Assessing the impact of social grants on household welfare using morning after simulation and PSM approach

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Assessing the impact of social grants on household welfare using "morning after" simulation and PSM approach

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Abstract

Despite having relatively well-developed social security system, poverty levels in rural parts of South Africa remains very high. This study employs a cross-sectional households' survey data conducted in Hlokozi village (located in one of the poorest provinces in South Africa – Kwazulu Natal Province) and propensity score matching technique (which accounts for non-random selection of households) to investigate the impact of social grants on rural household welfare. The results reveal that social grants have a significant and positive impact on rural household welfare. Specifically, the nearest neighbour matching estimates suggest that the causal effect for social grants on household welfare is the region of about R 5830. Consistent with the nearest neighbouring method, the results obtained using Kernel matching method shows that social grants are significant in improving rural household welfare. Our finding seem to lend credence to the conclusion of previous studies that social grants (conditional or unconditional) help in the way of lifting households out of poverty and improve their welfare. Thus rural areas (traditional rural areas) should continue to be a chief focus of poverty alleviation efforts in South Africa.

Keywords: PSM, poverty, household welfare and South Africa

JEL Classification: H55, J14, J18

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1 Introduction

Since the inception of democratic rule, South African government has turned to social grants to address the issues of poverty, income inequality and to improve household welfare. The coverage of social grants has increased substantially with more than 17 million (about 34% of the population) of South Africans being recipients of social grants. Despite an increase in the coverage of social grants and well developed social security system poverty in South Africa remains high by historical and international standards. Approximately half of South African population live in poverty (Hoogeveen and Özler, 2005; Tregenna, 2012; Biyase, 2014). Moreover, poverty is disproportionally dominant among subgroup of population that is vulnerable such as female headed-households (Posel and Rogan, 2011), children (Streak, 2005) and in rural areas (Dieden and Gustafson, 2003, Zimbalist, 2017).

A number of studies have examined the extent to which social grants have been successful in reducing poverty (Woolard and Leibbrandt, 2010; Satumba, Bayat and Mohamed, 2017; Armstrrong and Burger, 2009; Bhorat and Kanbur, 2006). While these studies have shed some light on poverty reducing effect of social grants (i) only a few studies have interrogated the impact of social grants on household welfare (ii) most of these studies have relied on descriptive analysis (Satumba, Bayat and Mohamed, 2017, Armstrong and Burger 2009), (iii) Besides poverty being high in rural areas, research on the impact of social grant on rural household welfare remains thin. Thus this paper contributes and improves upon the existing literature by using propensity score matching technique to investigate the impact of social grants in a village located in one of the poorest provinces in South Africa. The propensity score matching technique reduces selection bias and account for curse of dimensionality by matching grants recipients with non-recipients who have similar pre-treatment characteristics.

The rest of the paper is structured as follow: the next section reviews the existing empirical literature on the effects of social grants on household welfare. Section 3 describes the empirical methodology and database used in this paper and Section 4 presents the results. The last section provides some concluding remarks.

2 Literature review

The literature investigating the impact of social grants on poverty and households welfare in sub-Saharan African countries is vast (Levina, Van der berg and Yu (2011) for Namabia; Asfaw, Carraro, Davis, Handa and Seidenfield (2017) for Zambia; Kenya CT-OVC Team (2012) for Kenya; Lekobane and Seleka (2017) for Botswana; Woolard and Leibbrandt (2010), Booysen (2005), Woolard, Harttgen and Klasen (2011), Gatura and Tanga (2017), Zimbalist, (2017), Barrientos (2003), Bhorat and Kanbur (2006), Case and Deaton (1998) for South Africa) to name just few. Although South Africa is the most researched country due to richness of the data, there are still some gaps that exist in South Africa literature. We will only provide brief overview of South Africa literature, since our study is based in South Africa.

A study by Woolard and Leibbrandt (2010) investigated the impact of unconditional cash transfers on poverty using the first wave of National Income Dynamic (NIDS) study. They found that social grants have more impact on the income of household located at the bottom of income distribution -- suggesting that social grants are well targeted to the poorest of the poor. Moreover, they found that although social grants have negligible impact on poverty headcount ratio, the impact on the depth and severity of poverty was substantial.

Similar results were obtained by Satumba, Bayat and Mohamed (2017). Using 2010/2011 income and expenditure household survey, Satumba, Bayat and Mohamed (2017) assessed the impact of social grants on poverty, using Foster, Greer and Thorbecker poverty indices. They found that social grants significantly reduce poverty in provinces that have high poverty rates such as Limpopo and Eastern Cape and in rural areas. Moreover, the impact of social grants was more substantial among vulnerable groups such as Africans and female-headed households. Consistent with the findings of Woolard and Leibbrandt (2010), they argue that social grants are well targeted to the poor.

Armstrong and Burger (2009) used income and expenditure data of 2005 to assess the impact of social grants on poverty and inequality using normalized FGT class of decomposable poverty indices and the general entropy to measure poverty and inequality respectively. Consistent with Woolard and Leibbrandt (2010) and Satumba, Bayat and Mohamed (2017), they found that social grants have a considerable impact on the level, depth and severity of poverty. They further found that while the impact of social grants on poverty was substantial, the impact on inequality was negligible. Other studies that found social grants to be effective in reducing poverty include Booysen (2005), Woolard, Harttgen and Klasen (2011), Gatura and Tanga (2017), Zimbalist, (2017), Barrientos (2003), Bhorat and Kanbur (2006), Case and Deaton (1998) just to name few.

Notwithstanding a substantial number of studies conducted in South Africa, there are still some gaps in the South African literature. Firstly, most of South Africa studies have to a large extend focused on using national data to interrogating the impact of social grants on poverty, while the impact of social grants on poverty in rural areas of the country remains under-researched due to a lack of data in these areas. Secondly, Empirical strategies used in most of these studies are mainly descriptive and are based on the assumption that household welfare is only influenced by social grants. Our study seeks to fill these gaps by using a cross-sectional data collected in a village located in one of the poorest province in South Africa. We use appropriate estimation techniques that is not descriptive.

3 Data and methodology

This paper employs a cross-sectional households' survey data conducted in Hlokozi village to analyse the impact of social grants on household welfare. Stratified random sampling method was used in gathering data from the respondents. The respondents were classified on the basis of various features such as the main road and river valleys and the Hlokozi area was divided into three convenient sections. This was done primarily for reasons of convenience in numbering the homesteads – with 2205 numbers to be assigned. A sample was drawn for each section (proportionate to its household counts) by using a random number table. A total of 282 households were surveyed for the study.

As a way of setting the scene we first analyse the effect of social grants using a "naïve" or "morning after" simulation method (e.g. before-after comparisons). Specifically, households' welfare is calculated before and after excluding social grants from the total income. Implicit in this analysis is the unpalatable assumption that in the absence of social grants the household welfare of the recipients would have been the same as before the introduction of social grants. Moreover the analysis assumes that changes in household welfare of recipients are not influenced by any other factors except social grants. Given the inadequacies of this basic method, we also adopt appropriate analysis of social grant impact which requires a response to the question: What would have happened to the welfare of the recipients if they did not get the grants? To answer this question we perform propensity score matching which pairs households that receive social grants with other similar households, except for social grants. We estimate the probability of receiving social grants as a function of individual and household characteristics, rank recipient and non-recipient households by their propensity score, pair individual members of recipient households, and non-recipients with similar propensity scores, and calculate the average difference in welfare across them.

Specifically, we adopt a three-step estimation procedure to investigate the effect of social grants on household welfare. In the first step, we estimate a logit model comprising the explanatory variables of receiving social grants. These include age of the head of household, household income and household size, and gender of the household head. In the second step, the estimates of the logit model are used to compute the propensity score, understood as the probability of receiving social grants. In the third step, the propensity score derived from the logit model is used to match the receiving households with non-receiving households. The propensity score index is defined as the probability of receiving treatment conditional on observed covariates X:

$$\mathrm{P(X) = Pr(D = 1 \mid X)} \qquad (1)$$

Where $\mathrm{P(X)}$ is the abbreviation for propensity score, Pr is a probability, D=1 indicates exposure to the treatment, the "|" symbol stands for conditional on, and X is a set of observed covariates.

PSM analysis requires fulfilment of various assumptions such as the conditional independence assumption (CIA) or the assumption of selection on observables (Rosenbaum and Rubin (1983); Heckman and Robb (1985)). This assumption implies that conditional on the observable characteristics of potential participants, potential outcomes are not dependent of the participation status. The CIA can be expressed as following:

$$\mathrm{Y^0, Y^1 \perp D \mid X} \qquad (2)$$

Where: $\perp$ denotes independence and, D=1 indicates exposure to the treatment, the "|" stands for conditional on, X is a set of observed covariates and Y^0 *and* Y^1 are potential outcomes

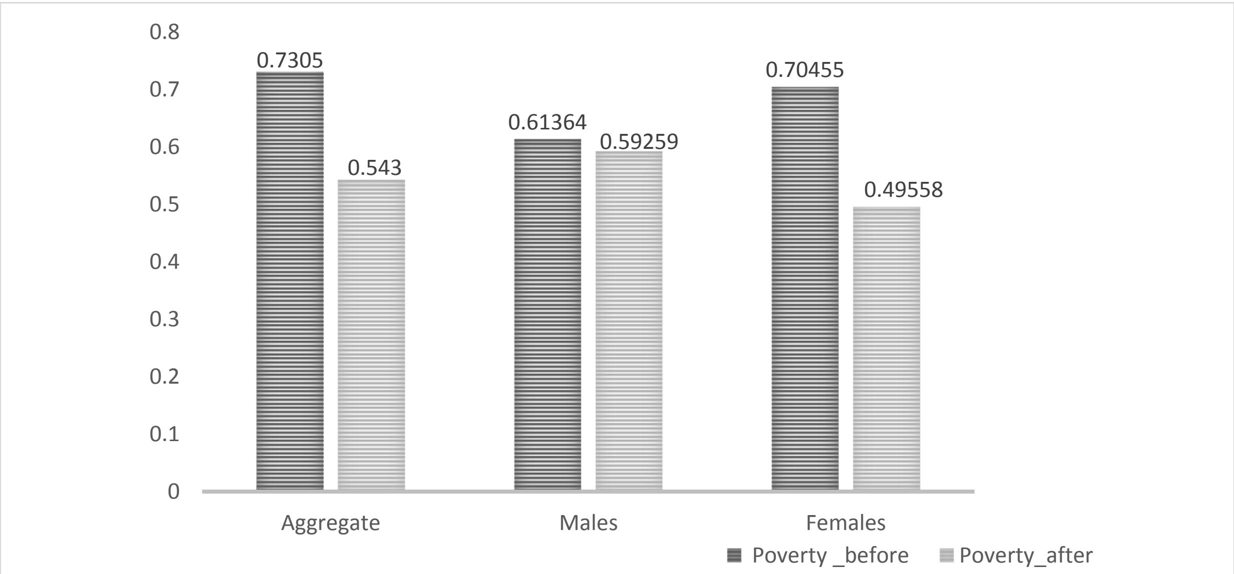
Since estimates are sometimes sensitive to the choice of matching technique, we implement two frequently used approaches. We consider nearest neighbour matching (NNM) and kernel-based matching (KBM). With nearest neighbour matching, each member of the treatment group is matched to a non-treated unit using the closest propensity score. Whilst the kernel-based matching the propensity score of each treated unit is matched with the kernel weighted average outcome of all non-treated units.

4 Results

4.1 "Morning after" simulation: Before and after comparison

We first present results based on "Morning after" simulation which provide us with a first impression on how social grants might affect household welfare (in figures 1-5). Figure 1 shows the level of poverty (P0) before and after social grant. The level of poverty, defined for income net of social grants is 73.05% and it goes down to 54.30% for income defined inclusive of social grants. Thus, social grants seem to be effective in reducing the level of poverty. These results are consistent with most studies in the literature (Hoogeven and Ozler, 2005; Armstong and Burger, 2009; Van der berg, Siebrits and Lekewza; 2010; Maitra and Ray, 2003). The table also shows poverty level by gender. Interestingly, poverty incidence declines from 61% to 59% for males and from 70% to 49% for females. Social grants have a considerable impact in reducing poverty among females.

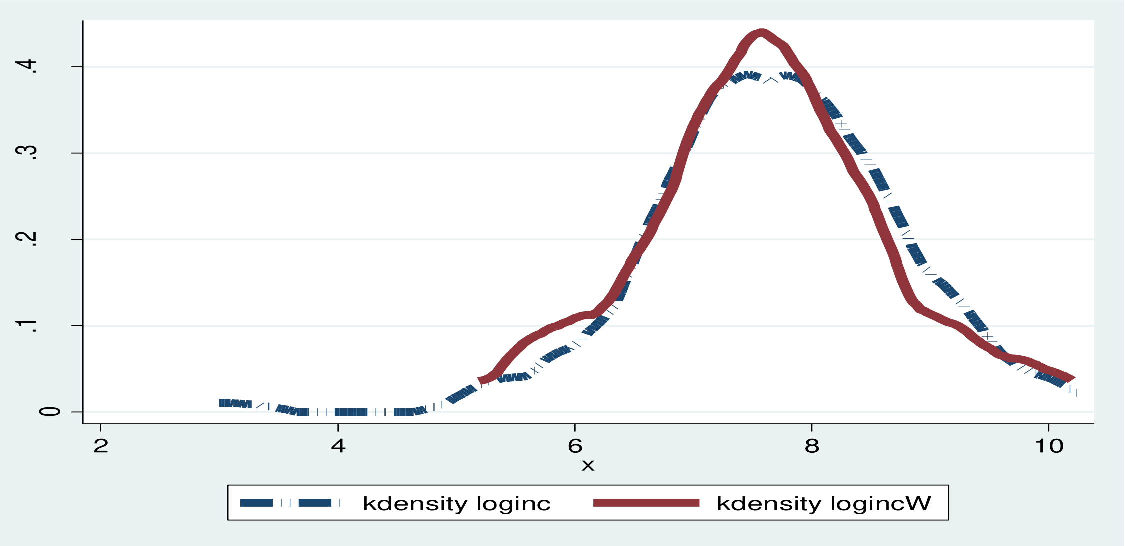
Figure 1: Level of poverty before and after social grants



Source: own calculation based on survey data

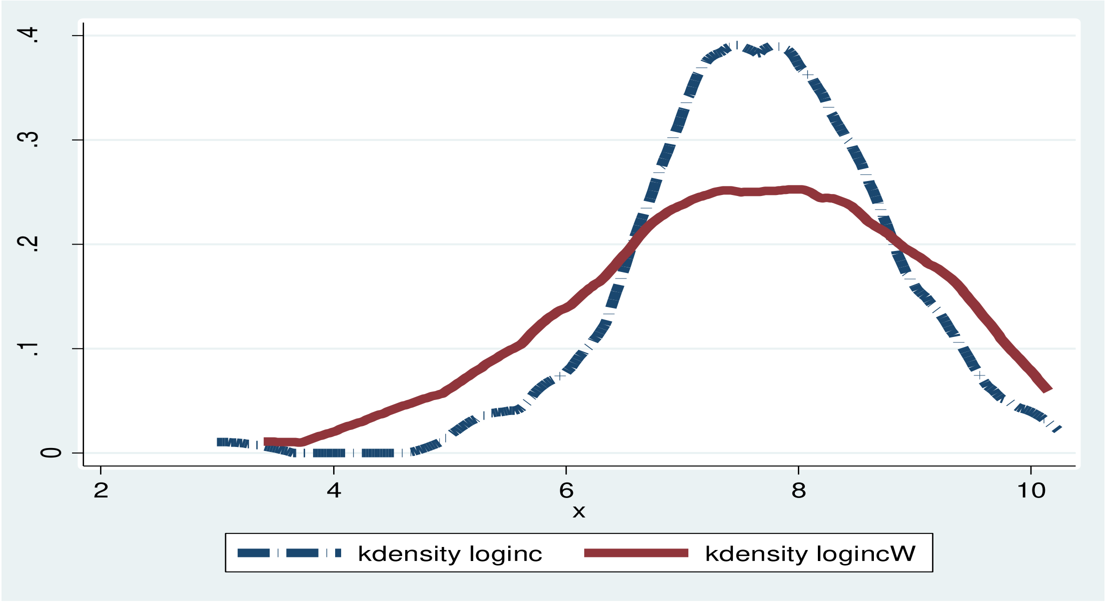
Following number of studies in this field (Biyase, Zwane and Rooderick, 2017; Posel, 2016, Maitra and ray, 2003), we assess the impact of social grants on the distribution of households' income by estimating the kernel density of a log of income with and without social grants for males and females separately. The most striking features of the two figures is that while social grants slightly shift the entire distribution of income for the males (figure 2), the impact on the distribution of income for the females (figure 3) is more noticeable.

Figure 2: Kernel density of income with and without grants for males



Source: own calculation based on survey data

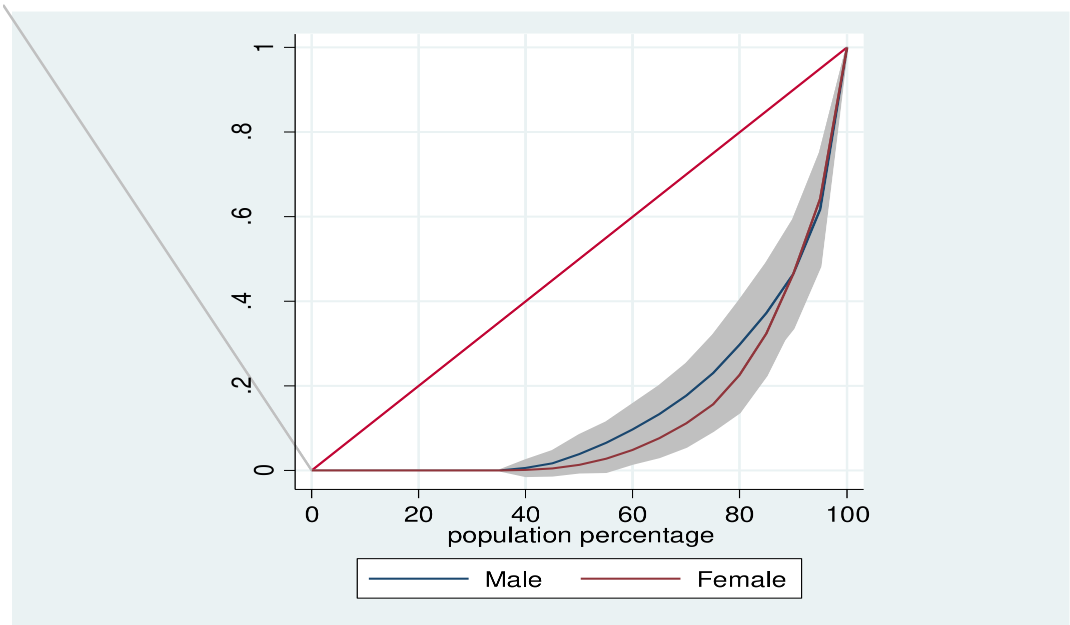
Figure 3: Kernel density of income with and without grants for males



Source: own calculation based on survey data

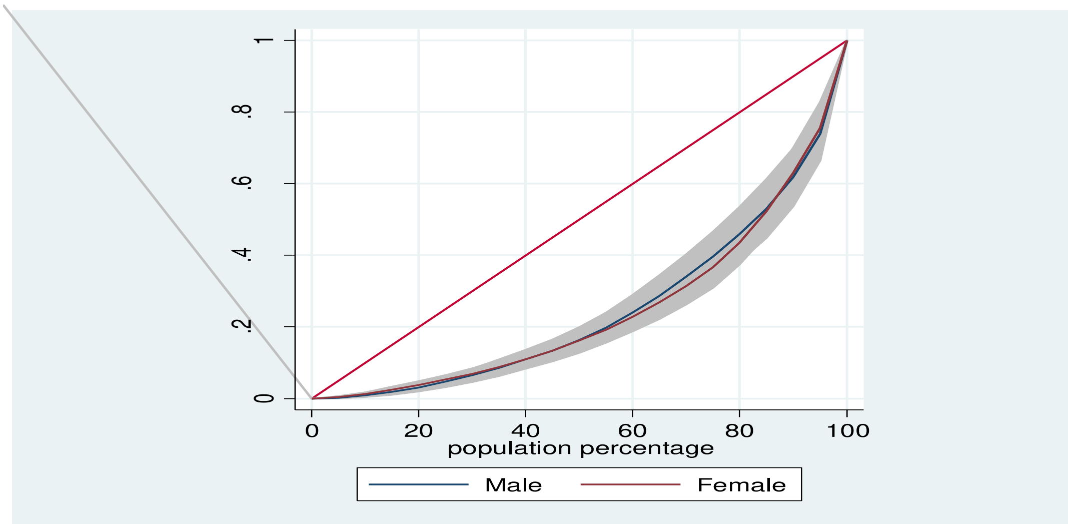
Lastly, we assess the impact of social grants on gender inequality by graphing the Lorenz curves when income is exclusive (figure 4) and inclusive (figure 5) of social grants. Lorenz curve plots cumulative distribution of the population on the horizontal axis against cumulative distribution of income share in the vertical axis. The further Lorenz curve lies below the diagonal line, the higher is the level of inequality. Comparison of two figures shows some interesting results. Firstly, female Lorenz curves lies below male curves in both graphs, implying that female inequality is higher than male inequality. Secondly, gender inequality is higher when income is defined net of social grants (figure 4) compared to when income is inclusive of social grants. Thus, social grant are effective in reducing gender inequality. Lastly, although not showed in one graph, social grants reduce the overall inequality for both females and males.

Figure 4: Lorenz curve for pre-transfer income



Source: own calculation based on survey data

Figure 5: Lorenz curve for post-transfer income



Source: own calculation based on survey data

4.2 Propensity-score matching estimates

Factors influencing social grants

Having reported the estimates from the naive approach, we now turn to the results of propensity-score matching. The first step in the analysis is to estimate the probability of receiving social grants as a function of household characteristics. The estimated coefficients of the probit model, along with the levels of significance are presented Table A1. The results suggest that households asset (measured by land), government assistance[3] (whether household has recieved some assistance from a state initiatives), food security, number of migrants in household, marrital status of the household head, age and gender of the household are not important in explaning the likelihood of receiving social grants. While these variables were were found to be insignificant determinants of social grants, they were included in the analysis because they constitute important factors in explaining household welfare (Biyase and Zwane 2018; Lekobane and Seleka, 2017; Malik, 1996; Serumaga-Zake and Naude, 2002; Mukherjee and Benson, 2003; Geda et al. 2005; Datt and Jolliffe, 2005; Mok et al. 2007; Julie et al. 2008; Litchfield and McGregor, 2008; Akerele and Adewuyi, 2011; Gounder, 2012; Edoumiekumo et al. 2013).

Among all the explanatory variables considered, education and remit dummy significantly influenced the probability of receiving social grants. For example, the likehood of receiving

[3] Initiatives taken to improve the standard of living of communities in non-urban areas.

remittances is positive, implying that remittances significantly increases the likelihood of receiving social grants. This is possible if migrants exert pressure on governments to increase their spending, using remittances as a leverage (Ambrosius, 2016). There are a number of empirical studies to support this claim (Aparicio and Meseguer 2012; Meseguer and Aparicio 2012; DuquetteRury 2014; Garcia Zamora 2005; Iskander 2015; Simpser et al. 2016). They found that "migrants use collective remittances by Home-Town-Associations (HTA) as leverage in order to obtain additional spending by municipal, state and federal governments for the financing of public works in their communities".

Impact of social grants on household welfare.

The effect of social grants on household welfare is estimated with the nearest neighbor (NNM) and kernel-based matching (KBM) algorithms. The results of the propensity score matching on the impact of social grants on household welfare are given in Tables 1 and 2. The results in Table 1 shows that social grants exerts a positive and significant impact on the household welfare (measured by per capita income) in Hlokozi village. Specifically, the nearest neighbor matching estimates suggest that the causal effect for social grants on household welfare is about R 5830 in Hlokozi.

With regard to kernel-based matching algorithm, (each participant is matched with a weighted average of all nonparticipants with weights that are inversely proportional to the distance between the propensity score of the participants and nonparticipants), the effect of social grants on household welfare shows an increase of R8535[4]. This finding is collaborated by Kyophilavong (2011) who found that cash transfers to poor households with children could reduce poverty and improve income distribution in both urban and rural areas and that poor rural families with children rather than the urban poor, seem to benefit more in terms of poverty reduction, from this cash transfer program. Thus these authors recommend that the Lao government should consider establishing a comprehensive social support program aimed at reducing poverty in Laos.

Our finding also confirmed the conclusions of other previous studies which have shown that conditional cash transfers (Banerjee et al. 2010; Brune et al. 2011; Bandiera et al. 2013), and

[4] As can be seen in the results all the matching techniques produce consistent estimates of the effect of social grants on household welfare.

unconditional cash transfers (Haushofe and Shapiro 2013; Blattman, Fiala, and Martinez 2013; Cunha, De Giorgi, and Jayachandran 2011) have positive effects on consumption, income, and other welfare indicators.

Table 1: Average treatment effect of grants on household welfare
Nearest neighbour matching

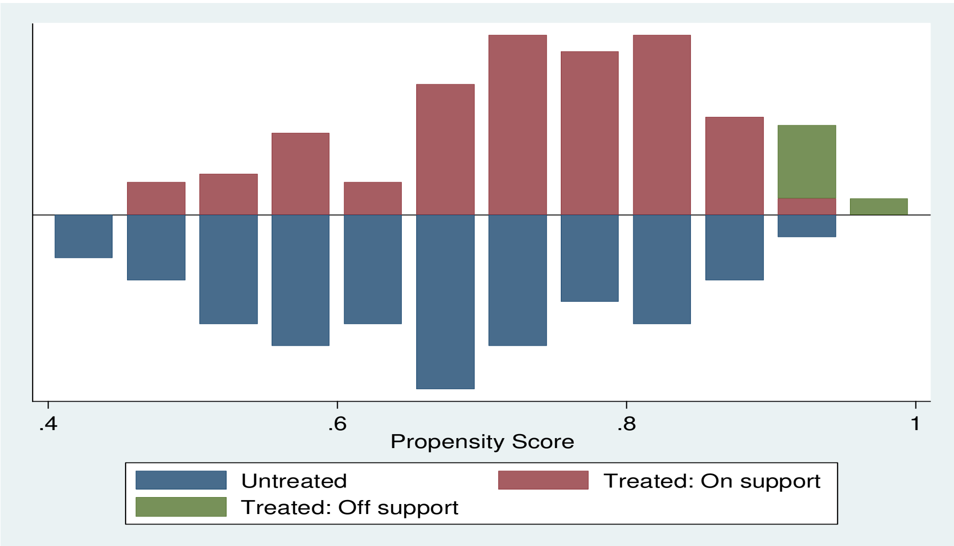
Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HH_income	Unmatched	7018.056	4769.048	2249.008	[1667.183]	1.35
	ATT	7678.696	1847.826	5830.87	[1917.244]	3.04

Table 2: Average treatment effect of grants on household welfare
Kernel estimator

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HH_income	Unmatched	7018.056	4769.048	2249.008	[1667.183]	1.35
	ATT	10155.38	1619.523	8535.862	[2861.943]	2.98

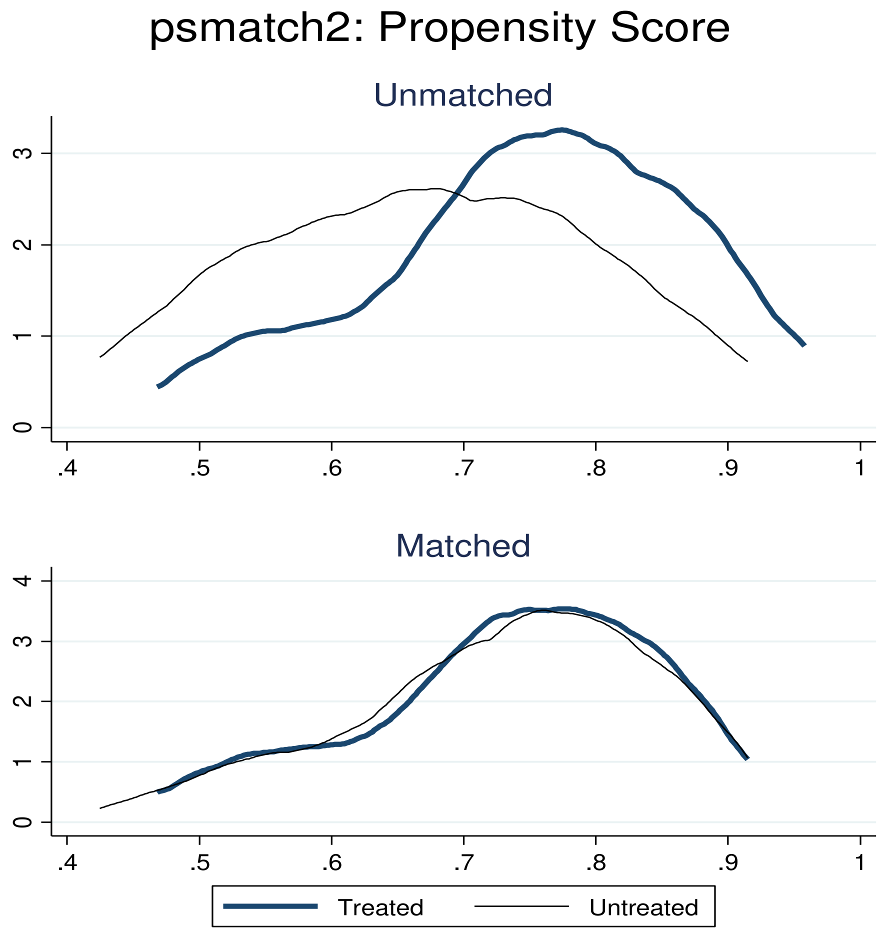
The density distribution of the propensity scores for recipients and non-reciepients is shown in (Figure 6) below. The bottom half of the graph shows the propensity score distribution for the non-treated or non-reciepients, while the upper-half refers to the treated or recipients individuals. Visual analysis of the density distribution of the propensity scores suggests that there is a high chance of getting good matches.

Figure 6: Distribution of the Propensity Scores in Common Support Area



We also plot the distributions of the propensity scores for the receiving households with non-receiving households to visually check the overlap condition and to see if the matching is able to make the distributions more similar. The distributions of the propensity scores, before and after the matching, are plotted in figure 7. Graphical assessment suggests that the densities of the propensity scores are more similar after matching. The plot also reveals a clear overlapping of the distributions.

Figure7: distributions of the propensity scores



Conclusion

This paper use both naïve approach ("morning after" simulation) and appropriate econometric technique (propensity score matching) to investigate the impact of social grants on household welfare in Hlokosi village, a village located in one of the poorest province in South Africa. Using "morning after" simulation analysis, we found that social grants are effective in improving household welfare. Perhaps interestingly, we found that the effect of social grants on the welfare by female is considerably higher compared to males. The results of the propensity score matching on the impact of social grants on household welfare shows that social grants exerts a positive and significant impact on the household welfare (measured by per capita income) in Hlokozi village. Specifically, the nearest neighbor matching estimates suggest that the causal effect for social grants on household welfare is about R 5830 in Hlokozi.

With regard to kernel-based matching algorithm, (each participant is matched with a weighted average of all nonparticipants with weights that are inversely proportional to the distance between the propensity score of the participants and nonparticipants), the effect of social grants on household welfare shows an increase of R8535[5]. This finding is collaborated by Kyophilavong (2011) who found that cash transfers to poor households with children could reduce poverty and improve income distribution in both urban and rural areas and that poor rural families with children rather than the urban poor, seem to benefit more in terms of poverty reduction, from this cash transfer program.

The policy implication of the findings is that social grants should continue to be used as a tool to alleviate poverty and reduce inequality in rural areas. Moreover, the coverage of social grants among females should be increased to reduce high level of female poverty and income inequality.

[5] As can be seen in the results all the matching techniques produce consistent estimates of the effect of social grants on household welfare.

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Appendix A

Table A.1: Estimation of the propensity scores, logit model estimating the probability of receiving

Variables	Coef.	Std. Err.	T-stats
Educ	0.916919	[0.423364]	**
Educ_SQ	-0.10524	[0.044474]	**
Migrant	0.289689	[0.411652]	
remit_dummy	4.506556	[1.803807]	**
Asset	-2.17482	[1.561949]	
Govt_assist	0.161962	[0.95197]	
Food_sec	-0.44847	[0.880984]	
Number of migrants in HH	0.269735	[0.523994]	
HHH_married	1.131275	[1.062169]	
Head_age	0.040736	[0.043255]	
Age_SQ	-0.00076	[0.000556]	
HH_gender_1	-0.4971	[1.012819]	
Cons	-4.41057	[2.800051]	**

Notes: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.