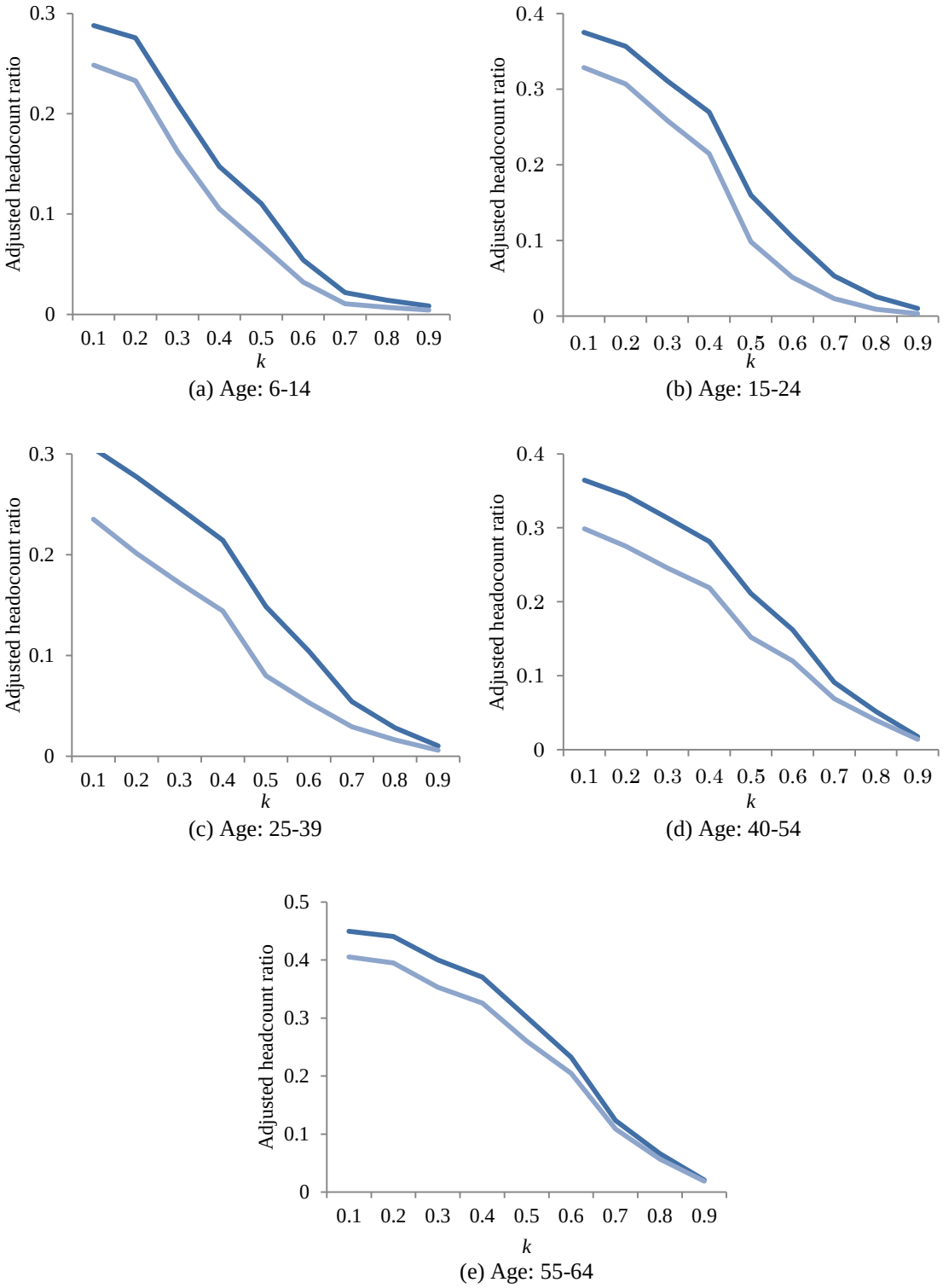
Note: Reported in parentheses are robust standard errors. Specifications of all models are the same as Table 4-5. * significant at the 10% level, ** significant at the 5% level.

Figure 3-1. Age distribution of persons with and without disabilities by gender



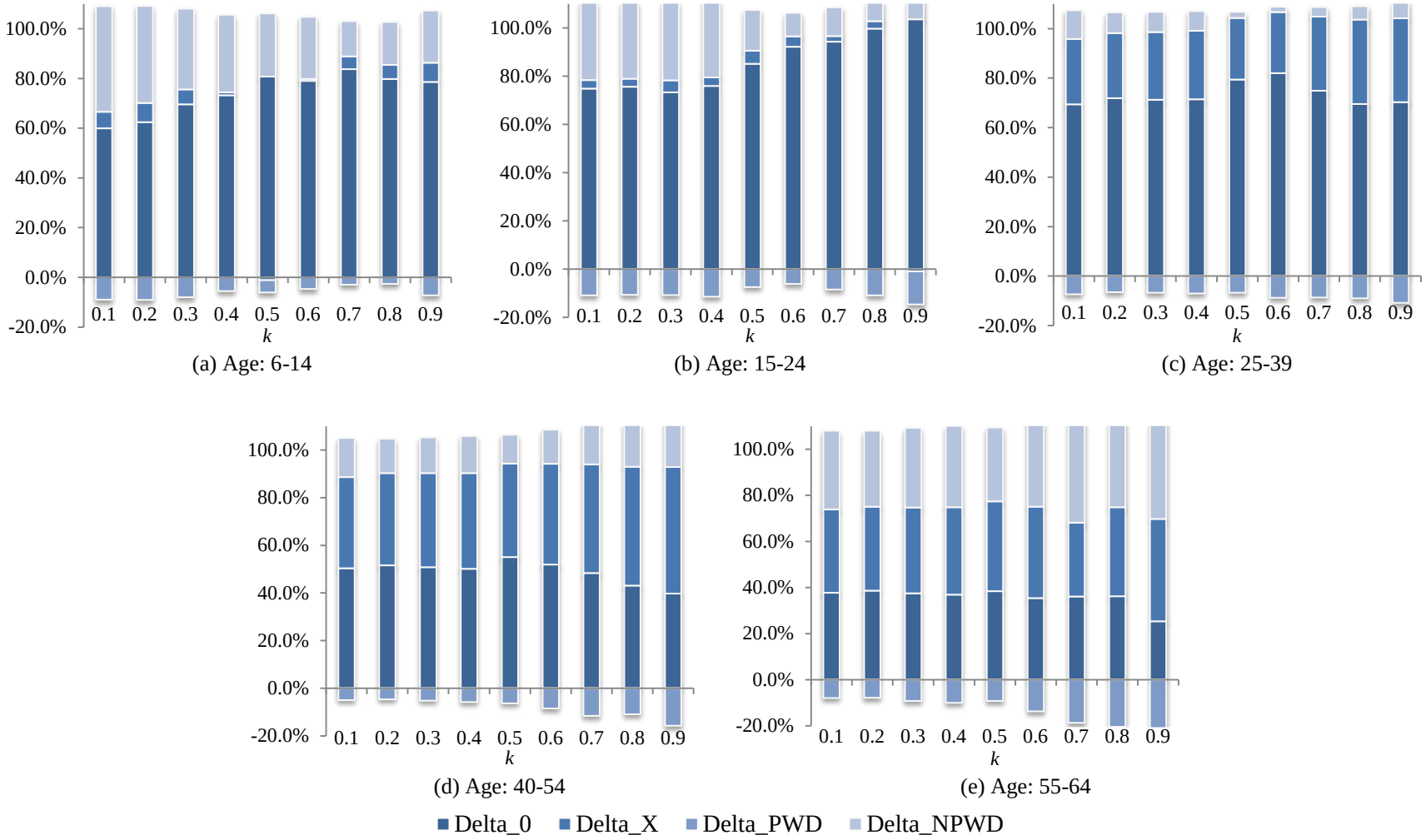
Source: Prepared by author using the 10% sample data of South African census in 2011.

Figure 3-2. Sensitivity analysis of the matching analysis with different poverty cutoffs



Source: Prepared by author.

Figure 3-3. Sensitivity analysis of the decomposition analysis with different poverty cutoffs

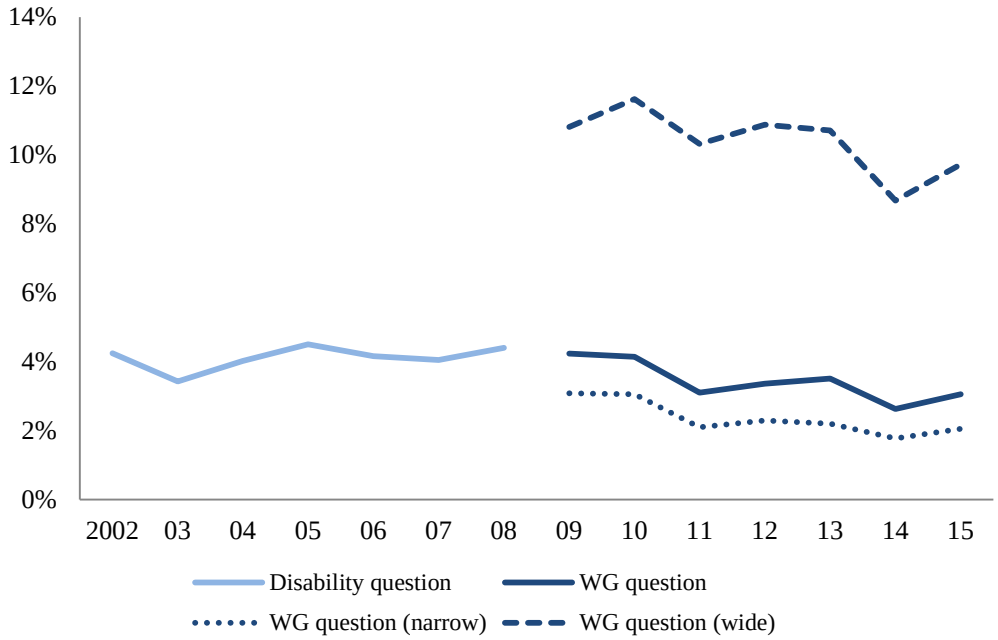


(a) Age: 6-14 (b) Age: 15-24 (c) Age: 25-39

(d) Age: 40-54 (e) Age: 55-64

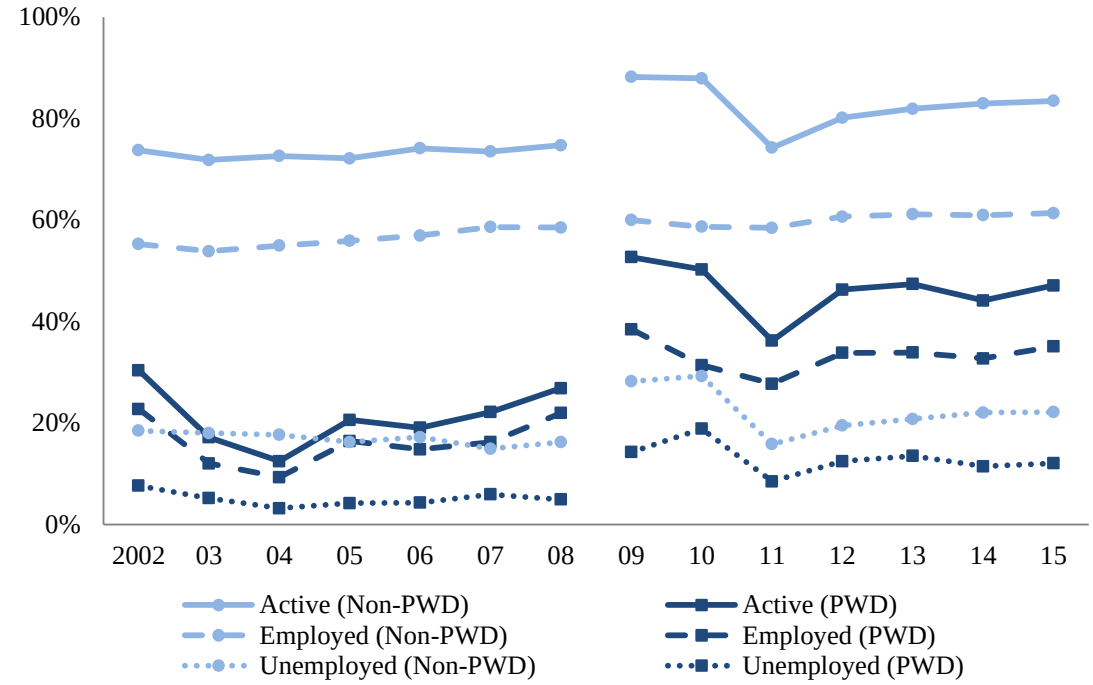
Source: Prepared by author.

Figure 4-1. Proportion of persons with disabilities by time and definition

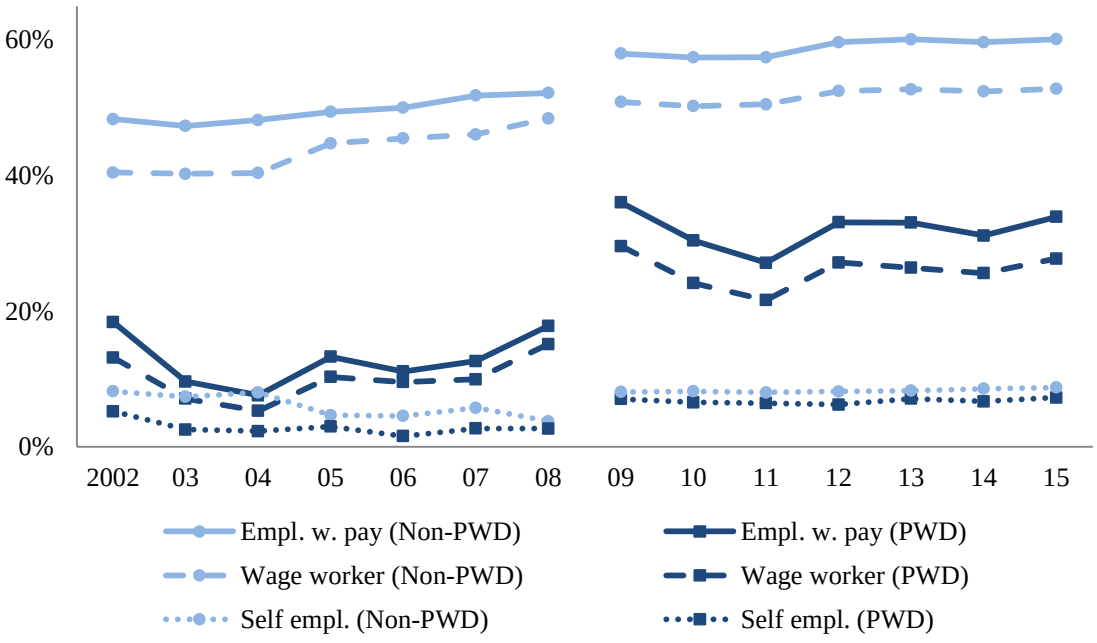


Source: Prepared by author using the General Household Survey from 2002 to 2015.
Note: Illustrated are the population proportions of persons with disabilities aged 25-59 years estimated by using the sampling weight of each survey.

Figure 4-2. Employment status and type by disability status



(a) Employment status



(b) Employment type

Source: Prepared by author using the General Household Survey from 2002 to 2015.
Note: Illustrated are the population means of each employment variable estimated with the sampling weight of each survey. PWD" stands for persons with disabilities.

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

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
Disability	-0.651***	-0.575***	-0.566***	-0.432***	-0.540***	-0.410***
	(0.082)	(0.071)	(0.104)	(0.077)	(0.095)	(0.078)
Education: primary	0.266***	0.201***	0.329***	0.206***	0.333***	0.239***
	(0.049)	(0.050)	(0.064)	(0.059)	(0.059)	(0.057)
Education: secondary	0.262***	0.255***	0.372***	0.357***	0.434***	0.419***
	(0.059)	(0.063)	(0.075)	(0.069)	(0.069)	(0.061)
Urban	0.054	-0.006	-0.055	-0.134**	-0.062	-0.133**
	(0.041)	(0.046)	(0.055)	(0.058)	(0.050)	(0.053)
Constant	0.436***	0.685***	0.409***	0.583***	0.331***	0.463***
	(0.050)	(0.053)	(0.063)	(0.056)	(0.059)	(0.054)
N	980	980	980	980	980	980
R^2	0.954	0.445	0.938	0.208	0.959	0.269
Panel B: Year 2009-15						
Disability	-0.303***	-0.267***	-0.305***	-0.318***	-0.299***	-0.292***
	(0.105)	(0.092)	(0.105)	(0.101)	(0.105)	(0.103)
Education: primary	0.067	0.082	0.193***	0.195***	0.218***	0.238***
	(0.070)	(0.074)	(0.069)	(0.067)	(0.069)	(0.069)
Education: secondary	0.154**	0.162**	0.422***	0.406***	0.434***	0.430***
	(0.069)	(0.068)	(0.071)	(0.061)	(0.071)	(0.063)
Urban	0.297***	0.198***	0.411***	0.261***	0.410***	0.276***
	(0.064)	(0.062)	(0.068)	(0.078)	(0.067)	(0.079)
Constant	0.478***	0.672***	0.089	0.203**	0.042	0.147*
	(0.078)	(0.078)	(0.081)	(0.082)	(0.081)	(0.082)
N	980	980	980	980	980	980
R^2	0.932	0.575	0.942	0.217	0.943	0.237

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

Appendix Table 2. Effects of disability on employment outcomes by sub-samples (full sample)

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08						
(i) Male only	-0.678***	-0.622***	-0.519***	-0.417***	-0.571***	-0.493***
	(0.116)	(0.097)	(0.156)	(0.109)	(0.150)	(0.101)
(ii) Female only	-0.593***	-0.487***	-0.584***	-0.404***	-0.458***	-0.259**
	(0.117)	(0.103)	(0.141)	(0.101)	(0.121)	(0.102)
(iii) African only	-0.815***	-0.777***	-0.889***	-0.842***	-0.855***	-0.808***
	(0.124)	(0.119)	(0.160)	(0.146)	(0.150)	(0.142)
(iv) Non-African only	-0.541***	-0.515***	-0.393***	-0.376***	-0.339***	-0.327***
	(0.094)	(0.086)	(0.102)	(0.088)	(0.093)	(0.087)
Panel B: Year 2009-15						
(i) Male only	-0.306**	-0.334***	-0.376**	-0.448***	-0.366**	-0.432***
	(0.131)	(0.124)	(0.158)	(0.141)	(0.157)	(0.144)
(ii) Female only	-0.348**	-0.268*	-0.297**	-0.246*	-0.290**	-0.213
	(0.156)	(0.142)	(0.143)	(0.138)	(0.142)	(0.138)
(iii) African only	-0.300*	-0.289***	-0.272*	-0.241*	-0.295*	-0.268**
	(0.160)	(0.109)	(0.159)	(0.127)	(0.157)	(0.131)
(iv) Non-African only	-0.187	-0.192	-0.300**	-0.330**	-0.241**	-0.273*
	(0.116)	(0.122)	(0.117)	(0.131)	(0.121)	(0.138)

Note: Reported are coefficients on cohort-mean of disability status in the regression model for each sub-sample, and those in parentheses are robust standard errors. Specifications of all models are the same as Table 4-5. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Appendix Table 3. Change in the effects of disability on employment outcomes (full sample)

	Active		Employed		Employed with payment	
	WLS	FE	WLS	FE	WLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Year 2002-08 (Reference year=2007)						
Disability * Year 2002	0.01	0.036	0.022	0.054*	0.005	0.037
	(0.022)	(0.024)	(0.028)	(0.028)	(0.026)	(0.026)
Disability * Year 2003	-0.054*	-0.015	-0.019	0.013	-0.014	0.001
	(0.032)	(0.025)	(0.042)	(0.029)	(0.041)	(0.026)
Disability * Year 2004	-0.069**	-0.026	-0.025	0.005	-0.017	-0.004
	(0.031)	(0.028)	(0.037)	(0.030)	(0.035)	(0.026)
Disability * Year 2005	-0.03	-0.001	-0.025	0.014	-0.031	0.014
	(0.023)	(0.019)	(0.028)	(0.021)	(0.027)	(0.022)
Disability * Year 2006	-0.042*	0.008	-0.023	0.019	-0.025	0.007
	(0.024)	(0.020)	(0.029)	(0.020)	(0.028)	(0.018)
Disability * Year 2008	0.031	0.051**	0.017	0.041*	0.000	0.026
	(0.028)	(0.021)	(0.029)	(0.021)	(0.027)	(0.017)
N	172	172	172	172	172	172
R^2	0.982	0.684	0.96	0.534	0.954	0.487
Panel B: Year 2009-15 (Reference year=2009)						
Disability * Year 2010	-0.024	-0.007	-0.052	-0.02	-0.045	-0.012
	(0.034)	(0.030)	(0.051)	(0.032)	(0.051)	(0.034)
Disability * Year 2011	-0.022	-0.046	-0.066	-0.073**	-0.06	-0.065**
	(0.038)	(0.028)	(0.044)	(0.028)	(0.044)	(0.029)
Disability * Year 2012	0.025	0.009	-0.010	-0.031	-0.007	-0.026
	(0.037)	(0.034)	(0.048)	(0.045)	(0.048)	(0.044)
Disability * Year 2013	0.023	0.021	-0.051	-0.036	-0.048	-0.033
	(0.036)	(0.029)	(0.043)	(0.039)	(0.043)	(0.039)
Disability * Year 2014	-0.026	-0.043	-0.068	-0.048	-0.067	-0.044
	(0.036)	(0.033)	(0.048)	(0.040)	(0.048)	(0.042)
Disability * Year 2015	0.014	-0.005	-0.041	-0.025	-0.037	-0.021
	(0.043)	(0.029)	(0.057)	(0.045)	(0.056)	(0.044)
N	172	172	172	172	172	172
R^2	0.972	0.709	0.932	0.397	0.934	0.393

Note: Reported in parentheses are robust standard errors. Specifications of all models are the same as Table 4-5. * significant at the 10% level, ** significant at the 5% level.