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An Empirical Analysis of the Determinants of poverty and household welfare in South Africa

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Abstract

The data used for our analysis is drawn from the first four waves of the National Income Dynamic Study to determine the factors that influence poverty and household welfare in South Africa. Contrary to most existing studies, which have applied ordinary least squares and probit/logit models on cross-sectional data, this analysis captures unobserved individual heterogeneity and endogeneity, both via fixed effect, and via a robust alternative based on random effect probit estimation. The results from fixed effect and random effect probit indicate that levels of education of the household head, some province dummies, race of the household head, dependency ratio, gender of the household head, employment status of the household head and marital status of the household head are statistically significant determinants of household welfare. Consistent with previous research, we also found that, compared to traditional rural areas (used as reference category), households living in urban and farms are less likely to be poverty stricken, which implies that rural areas (traditional rural areas) should continue to be a major focus of poverty alleviation efforts in South Africa.

Keywords: fixed effect, random effect probit, poverty, household welfare and South Africa
JEL Classification: H55, J14, J18
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1 Introduction

This paper investigates the determinants of poverty and household welfare in South Africa using the National Income Dynamic Study data. South Africa offers a useful case due to its long and notorious history of high poverty levels, despite having decreased in recent years. The issue of poverty has been on the agenda of the South African government for many years. For example, in 2004 the Accelerated and Shared Growth Initiative for South Africa (ASGISA) acknowledged the challenges of prolonged poverty and other related problems (unemployment, and low earnings, and the jobless nature of economic growth). The New Growth Path policy announced by President Zuma in 2010 still raised similar issues – unemployment and poverty remains extremely high by international standards. The most recent government policy (the National Development Plan) introduced in 2013 as South Africa's long-term socio-economic development roadmap placed even more emphasis on similar issues and was viewed as a policy blueprint for eradicating poverty and reducing inequality in South Africa by 2030.

Although many studies have investigated trends and profile of household welfare in South Africa, empirically, (i) there is a limited number of studies investigating the determinants of household welfare and poverty (ii) the statistical inference of some of these studies relies on cross-sectional data using multivariate ordinary least squares (OLS) analysis and probit or logit model. Moreover, the findings from the existing studies have not offered clear evidence regarding the determinants of household welfare, which creates a gap in the literature and has serious policy implications. This paper contributes and improves upon the existing literature by using a four years of panel data from the National Income Dynamic Study. Using appropriate panel data approaches such as fixed effect and random effect probit we explicitly account for unobserved household heterogeneity and endogeneity bias in the estimated coefficients. Such bias can arise due to the "missing variable" problem" Gewwe (1991).

The remainder of this paper is structured as follows. Section 2 offers a brief review of the existing empirical literature. Section 3 describes the panel data employed in this paper. Section 4 discusses the methodology employed. Section 5 presents the empirical results. Finally, section 6 provides some concluding remarks.

2 Literature review

The empirical literature on the determinants of poverty and welfare within a country specific settings as well as cross-country settings is well established. However, the empirical finding has continued to generate controversies among scholars, with no profound empirical answer with reference to the appropriate factors that are likely to influence household's poverty and welfare statuses (see for instance, 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; Sekhampu, 2013; Edoumiekumo et al. 2014; Lekobane and Seleka, 2017). Controversies, especially with reference to the ambiguous results, can be attributed to diversified data coverage in a large number of countries and even the adopted measurement approach (Akerele and Adewuyi (2011)).

In measuring poverty and welfare, scholars often adopt various approaches. Some studies have embraced a non-monetary approach – computing an asset index which gives socio-economic status of each household in the sample (see for example, McKenzie, 2003; Cortinovis et al., 1993; Booysen, 2002; Vyas and Kamaranayake, 2006; Achia et al., 2010; Kimsun, 2012; Xhafaj and Nurja, 2013; Farah, 2015; Habyarimana et al. 2015; Sahn and Stifel, 2000; Sahn and Stifel, 2003; Barrett et al, 2006; Booysen et al., 2008). While another strand of literature, have endorsed the use of monetary dimension to poverty analysis. The major focus of these studies is on the income or consumption expenditure as measures of household welfare (more on this later).

What are the determinants of poverty and household welfare? Poverty, household welfare and its determinants have been a major and extensive area of study and research for many years, in both developed and developing countries. The determinants of poverty and household welfare have been modelled using two alternative approaches. The first approach employs probit/logit models to examine the determinants of the probability of a households being poor. This approach has been widely used in the empirical literature by previous scholars (see Grootaert, 1997; McKenzie, 2006; Malik, 1996; Serumaga-Zake and Naude, 2002; Geda et al., 2005; Mok et al., 2007; Akerele and Adewuyi, 2011; Edoumiekumo et al., 2013; Edoumiekumo et al., 2014).

The second alternative approach models the determinants of welfare as measured by consumption or income using Ordinary Least Square (OLS). This is the approach followed by Glew (1991), Kabubuo-Mariara, 2002, Mukherjee and Benson (2003), Quartey and Blankson (2004), Adams (2004, 2006), Datt and Jolliffe (2005), Guzman et al. (2006), Quartey (2006), Akerele and Adewuyi (2011). The empirical results from these approaches tend to yield similar results because factors that increases welfare measured by income or consumption should lower the probability of falling into poverty (Kabubuo-Mariara, 2002).

The most intensively studied determinants of poverty and household welfare include: age of the of the household member or head of household, gender of the head of household, marital status, households whose heads are cohabiting, households headed by separated couples, households whose head are never married, employment status – paid employment, self-employed, household characteristics –household size, dependency ratio, geographical factors – rural, urban and provincial dummies and so forth.

Among the most important variables to explain chronic poverty incidence is the level of education of the household head (see Kabubuo-Mariara (2002); Geda et al. (2005); Mok et al (2007); Shete (2010); Edoumiekumo et al. (2014) and Isam et al (2016)). Specifically these studies have observed that a head of households whose highest educational attainment was at the primary school level, the secondary level, tertiary level were significantly more likely to non-poor than those with no schooling. Reaching a similar conclusion, other studies (Mutherjee & Benson, (2003); (Gounder, 2012); and Litchfield & McGregor, (2008); and Lekobane & Seleka (2017); Quartey and Blankson (2004); Datt and Jolliffe (2005); Akerele and Adewuyi (2011) observed that higher levels of education tend to improve household welfare.

There is more or less consistent findings affirming the importance of dependency ratio in explaining the poverty incidence and household welfare. For example Geda et al. (2005); Shete (2010); Edoumiekumo et al (2013); Dartanto and Nurkholis (2013); Edoumiekumo et al. (2014) and Isam et al. (2016) found that higher dependency ratio significantly and positively increase the probability of households plunging into poverty. By the same token, higher dependency ratio has been found to exert a negative impact on household welfare (Akerele & Adewuyi, 2011); Litchfield and McGregor (2008) and Lekobane & Seleka (2017)

Most empirical literature suggests that household size has significant negative effect on the welfare status of a household and poverty. Specifically, the larger the household size the higher the likelihood of falling among the poor, since more resources are required to meet the basic need of the household (Lanjouw and Ravallion, (1995); Sekhampu, (2013); Serumaga-Zake & Naude, (2002); Geda et al., (2005), and Baulch &McCulloh, 1998; Gounder (2013) and Lekobane & Seleka (2017)). Likewise, larger household size is mostly negatively correlated with household living standard as measured by consumption per person (Gounder, 2012); Litchfield & McGregor, (2008); Datt & Jolliffe, (2005), Mukherjee & Benson, (2003), and Fagernas & Wallace, (2007).

We are not the first to investigate the determinants of poverty in South Africa. Previous studies seemingly due to data constraints, have relied on the cross-sectional methods rather than panel data methods. For example, Sekhampu (2013) used the logistic regression model and found that household size, age of the head of household, employment level of the household head significantly explain the probability of household falling into poverty in the township of Bophelong.

3 Data and variables

The analysis of determinants of household welfare employs data from the first four waves of a National Income Dynamic Study conducted from 2008 to 2014. It is collected by the Southern African Labour and Development Research Unit (SALDRU), based at the University of Cape Town's School of Economics. For wave one, interviews were conducted during 2008 with a representative sample of over 28,000 individuals in 7,300 households. The same individuals were re-interviewed in successive waves – the latest available being 2014. The beauty of the NIDS data is that it contains a wide range of information about individual and household demographics, consumption, income, employment, health, poverty, well-being, fertility and mortality, migration, education, vulnerability and social capital.

In addition to the dependent variables (household per capita income[*] and poverty), we use several control variables in our econometric analysis. We use as independent variables several factors identified in the literature as important determinants: levels of education of the

[*] To calculate the per capita income, the total household income is divided by the number of people in this household or household size.

household head, province dummies, race of the household head, dependency ratio, indicator variables for location of the household — rural or urban, gender of the household head, employment status of the household head, marital status of the household head, asset ownership and household size and age of the household head (see table 1).

Table 1: Explanatory variables used in the empirical analysis

Variables	Type	Description
Dependent variable		
Poverty incidence	Dummy	Poverty status; 1 = poor, 0 = non-poor
PCI	Continuous	Income per capita
Explanatory variables		
Dep_ratio	Continuous	Dependency ratio
Living with partner	Dummy	1 = living together, 0 otherwise
Widower	Dummy	1 = widower, 0 otherwise
Divorced	Dummy	1 = divorced, 0 = otherwise
Never Married	Dummy	1 = never married, 0 = otherwise
Age of HH head	Continuous	Age of HH head (in years)
Age SQ	Continuous	Age squared
Asset ownership	Continuous	Amount of asset ownership
Size of HH	Continuous	Total number of members in HH
Coloured	Dummy	1 = Coloured HH head,0 = Otherwise
Indian	Dummy	1 = Indian HH head, 0 = Otherwise
White	Dummy	1 = White HH head, 0 = Otherwise
Primary education	Dummy	1 = HHH with primary education, 0 = Otherwise
Secondary education	Dummy	1 = HHH with secondary education, 0 = Otherwise
Tertiary education	Dummy	1 = HHH with tertiary education,0 = Otherwise
Matric	Dummy	1= HHH with matric, 0= Otherwise
Gender of HH head	Dummy	1 = Female, 0 = Otherwise
Employment status of HHH	Dummy	1= Employed 0= Otherwise
Urban	Dummy	HH in urban areas
Farm	Dummy	HH in farm areas
Eastern Cape	Dummy	HH in Eastern Cape
Northern Cape	Dummy	HH in Northern Cape
Free State	Dummy	HH in Free State
KwaZulu-Natal	Dummy	HH in KwaZulu-Natal
North West	Dummy	HH in North West
Gauteng	Dummy	HH in Gauteng
Mpumalanga	Dummy	HH in Mpumalanga
Limpopo	Dummy	HH in Limpopo

Table 2 present the summary statistics focusing on the means and standard deviation of the variables used in the empirical analysis. As can be observed from the table, there are some notable variations across the waves in most of the variables. For example, the mean poverty ratio of 0.47 was computed in 2008, this figure dropped significantly to an average of 0.45, 0.38 and 0.33 in 2010, 2012 and 2014 respectively. Likewise, the mean dependency ratio of 66.74 was captured in 2008, but decreased to an average of 58.46, 54.38 and 48.57 in 2010, 2012 and 2014. A similar trend is also observed on household assets where the mean of 0.17 was recorded for 2008 before decreasing to an average of 0.12 in 2010, but increased to an average of 0.14 and 0.17 in 2012 and 2014 respectively. On the contrary, the mean household employment remained pretty stable in all the four waves – household employment was 0.53, 0.50, 0.53 and 0.59 in 2008, 2010, 2012 and 2014.

Table 2: Summary statistics of variables used in regressions

	2008		2010		2012		2014	
Variable	Mean	Std dev.	Mean	Std dev.	Mean	Std dev.	Mean	Std dev.
Poverty ratio	0.47	0.49	0.45	0.49	0.38	0.49	0.33	0.47
PCI	2 441	5 282	3 095	23 123	2 708	5 551	3 079	12 551
Dependency ratio	66.74	34.41	58.46	27.84	54.38	27.66	48.57	25.36
HHH_age	45.16	15.11	45.33	15.0	43.46	14.96	44.13	15.38
HH_assets	0.17	0.37	0.12	0.32	0.14	0.35	0.17	0.38
HH_size	5.22	3.31	5.64	3.50	5.20	3.26	5.18	3.37
HHH_empl	0.53	0.50	0.50	0.50	0.53	0.50	0.59	0.49
HHH_gender	0.39	0.49	0.46	0.50	0.53	0.50	0.54	0.50
Coloured	0.09	0.29	0.08	0.28	0.08	0.27	0.078	0.26
Indian	0.03	0.16	0.02	0.15	0.02	0.15	0.02	0.15
White	0.10	0.29	0.12	0.33	0.12	0.32	0.11	0.32
Primary education	0.24	0.423	0.26	0.42	0.20	0.40	0.18	0.39
Secondary education	0.32	0.46	0.33	0.47	0.34	0.48	0.32	0.47
Matric education	0.20	0.40	0.17	0.38	0.22	0.42	0.150	0.36
Tertiary education	0.13	0.34	0.17	0.37	0.15	0.36	0.27	0.45
Farms	0.08	0.27	0.07	0.25	0.06	0.24	0.04	0.20
Urban	0.59	0.49	0.59	0.49	0.60	0.49	0.62	0.49

4 Methodology

While previous studies have relied on cross sectional data using OLS and probit models (see Malik (1996); Naude (2002); Mukherjee and Benson (2003); Datt and Jolliffe (2005); Serumaga-Zake and Geda et al. (2005); Mok et al. (2007); Akerele and Adewuyi (2011);

Edoumiekumo et al. (2013) and Edoumiekumo et al. (2014)), we captures unobserved individual heterogeneity and endogeneity, both via fixed effect, and via a robust alternative based on random effect probit estimation. First a random effect probit model was estimated, with the probability of a household being poor as the dependent variable and a set explanatory variables: levels of education of the household head, province dummies, race of the household head, dependency ratio, indicator variables for location of the household — rural or urban, gender of the household head, employment status of the household head, marital status of the household head, asset ownership, household size and age of the household head (see table 1 above). Given the dichotomous nature of the outcome variable, we assigned a value of 1 if the household is poor and 0 otherwise.

The random effect probit can be shown as follow:

$$Y_{it}^{*} = x_{it}\beta + \delta_i + \varepsilon_{it} \quad (1)$$

And

$$Y_{it} = 1\ [Y_{it}^{*} > 0] \quad (2)$$

Where i and t subscripts refer to households and time periods (t = 4) respectively, Y_{it}^{*} is a latent dependent variable for being in poverty, Y_{it} is the observed outcome, x_{it} is a vector of time-varying and time invariant regressors that influence Y_{it}^{*} and it includes all the variables on the right hand sides (listed in table 1), β is the vector of coefficients associated with the regressors, δ_i indicates unobserved household-specific random effects and it ε_{it} is a random error which is assumed to be normally distributed. Equation 2 shows the observed binary outcome variable.

The second approach also took full advantage of the panel nature of National Income Dynamic Study data and employed appropriate panel data model (fixed effect). The fixed effect specification was chosen based on the usual Hausman test[†] and the fact that the time-invariant term could account for unobserved characteristics such as the socioeconomic characteristics that could be correlated with the independent variables in the model. This approach involves

[†] The Hausman test was used to determine whether the fixed effects or random effect was the appropriate model for our study. The results of the Hausman specification test, reported at the bottom of table 4 rejects the random effects model in favour of the fixed effect model.

regressing the natural logarithm of per capita income against a series of independent variables (as discussed above). The regression equation was specified as:

$$ln\ PCI_{it} = \sum_{i=1}^{n} x_{it}\beta + \delta_i + \varepsilon_{it} \quad (1)$$

where, $ln\ PCI_{it}$ is the logarithm of household per capita income, x_{it} are the explanatory variables as defined above and ε_{it} is the error term and β is the parameter to be estimated.

5 Empirical results

5.1 Random effect estimates

The results of our investigation of the determinants of poverty incidence are reported in Table 3. It is evident that most of the explanatory variables are statistically significant at 1%, with expected signs. More specifically, the results indicate that unmarried (divorced, never married or widowed and living with a partner) head of households, were significantly more likely to be poor than their counterpart (married head of households). As expected, female-headed households are more likely to be poor than male-headed households. This finding is collaborated by Buvinic and Gupta (1997) who found that, out of 61 studies looking at the link between poverty and female-headed households in developing countries, 38 found female-headed households over-represented among poor households. Unsurprisingly, the probability of being poor for a household member whose head is employed is lower. Likewise an increase in the number of household members significantly increase the probability of being poor. This finding is similar to those of Ayalneh et.al (2008); Herrera (1999); Afera (2015); Haddad and Ahmed (2003), and Woolard and Klasen (2005).

The results also show that educational levels (primary, secondary, matric and tertiary) of the household head significantly reduce the probability of being poor, implying that a higher level of education provides greater opportunities for a better job and, subsequently, a higher income. These findings confirmed the conclusions of other studies, such as Hondai et al (2005) Sarwar et al (2011); Bigsten et al. (2003) and Widyanti et al. (2009). Consistent with previous research (see Habyarimana et al (2015); Fields et al. (2003) and Kedir and McKay (2005), we also found that, compared to traditional rural areas (used as reference category), households living in urban and farms are less likely to be poverty stricken, which implies that rural areas (traditional areas)

should continue to be a major focus of poverty alleviation efforts in South Africa. Along the same lines, the probability of being poor for households in the Eastern Cape, KwaZulu-Natal, Northern Cape provinces/regions, is significantly higher than Western Cape provinces/region. Whereas, the location effects of households from the North West, Mpumalanga and Gauteng provinces/regions do not statistically differ from those in the Western Cape. As expected, the dependency ratio increases the likelihood of being poor. The results also indicate that race dummies have an important influence on poverty incidence. In comparison with Black population group, Whites, Indians and Coloured population groups, are less likely to be poor. This is a well-known phenomenon which is usually attributed to the economic legacy of apartheid which disadvantages the African majority.

Table 3: Random effect probit estimates of the determinants of household welfare, 2008-2014

Poverty incidence	Coef.	Robust Std. Err.
HHH_age	0.0077168	0.004375
HHH_ageSQ	-0.000315***	4.38E-05
HHH_gender	-6.454509***	0.48735
Dep_ratio	0.193272***	0.008457
Own_assets	0.1384396***	0.023003
HH_size	0.2350468***	0.006742
HH_employed	-0.78348***	0.027044
Marital Status (Married omitted):		
Living with partner	0.3555252***	0.044739
Widower	0.2807244***	0.039889
Divorced	0.2036007***	0.064389
Never Married	0.2536219***	0.035312
Race dummies (African omitted)		
Coloured	-0.371872***	0.051008
Indian	-1.514022***	0.189767
White	-1.172475***	0.149073
Levels of education (No schooling omitted)		
Primary	-0.178258***	0.03885
Secondary	-0.482389***	0.043026
Matric	-0.842987***	0.052575
Tertiary	-1.310536***	0.059915
Geo-type dimensions (traditional areas omitted)		
Urban	-0.451435***	0.032987
Farms	-0.345131***	0.05198
Provincial dimensions (Western Cape omitted)		
Eastern Cape	0.4226936***	0.059638
Northern Cape	0.1456177*	0.060675
Free State	0.3036578***	0.069882
KwaZulu-Natal	0.2032978**	0.058568
North West	0.008229	0.070239
Gauteng	0.061345	0.062518
Mpumalanga	0.047838	0.06928
Limpopo	0.2822101***	0.068574
Wave_2	0.065677***	0.027474
Wave_3	0.3916084***	0.033195
Number of obs	=29,368	

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

5.2 Fixed effect estimates

As a robustness check we used an alternative method (fixed effect) which produced qualitatively similar results. Arguably, this is not very surprising given that, factors that

increase welfare measured by income or consumption should lower probability of falling into poverty (Kabubuo-Mariara 2002). As Table 4 (second column) shows, levels of education of the household head, some province/regional dummies, race of the household head, dependency ratio, gender of the household head, employment status of the household head and marital status of the household head are statistically significant determinants of household welfare. Consistent with the random effect probit estimates, gender of the household head enters with predicted positive sign, at 1% level of significance. That is, male-headed households are better off than female-headed ones (Barros et al., 1997; World Bank, 1991). Educational levels (Primary, secondary, matric and tertiary), remain an important determinant of household welfare — enters positively and significantly in both specifications.

In line with the random effect probit estimates, location (i.e. farms and urban areas) once again matters in explaining welfare outcomes and enter with predicted positive sign. Likewise, certain provincial/regional dummies (such as Eastern Cape, Mpumalanga, Gauteng and North West) have a negative coefficient and significant at the 1% level, showing differences in welfare. Other regional/provincial dummies (i.e. KwaZulu-Natal, Limpopo, Free State and Northern Cape) are no longer significant, although they enter with negative expected signs. In terms of marital status and in comparison married head of household, households headed by those who lived together, widowed and never married enjoy lower welfare.

Table 4: Fixed effect estimates of the determinants of household welfare, 2008-2014

LOG_PCI	Coef.	Robust Std. Err
HHH_age	-0.001774	0.001904
HHH_ageSQ	0.0001392***	1.84E-05
HHH_gender	0.3232643***	0.022345
Dependency ratio	-0.100701***	0.002567
Own_assets	0.131226***	0.011089
HH_size	-0.120957***	0.002782
HH_employed	0.5060797***	0.011875
Marital Status (Married omitted):		
Living with partner	-0.306619***	0.020073
Widower	-0.103021***	0.017168
Divorced	-0.040915	0.028765
Never Married	-0.138215***	0.016055
Race dummies (African omitted)		
Coloured	0.1644728***	0.021919
Indian	0.6931187***	0.056832
White	0.9575781***	0.033532
Levels of education (No schooling omitted)		
Primary	0.0623172**	0.016255
Secondary	0.2605575***	0.018602
Matric	0.5713914***	0.0235
Tertiary	0.9966403***	0.024875
Geo-type dimensions (traditional areas omitted)		
Urban	0.2400817***	0.015202
Farms	0.1363666***	0.021439
Provincial dimensions (Western Cape omitted)		
Eastern Cape	-0.130512***	0.025443
Northern Cape	-0.0391435	0.025767
Free State	-0.040409	0.031806
KwaZulu-Natal	-0.0101874	0.024454
North West	-0.1422126***	0.031051
Gauteng	0.1911663***	0.025983
Mpumalanga	-0.1629901***	0.029914
Limpopo	-0.006065	0.030867
Wave_2	0.1400068***	0.011779
Wave_3	0.2988954***	0.009402
Number of obs	=29,351	

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

Conclusion

The issue of poverty remains on the agenda of the South African government and is of paramount importance to policy-makers, academics and development practitioners. In this paper, we employed a methodology for estimating both poverty and household welfare using the National Income Dynamic Study. We identified various factors such as levels of education of the household head, some province/regional dummies, race of the household head, dependency ratio, gender of the household head, employment status of the household head, marital status of the household head as statistically significant determinants of household welfare and the probability of being poor. More importantly we found that compared to traditional rural areas (used as reference category), households living in urban and farms are less likely to be poverty stricken. Moreover, we found that, educational levels (primary, secondary, matric and tertiary) of the household head reduce the probability of being poor. These results suggest that investing in education and improving the economic conditions of the rural dwellers (traditional rural areas) should continue to be a major focus of poverty alleviation efforts in South Africa.

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