

LAND OWNERSHIP, TENURE AND SUBJECTIVE WELL-BEING IN SOUTH AFRICA



UNIVERSITY OF THE
WITWATERSRAND,
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MComm. Economics: Research Report

ECON 7008A

A Research Report submitted in partial fulfilment of the Degree of
Master of Commerce (Economics/Economic Science)
in the School of Economic and Business Sciences,
University of the Witwatersrand

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March 2019

Word Count: 14 532

Date: 26 September 2019

Abstract

The dual land tenure system, characteristic of South Africa's land economy, is comprised of private ownership and communal land ownership presided over by a traditional council. This paper has two main findings in relation to land tenure in South Africa: owning land, compared to not owning land, and owning land privately, compared to owning land communally, has a positive, statistically significant impact on subjective well-being. Using waves 4 and 5 of the National Income Dynamics Study (NIDS) longitudinal dataset, a set of econometric methodologies is employed to quantify the impact of ownership and tenure on self-reported well-being using an ordinary least squares estimation as a point of analytical departure. To account for possible endogeneity stemming from self-selection and unobserved heterogeneity, an instrumental variable, propensity score method and Heckman's ordered selection *probit* model is computed. A persistent positive effect of land ownership and private ownership on subjective well-being is found across the various estimation strategies. Further robustness checks are assessed to increase the internal validity of the main methodology; this includes a mixed effects and ordered logit approach that treats subjective well-being as ordinal. The estimated increases in subjective well-being ranges between 0.348 to 0.466 levels for landowners and 0.277 to 0.331 levels for private owners.

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1. Introduction

Wealth inequality in South Africa remains a persistent socioeconomic difficulty that is most evident in the land ownership patterns of the historically disadvantaged. The legal framework of the colonial and apartheid governments that systematically excluded black people from legally owning land has had far-reaching impacts on the ownership and tenure security of approximately 30 million people who live in poverty. Two decades after the advent of democracy in South Africa and the legacy of this spatial separation has filtered into our current socioeconomic landscape as land ownership remains heavily skewed towards a minority. A land audit conducted by the Department of Rural Development and Land Reform (2017) found that black people owned approximately 4% of the total farms and agricultural holdings compared to 72% of land owned by their white counterparts, who only make up 8.9% of the population. In addition to rebalancing the ownership composition through redistribution and restitution initiatives, many disadvantaged black people who live in former homelands also have insecure tenure rights on their land, making it cumbersome to exercise their rights over their land, putting them at risk of being evicted.

The two primary forms of land tenure systems evident in most southern African economies consists of customary¹ and statutory tenure. Customary land tenure systems are traditional, indigenous forms of ownership usually managed by a community trust that is overseen by a community leader (Clark and Luwaya, 2017). Tenure use rights under customary ownership are usually secure, however there are certain limits to land use as the land is ultimately tied to the community trust (Platteau, 1996). They cannot, for example, sell their land in their personal capacity without permission from the chief or local tribal authorities. Customary land-rights are also limited in scope in terms of their use: for example, right - holders cannot lease or use the land as collateral for loans. It is estimated that approximately 13% of South Africa's total land area in the former *bantustan*² land is held in trust for communal area residents (Cousins and Hall, 2017).

¹ The words 'tribal', 'traditional', and 'customary' are often incorrectly used interchangeably. This conflation was often made and enforced by colonial governments as they assumed that indigenous customary landholdings consisted only of tribal ownership (referred to as the 'communal paradigm'). To avoid making this error, this paper will use 'customary' to refer to what would otherwise, incorrectly, mean tribally. The word 'communal' will refer explicitly to mean land shared by all members of a community

² An area set aside during the period of apartheid for a particular indigenous African people; a so-called homeland.

Conversely, statutory tenure is governed by the existing laws of the state and enforces individual title to land ownership. In addition to finding that owning land results in greater well-being levels than not owning land, a key finding of this paper is that individuals who own land privately, with the option to sell their land right, have a higher level of well-being than those who own land privately. It is hypothesised that one of the key reasons for this difference in well-being is due to the limitations on customary land use rights. In a developing country such as South Africa, where poverty and unemployment are significant, any absolute or relative increase in income or wealth will likely have significant impacts on well-being. This is because any positive income stream will contribute primarily to meeting basic physical needs. This is in line with the existing literature that posits a curvilinear relationship between income and well-being; high income countries tend to exhibit diminishing marginal utility with increasing incomes because wealth contributes to subjective well-being predominantly in meeting primary needs (Diener et al., 1995).

Land reform is thus often touted as a vital component to raising the living standards of the poor in South Africa as it increases household wealth. Tenure reform is a cornerstone of land reform policy in South Africa and is also enforced in the Constitution, stating that ‘A person or community whose tenure of land is legally insecure as a result of past racially discriminating laws or practices is entitled, to the extent provided by an Act of Parliament, either to tenure which is legally secure or to comparable redress’. Proponents of individual private property rights argue that individual land titling is the only method to achieve tenure security in South Africa.

Counter-arguments suggest that individual titling will likely dilute community identity and expose low-income earning communities to even greater tenure insecurity. Greater access to financial institutions may expose these communities to high interest rates and taxes, subjecting them to potential repossession. This debate, also presumed within the laws of the current governing institutions, enforces a divisive understanding of historical land ownership patterns in South Africa. Ramutsindela and Mogashoa (2013) submit that the dual tenure system, endorsed by the colonial government to advance its imperial interests, obscures the fact that Africans ‘purchased and owned land as individuals, syndicates and as tribes’. Thus, the implication that any indigenous forms of ownership cannot co-exist with private institutionalised or freehold rights need not hold. This is especially true if the opportunity cost to owning limited rights to land is the increase in potential income streams garnered from owning land that is statutorily recognised by financial institutions.

Therefore, the difference in welfare between the two types of tenure systems may shed light on the importance of abstracting from a dichotomous understanding of landownership in South Africa. The following paper employs several econometric models to evaluate the comparative effects of different types of ownership patterns on subjective well-being in South Africa. The tenure variable used exploits the questions asked about land ownership in waves 4 and 5 of the National Income Dynamic Study dataset. Specifically, respondents who are landowners, are asked whether they own land privately (with the right to sell their right) or if they have secure rights on customary property. The identification strategy used includes an instrumental variable approach as well as a propensity score matching method to emulate a randomised control trial in that it constructs a treatment and control group, controlling for observable characteristics. Differences in post-treatment well-being outcomes between the treatment group (landowners) and the control group (non-landowners) are assumed to be solely as a result of the impact of the treatment. Other models assessed include a fixed and mixed effects models, an ordinal *probit* estimation and Heckman's ordered *probit* model to account for self-selection.

The main results of regressing the two primary independent variables on the subjective well-being variable – *ownership* and *tenure* – reveal a strong positive, statistically significant causal relationship of owning land, and owning land privately, on subjective well-being. While it is not unexpected that there are clear benefits to owning an asset like land over not owning land, the second result may need further extrapolation. It is hypothesised that one of the main reasons owning land privately returns better well-being levels is because it creates an avenue to credit access that is otherwise unavailable under customary tenure systems. Other prospective explanations include the foregone opportunity to lease the land or possibly use the loan credit to explore agricultural activities for subsistence farming or profit extraction from the productive use of the land.

The model presented in this paper is the first empirical analysis that directly investigates the effect of land tenure systems on subjective well-being in South Africa. An additional novel aspect of this study is that, by controlling for a host of effects that affect well-being, this paper seeks to explain the mechanism through which the option to sell one's land rights positively influences self-reported well-being. While a great deal of the current literature on happiness has found income and wealth to be an essential component, this paper is the first of its kind in

the South African context³ to evaluate the increase in well-being via potential credit access from the option to sell one's land right or use it as collateral for a loan.

This paper is structured as follows: Section 2 establishes the background to land ownership patterns by giving a brief history that informs the current dual tenure system in South Africa. This is then followed by a literature review on the determinants of subjective well-being and its link to property rights and asset ownership. The review also discusses other similar papers and their key findings and how they influence the current study. Section 3 expands on the data and variables used and provides an explanation of the array of variables included in the analysis. Section 4 covers the methodological identification strategy employed and highlights the strengths and weakness of each consecutive model to improve the internal validity of the empirical analysis. This analysis will be further explored in Section 5 in which the results of the methodology implemented is assessed. The main independent variables of interest are two indicator variables that capture whether an individual owns land (*ownership*) and a *tenure* variable that captures the two types of ownership types. This section also includes further discussion on the possible explanations for the empirical results and elaborates on the drawbacks of the study. Section 6 presents three more models to validate the robustness of the initial econometric methods while Section 7 includes a discussion to help frame and understand the results of the paper from a policy perspective. Section 8 concludes the paper.

2. Literature Review

2.1. A brief history of land ownership in South Africa

The voracity of colonial land dispossession from the eighteenth century enforced the weakening of property rights and the displacement of many black South Africans. This resulted in an unequal spatial distribution delineated across racial lines; only approximately 13 percent of the marginalised land area was reserved and available for residence for black people. Currently, approximately 17 million people- a third of South Africa's population - reside in these so-called former homelands (Clark and Luwaya, 2017). The current economic and political pressure for land reform is therefore due to the historical legacy of land dispossession that has filtered into current ownership patterns. Equally important is the living standards of the poor who reside in marginalised rural areas with insufficient access to assets or the formal economy.

³ To the authors knowledge.

Land reform in South Africa encompasses three strands of implementation: land redistribution, land restitution and land tenure reform. The intention of land restitution is to restore land rights to those most marginalized by racially discriminating legislative constructs such as the Natives Land Act of 1913. Land redistribution involves easing access to productive land to the majority of black people who were not statutorily allowed to own land. Land tenure reform refers to the validation and statutory recognition of insecure land-right holders who often have no legal claim to the land they occupy (Ngcukaitobi, 2018).

The colonial government enforced a dual tenure system that allowed settlers to own land while the black majority were effectively removed from their ancestral lands, forced to communally reside on land reserves. For most of the twentieth century, these reserves were used as labour outposts for mining and industrial centres, however as the demand for industrial production steadily declined in the second half of the century, poverty deepened in these areas (Walker, 2003). This duality in tenure was further solidified by the apartheid government who legally enforced divisive ownership across racial lines with the implementation of the Glen Grey Act (1894) and the Natives Land Act (1913) (Ngcukaitobi, 2018). Tenure insecurity is thus most prevalent amongst farm labourers, customary tenure systems in rural areas of the former *bantustans* as well as people living in informal settlements and backyard dwellings in urban areas (Rugege, 2004). Owing to the complexity of improving tenure reform in the former *bantustans*, land tenure reform has lagged behind restitution and redistribution initiatives.

The delay in land tenure reform post-apartheid meant that recipients of land redistribution and restitution programs were granted to communities and households without a well-defined tenure system. The redistribution and restitution programs thus legislated that they owned land as common property under the legal banner of the Community Property Association Act (CPA). Communities owned land primarily through CPAs which allowed them to ‘acquire, hold and manage property on a basis agreed to by members of a community in terms of a written constitution’ (Communal Property Association Act, 1996). Under the CPA (1996) communal property rights holders may have secure tenure rights, as land titles are governed by the state as well as tribal authority chiefs. Permission-to-Occupy (PTO) certificates are granted to residents who are not statutorily recognized, implying that buying or selling the land is proscribed by law and, by extension, using the land as collateral for a loan is not permitted.

2.2. Wealth as a determinant of well-being

There is a plethora of literature, both nationally and internationally, that focuses on the range of factors that influence happiness, or self-reported well-being. Original, nascent economic theories of well-being often posited that economic standing, usually measured by individual income, is an important determinant of one's overall happiness because it enables people to better provide for their needs (Veenhoven, 1991). The extent of one's needs – based on social and economic standing – will inform how it impacts their overall happiness. People who live under poor conditions will generally have lower well-being levels than high income earners because unfavourable living standards do not allow them to adequately meet their basic living needs. For example, research by Fahey and Smyth (2004) shows that higher income countries report higher well-being levels due to increased education levels mainly because the positive economic effects of education are greater for lower income earners. The distinction between the absolute and relative effects of income on well-being has therefore become a much explored topic in the well-being literature. Indeed, while prior research has found positive effects of income on happiness levels, this effect is different for people across the income spectrum (Diener et al., 1995). This is represented by a curvilinear relationship between income and subjective well-being implying diminishing returns to increases in income.

While Veenhoven's (1991) *need theory* may help explain why lower earning individuals report higher happiness levels compared to higher income earners it does not fully explain why happiness levels remain constant at higher wealth levels evidenced by Easterlin (1974). The *Easterlin Paradox* refers to the phenomenon in which despite the positive effects of individual income on happiness, there is no similar effect of income at the aggregate country level, in the long run, in the United States. The implication of this theory is that how one perceives their income level relative to others' is also an important contributing factor to well-being. This is especially evident in high-income countries in which Easterlin (1974) found that average happiness levels remained constant as average country income increased. The *Easterlin Paradox*, however, need not apply in a developing country context, like South Africa, where income inequality is high and approximately 55% of households live below the poverty line (Statistics South Africa, 2018). Comparing happiness levels between an individual level and aggregated district municipality level, Kollamparambil (2019) found that the absolute effect of income dominated the relative effect thus impacting happiness inequality such that, 'an increase in income inequality leads to an increase in happiness inequality because happiness

levels are low for the majority of population in the presence of wide income disparity and low absolute levels of income’.

Importantly, income is not the only measure of economic well-being and using other wealth measures has been found to show stronger effects on happiness compared to income⁴. Using information on the possession of various items such as real estate, investments and savings, Christoph (2010) found a much stronger relationship between wealth and happiness than the income variable used in his study. This is consistent with other previous research like Heady et al. (2005) who argue that more advanced material measures, such as household financial assets, provides a stronger correlation between happiness and one’s material circumstances.

Secure property rights over land and property ownership is thus an important addition to income as a complement measure of wealth. A study by Cheng et al. (2016) determines the relationship between the differences in well-being between individuals in China who own homes and those with less secure property rights such as partial and minor ownership. The study uses a longitudinal dataset spanning 2009 to 2011 and addresses endogeneity pervasive in causality studies by including several instruments for income such as industry-occupation-province average monthly consumption expenditure and regional house prices. The study finds a consistent and positive effect of full ownership over partial and non-ownership for a range of econometric models including fixed effects and an ordered logit approach. The models adopted in Cheng et al. (2016) informed the treatment of endogeneity in this study – household consumption expenditure will be used as an instrumental variable for income – the main difference is that this paper specifically looks at the effects of property rights over land ownership, a relatively unexamined relationship. Similar to Cheng et al. (2016), this paper will adopt an OLS, Fixed Effects, Instrumental Variable and a Propensity score matching methodology to determine the causal effects of land rights on well-being with particular attention on eliminating endogeneity. The current analysis will supplement this by including Heckman’s ordered *probit* regression to further control for self-selection bias in the system.

The only study that investigates the direct effects of land ownership on subjective well-being is by Landeghem et al. (2014). Using household level data through a rural household survey

⁴ Other key influences on subjective well-being, other than economic status, is discussed extensively in Dolan et al. (2007) for an international perspective and Posel and Casale (2011) and Kollamparambil (2019) for a more national context. Generally, personal characteristics (race, age, gender etc.), attitudes and beliefs, socially developed characteristics (health, unemployment status etc.), relationships and the wider economic, social and political environment have all shown correlates with subjective well-being.

conducted in Moldova, the study seeks to determine the effects on happiness stemming from increased land ownership in 500 rural households. The redistribution of land rights through Moldova's land reform program in the late 1990's was exploited and treated as a quasi-natural experiment given that there was no market for selling land at the time. The redistribution program assigned, on average, 2.5 hectares of land to households in rural areas across Moldova which led to increased agricultural activity. It also led to a substantial number of households – about 40% by 2004 – leasing parts of their land as an additional income stream. The subjective well-being variable was measured from a response to a well-being scale question from a World Bank rural household survey. The ordered logit regressions in the model show that household land holdings have a statistically significant positive impact on household well-being while well-being is negatively related to household welfare when compared to their neighbour's average land-ownership. The latter result was statistically significant for households across the income spectrum.

The positive welfare effects of land-ownership has garnered some interest for developing countries owing to the growing relevance of eradicating high income and asset, inequality. Most of the assessed welfare effects are measured in terms of the consumption and income effects. A study by Keswell and Carter (2014) examined the efficacy of South Africa's 2001 Land Redistribution for Agricultural Development (LRAD) program on per capita household consumption. Employing a generalized propensity score method, as well as exploiting the implementation features of the LRAD to extract exogenous variation in the treatment group (recipients of land), they match beneficiaries based on observable characteristics that are likely to affect treatment such as gender, household size and education. They find that the land transfers increased medium term household living standards by at least 50%. We include in this paper a propensity score method, similar to Keswell and Carter's (2014) matching method, to identify causality in the model. However, while Keswell and Carter's (2014) is the closest South African paper that looks at the quantitative effects of land reform, the current analysis focuses on subjective well-being effects and not per capita consumption.

The paucity of the effects of land ownership on happiness is due to the difficulty in accounting for the non-randomness of owning land (Keswell and Carter, 2014). Higher income earners are likely to be land owners and recipients of land via land reform programs are generally targeted to lower income members of society. A major difficulty in estimating the impact of land ownership on well-being is therefore establishing an appropriate counterfactual such that the estimated impact is devoid of any socioeconomic or personal influences on well-being. The

contribution of this paper is that it seeks to fill this gap by using a rich panel dataset and employs a varied set of regressions to estimate the effects of land ownership on subjective well-being in South Africa. While there is scarce empirical research on the mechanisms that influences the positive effect of land-ownership on well-being, the theoretical contributions abound.

Land titling, as the formalization of informal land rights, ultimately allows the right-holder access to buy and sell their right in a formal land market. A major drawback of communal ownership arrangements is that it prohibits formal market engagements because informal ownership rights are not recognized by formal sector institutions (Deininger et al., 2014). This is true for communal property rights holders who have permission to occupy certificates but are unable to convert or sell these rights in a formal market or use it as collateral in formal lending institutions. De Soto (2000) argues that the rights over assets for the poor are not fully legally documented which implies that these assets cannot be formally converted into capital, thus the poor are unable to access the economic benefits of attaining credit. Secure land rights are also vital for landowners because it allows them to make full use of the land without compromising their tenure security (Lawry et al., 2016).

Consequently, development theory suggests that individual titling can be used to foster economic development as individual property rights can be used for mortgage financing (Feder and Nishio, 1999 and de Soto, 2000). Formalising land ownership for the poor creates an enabling credit environment for the poor, increasing investment opportunities and reducing poverty levels. This is especially relevant for Africa, as approximately 51% of all refused credit are unaccepted by financial institutions as a result of insufficient credit (Domeher and Abdulai, 2012).

However, land belonging to local communities and collectivities does not only have economic value but also holds cultural and spiritual significance (Atuoye et al., 2019). Traditionalist theories of customary land ownership argue that individual titling erodes the social structure of customary tenure and, in turn, facilitates further conflict. In most cases, Platteu (1996) found that customary land owners viewed their community and families as belonging to the land as opposed to the land belonging to them. The connection to their land encompasses the social, spiritual and familial attachment to land that has ancestral significance. Feder and Nishio (1999) surveyed the experiences of people living on customary land in South Africa and found that most expressed fear of losing their cultural identity as an important factor into their resistance to land titling. A further dissuading factor is the possibility of becoming vulnerable

to high interest rates and taxes, and a further entrenchment of poverty if they default on their loans (Atuoye et al., 2019).

Presupposing that different forms of historical customary land ownership precludes the option to buy and sell land presents a myopic understanding of the nature of customary land ownership. Ramutsindela and Mogashoa (2013) suggest that the historical understanding of the racial-based communal land systems enforced by the colonists and the apartheid-era government overshadows tenure systems adopted by Africans before the arrival of the Dutch. Before the enforcement of the Natives Land Act, Africans owned and traded land and also accessed land through various forms of tenure relationships such as leasing and sharecropping. On the other end of the spectrum many pre-colonial societies owned land that was passed down through patrilineal associations. However, what most African tenures have in common is that rights are held, transmitted, and controlled at the level of the family (Ramutsindela and Mogashoa, 2013). This paper takes this nuanced perspective of varied pre-colonial tenure systems as a point of departure. We present findings of the positive well-being effects from the option to sell one's land-right or using it as collateral for a loan⁵ as a valid alternative to restricted land use rights.

3. Data and Descriptive Statistics

This section proceeds to explain the primary dataset used to model and analyse the effects of landownership on subjective well-being. Section 3.1 will expound on the NIDS dataset, Section 3.2 further explains the process involved in coding the independent, dependent variables and the control variables. The descriptive statistics will be presented in Section 3.3.

3.1 Data

The primary longitudinal dataset analysed in this paper is drawn from the fourth (2015) and most recent 2017 National Income Dynamics Survey (NIDS) waves specifically because the surveyed questions about landownership were not previously asked in the first three waves. From the fourth wave onwards, respondents are asked whether someone in the household is a landowner (yes or no); and respondents were further asked on what basis the landowner owns

⁵ This is not to suggest the removal customary systems. As suggested earlier in this paper, these two tenure systems can coexist, however any extension of this notion is not within the bounds of this paper.

the land; either through '*Private ownership with the right to sell*' or through '*secure rights on tribal allocations*' (SALDRU, 2017).

NIDS is a product of the research conducted by the Southern African Labour Development Research Unit (SALDRU) and the National Treasury and provides a rich set of surveyed information from which to construct relevant individual, household and geographic variables. It also includes a host of variables that measure emotional well-being and general feelings about the respondent's outlook on life, their community and social environment. The initial Wave 1 sample consisted of approximately 28 000 sampled individuals in 7300 households that were subsequently interviewed biennially (Leibbrandt and Woolard, 2010).

Due to attrition and non-responses over the consecutive 8 years, especially among high-income earners, a top-up sample of 2775 people was added to maintain the representativeness of the sample. Leibbrandt et al. (2016) determine that attrition rates in the NIDS dataset are relatively high compared to other similar panel surveys in other countries (most of which are from OECD countries). This is true especially for the White and Indian/Asian respondents (Eyal and Burns, 2016 and de Villiers et al., 2013) and given the historical nature of South Africa's economic landscape this implies that non-responses is disproportionately high among high income households. It is therefore necessary to account for this selection bias, as a significant decline in surveyed households affects the accuracy and national representativeness of the data.

In addition to the sample top-up, to address attrition and systemic non-responses, panel weights are created to help make the sample as representative of the South African population as possible. To achieve this, the probability of being re-interviewed is computed by SALDRU by way of a *probit* model that estimates a balanced sample and probability weights needed to correct for these biases. Table 1 illustrates the sample size by group, by applying the relevant sample weight. The survey design of NIDS is also constructed to control for geographic disparities (using Primary Sampling Units- or, PSU) that may cause over- or under-concentration of observations within certain geographical areas (Eyal and Burns, 2016).

Table 1 - Sample size comparison by cohort

	Forms of ownership	Unweighted (%)	Weighted (%)
Wave 4 (2015)	Total non-landowners (%)	10,681 (69.88%)	7,781.82 (71.49%)
	Total landowners (%)	4,603 (30.12%)	3,103.19 (28.51%)
	Secure rights on tribal authority allocations (%)	740 (16.08%)	348.73 (10.66%)
	Private ownership with right to sell (%)	3,863 (83.92%)	2,922.27 (89.34%)
	Total observations	15,284 (100%)	10,885 (100%)
Wave 5 (2017)	Total non-landowners (%)	11,204 (66.28%)	7,538.52 (69.75%)
	Total landowners (%)	5,700 (33.72%)	3,269.48 (30.25%)
	Secure rights on tribal authority allocations (%)	974 (17.09%)	512.44 (15.01%)
	Private ownership with right to sell (%)	4,726 (82.91%)	2,902.56 (84.99%)
	Total observations (100%)	16,904 (100%)	10,808 (100%)

The inclusion of the panel weights to both waves 4 and 5 adjusted the sample size resulting in a relatively significantly smaller sample size. The unweighted column includes the eligible sample without any missing values and any panel weights. It is evident that owners of secure rights on tribal authority allocations contain a comparatively small sample size of only 16.08% of the total landowners, which decreases to 10.66% when weighted. A similar result is found in wave 5 although the proportion of weighted communal land-owners is moderately greater at 15.01%. Given the historical context in which land was largely dispossessed in favor of a minority of the population, it is unsurprising that the weighted sample, which is nationally representative, calibrates to about 70% of the total sample as non-landowners.

3.2 Dependent variables and Independent variable coding

3.2.1 Independent variables

As noted in Section 3.1, the questionnaire design was improved between waves 3 and 4 with respect to the landownership variable, which provides the basis from which this study is estimated. In the first three waves of the NIDS panel questionnaire, households are asked a set of questions regarding the land- ownership status of the household and given two options with regards to the tenure of land-ownership: whether the land-right holder owns the land privately or through tribal authority-governed communal land. From the fourth wave onwards, land-right holders are asked specifically if they own the land privately *with the right to sell* the asset. This adds a nuanced distinction as it may improve one's life satisfaction if for example, the option to gain financial collateral from the land is available. Therefore, the two main independent

variables are *ownership* and *tenure*. The ownership variable is coded as an indicator variable to include adult individuals between the ages of 18 and 75 years who either report having a land right or do not. Households that have more than one owner are coded as landowners in the ownership variable, as the study examines the well-being at an individual level. The *tenure* variable relates to the sub-sample who own land; and is then divided between private land owners and communal rights owners, reflecting the dual tenure system evident in South Africa.

3.2.2 Outcome variable

The dependent variable in this analysis is subjective well-being, a common indicator of life satisfaction. In the NIDS dataset, adult respondents are asked a range of questions regarding their emotional health, subjective feelings about local social cohesion and general well-being levels. The variable of interest stems from the surveyed question:

Using a scale of 1 to 10 where 1 means “Very Dissatisfied” and 10 means “Very satisfied, how do you feel about your life as a whole right now?”

The variable is then constructed to include all ten ordered categories. Given the ordered nature of the variable, whether it is appropriate to treat this variable as continuous or ordinal has been researched extensively (Ferrer-i-Carbonell and Fritjers (2004), Tabachnick and Fidell (2001), Kahneman and Krueger (2005)); the general heuristic proposed by Tabachnick and Fidell (2001) is to treat the life satisfaction variable as continuous if there are at least 6 categories. The main models assessed in this study will treat the 10-category life satisfaction variable as continuous and as a robustness check, a recoded version of the continuous variable will be used such that two consecutive levels of self-reported well-being are grouped into one level; thus creating an ordinal variable with 5 categories.

The literature generally uses the terms life satisfaction, happiness and subjective well-being interchangeably however Wilson (1967) argues that self-reported happiness is most relevant and related to overall well-being. Self-reported well-being is a numeric representation of one's overall quality of life. This considered, it is clear that because of the subjective nature of the well-being variable, it poses issues about reliability and validity of responses (Schwarz and Strack, 1999). It could be argued that some people are more inherently happier than others, or that one person's level 5 happiness is equivalent to another person's level 6 happiness in reality. Given the extensive literature on this matter, Kahneman and Krueger (2005) argue that retrospective accounts of life satisfaction are likely to be biased if other influences such as the weather, contextual circumstances, mood sensitivities, question ordering bias and personality

are not accounted for; but this need not imply that the single question approach is not valid. This is because samples that are representative of the population will average out most – if not all – idiosyncratic factors. In addition, using multivariate regressions and longitudinal data also assist in removing potentially confounding biases in the questionnaire design. Other identification strategies such as quasi-experimental models – like propensity score and instrumental variables – will assist in improving the internal validity of the results (Graham and Chaparro, 2011).

3.2.3 Control variables

The control variables included, and their expected effects on well-being, are informed by the current international and national literature on subjective well-being. Dolan et al. (2008) provides an extensive compilation of the literature and categorizes the potential influences into income, personal characteristics, socially developed characteristics, attitudes and beliefs, relationships and the wider economic, political and economic environment. Integrating this into the South African context, following Posel and Casale (2011) as well as Blaauw and Pretorius (2013), the control variables included a range of variables from geographic indicators to personality traits. Table A1 in the Appendix includes a list of the control variables included and the expected effect it may have on well-being. The demographic variables include the *age*, *age*², *education*, *education*² as well as four indicator variables for race. It is expected that as one ages the effect of owning land will decrease overtime, implying a negative coefficient on *age*². The opposite effect is expected on the *education* and *education*² variables. As one increases education years, this will likely positively impact on well-being given the expected income returns of improving education. Personality variables are also included such as the respondent's expected income in five years, relative happiness and health outcomes. As all the included variables are coded such that the more positive outcome is equal to 1 for the indicator variables (for example, the variable *income step* is coded such that the higher levels of income step are coded as 1 and lower levels as 0), we expect the effect of most of the personality variables will lead to positive coefficients. Other variables included are whether the household lives in a formal housing structure and whether the household has access to electricity and piped water. The expected effect of having these utilities is positive on well-being.

3.3 Descriptive Statistics

This section provides a host of descriptive statistics that assist in framing an understanding about the included variables in this study. Table 2 features the differences between landowners

and non-landowners, in columns 1 and 2, as well as the dual tenure types in columns 3 and 4. All statistics are panel weighted to address attrition and systematic non-response. Table 2 shows that there are significant differences in age in the main sample, with the greatest proportion of landowners aged between 18 and 45 years whereas the average *age* of non-landowners is skewed to the older population. The racial demographics is representative of the population given that the majority of individuals surveyed are African. African people account for 98% of the sub-sample who own communal land-rights and there are no Asian or Indian surveyed individuals in the sample who own communal land rights.

Private landowners have a higher proportion of employed individuals, compared to communal owners, and report higher education levels at tertiary and above: 16.5% of the private landowners have a tertiary qualification compared to only 9% of communal landowners. Interestingly, more than 55% of the communal landowners are female, a higher average than private landowners. It is expected that individuals on an upper income level will likely be landowners; average differences in education attainment between landowners and non-landowners may support this hypothesis⁶. The household set of variables reported in Table 3 sheds light on some of the differences in household income across samples.

Table 2 - Individual characteristics for main sample and subsample (panel weighted)

	Ownership		Tenure	
	Landowner	Non-landowner	Private Ownership	Secure Rights on Tribal allocation
AGE				
<i>18-30 years</i>	0.0675 (0.251)	0.413 (0.492)	0.0670 (0.250)	0.0708 (0.257)
<i>31-45 years</i>	0.368 (0.482)	0.368 (0.482)	0.373 (0.484)	0.335 (0.472)
<i>46-60 years</i>	0.360 (0.480)	0.159 (0.366)	0.367 (0.482)	0.316 (0.465)
<i>61-75 years</i>	0.204 (0.403)	0.0603 (0.238)	0.193 (0.395)	0.278 (0.448)
RACE				
<i>African</i>	0.746 (0.435)	0.798 (0.401)	0.710 (0.454)	0.983 (0.130)
<i>Coloured</i>	0.0789 (0.270)	0.101 (0.301)	0.0884 (0.284)	0.0163 (0.127)

⁶ Literature on the causal relationship between income and education, see: Angrist and Krueger (1991) for international literature and Biyase and Zwane (2015) for South African case

<i>White</i>	0.139 (0.346)	0.0752 (0.264)	0.160 (0.366)	0.000841 (0.0290)
<i>Indian or Asian</i>	0.0364 (0.187)	0.0254 (0.157)	0.0419 (0.200)	- -
GENDER				
<i>Female</i>	0.527 (0.499)	0.496 (0.500)	0.519 (0.500)	0.579 (0.494)
<i>Male</i>	0.473 (0.499)	0.504 (0.500)	0.481 (0.500)	0.421 (0.494)
MARITAL STATUS				
<i>Married or living with a partner</i>	0.584 (0.493)	0.339 (0.473)	0.589 (0.492)	0.554 (0.497)
EDUCATION ATTAINMENT				
<i>Between Grade1 and Grade 7</i>	0.0714 (0.257)	0.0344 (0.182)	0.0553 (0.229)	0.177 (0.382)
<i>Between Grade 8 and Grade 11</i>	0.185 (0.389)	0.102 (0.303)	0.168 (0.374)	0.296 (0.457)
<i>Matric</i>	0.350 (0.477)	0.450 (0.498)	0.348 (0.477)	0.361 (0.481)
<i>Tertiary</i>	0.155 (0.362)	0.228 (0.419)	0.165 (0.371)	0.0902 (0.287)
<i>Above tertiary</i>	0.238 (0.426)	0.186 (0.389)	0.263 (0.440)	0.0759 (0.265)
OTHER				
<i>Migrant</i>	0.105 (0.307)	0.312 (0.463)	0.100 (0.301)	0.132 (0.339)
<i>Employed</i>	0.546 (0.498)	0.562 (0.496)	0.575 (0.494)	0.362 (0.481)
Observations	5700	11203	4726	974

-Values in brackets indicate standard deviations

The household income variable is computed as its natural log to linearize the real relationship between subjective well-being and household income. Average log of household income per capita for landowners is slightly higher for landowners than non-landowners. Although the income quintiles are not included as variables in the regression analysis, dividing the samples by the quintiles assists in understanding the extent of the differences in income levels. Across the income quintile scale, individuals without land have a higher proportion of being in the poorest quintile while landowners have a comparatively higher proportion of individuals in the richest quintile. Differences on the extreme spectrum of income quantile shows that 34.4% of the landowners are in the richest quintile compared to 22.4% of non-landowners. Income disparities are most evident within the communal rights owners sample with only 9% reported in the richest quintile while 34.5% are in the poorest.

Table 3 - Household-level characteristics of main sample and subsample (Panel weighted)

	Ownership		Tenure	
	Landowner	Non-landowner	Private Ownership	Secure Rights on Tribal allocation
<i>Household size</i>	3.766 (2.365)	3.906 (3.168)	3.689 (2.287)	4.270 (2.775)
<i>Household has access to piped water</i>	0.917 (0.276)	0.934 (0.248)	0.937 (0.243)	0.783 (0.413)
<i>Household lives in a formal dwelling</i>	0.842 (0.365)	0.810 (0.392)	0.858 (0.349)	0.738 (0.440)
<i>Household has flushing toilet</i>	0.635 (0.481)	0.703 (0.457)	0.713 (0.453)	0.123 (0.329)
<i>Household has electricity</i>	0.894 (0.308)	0.898 (0.303)	0.903 (0.295)	0.828 (0.378)
<i>Log of household income per capita</i>	7.941 (1.350)	7.682 (1.154)	8.067 (1.353)	7.106 (0.989)
<i>Quintile 1 (poorest)</i>	0.187 (0.390)	0.198 (0.398)	0.164 (0.370)	0.345 (0.476)
<i>Quintile 2</i>	0.152 (0.359)	0.190 (0.392)	0.141 (0.348)	0.226 (0.419)
<i>Quintile 3</i>	0.143 (0.350)	0.189 (0.391)	0.140 (0.347)	0.162 (0.369)
<i>Quintile 4</i>	0.173 (0.378)	0.200 (0.400)	0.174 (0.379)	0.167 (0.373)
<i>Quintile 5 (richest)</i>	0.344 (0.475)	0.224 (0.417)	0.381 (0.486)	0.0992 (0.299)
Observations	5700	11203	4726	974

-Values in brackets indicate standard deviations

There are also stark differences in household characteristics between private owners and communal owners; only 12.3% of the latter report a flushing toilet compared to 71.3% of private owners. About 94% of private landowners have access to piped water (onsite or offsite)⁷ compared to only 78.3% of communal landowners. In addition, private landowners that live in formal housing structures is 86% compared to only approximately 74% of communal landowners.

Table 4 reports the descriptive statistics for the household-characteristics variables included in the analysis. From the sample of landowners, the self-reported income step level of above 4 is

⁷ See appendix for detailed description of variables

22.1% compared to 18.4% for non- landowners. On average, landowners also report greater positivity and optimism for the future (61.4% compared to 58.85%). Landowners and private owners also have a higher average of owning a credit card and bank account compared to their sample counterparts. The percentage of private landowners that are positive and optimistic about the future is 63.6% compared to 48.5% of communal landowners. This is supported by a rudimentary analysis between the average subjective well-being and the ownership types; Graph 1, panel (a) and (b) show that the average life satisfaction levels are relatively higher for landowners (compared to non-landowners) and landowners with private property rights.

The remainder of the variables, geographic types and provinces, are included in A2 in the Appendix. It is evident that approximately 87.9% of the sample that own communal rights are from tribal areas, mostly geographically based in Eastern Cape (38.6%), Kwa-Zulu Natal (24.2%) and Limpopo (18.1%). Private landowners reside in Urban Formal areas (56.5%) although a sizeable portion, 26.3%, are from Tribal Authority areas as well.

Table 4 - Individual perception and financial variables of main sample and subsample (panel-weighted)

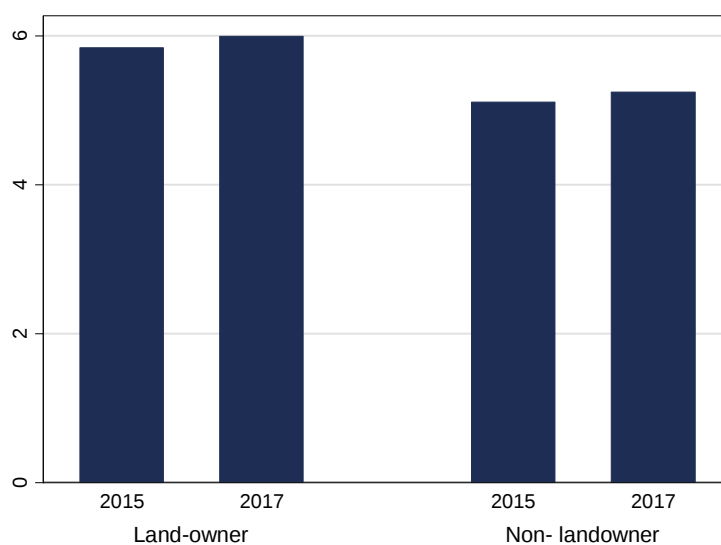
	Ownership		Tenure	
	Landowner	Non-landowner	Private Ownership	Secure Rights on Tribal allocation
<i>Owens a Bank account</i>	0.694 (0.461)	0.689 (0.463)	0.727 (0.446)	0.496 (0.500)
<i>Owens a credit card</i>	0.100 (0.301)	0.0531 (0.224)	0.115 (0.319)	0.0143 (0.119)
<i>Perceived current income step</i>	0.221 (0.415)	0.184 (0.388)	0.237 (0.426)	0.124 (0.329)
<i>Log of expected income in 5 years</i>	38398.5 (163857.1)	30670.6 (118425.2)	41085.9 (173491.6)	22305.5 (84269.0)
<i>Above average health status</i>	0.847 (0.360)	0.920 (0.272)	0.846 (0.361)	0.854 (0.353)
<i>Religion is important</i>	0.897 (0.304)	0.881 (0.324)	0.898 (0.303)	0.891 (0.311)
<i>Household experiences frequent domestic violence in neighbourhood</i>	0.210 (0.407)	0.297 (0.457)	0.226 (0.418)	0.106 (0.308)
<i>Crime is common in neighbourhood</i>	0.498 (0.500)	0.521 (0.500)	0.500 (0.500)	0.484 (0.500)

<i>Positivity and optimism for the future</i>	0.614 (0.487)	0.588 (0.492)	0.636 (0.481)	0.485 (0.500)
<i>Relative level of happiness is the same or happier in comparison to 10 years ago</i>	0.733 (0.442)	0.730 (0.444)	0.717 (0.450)	0.838 (0.369)
Observations	5700	11203	4726	974

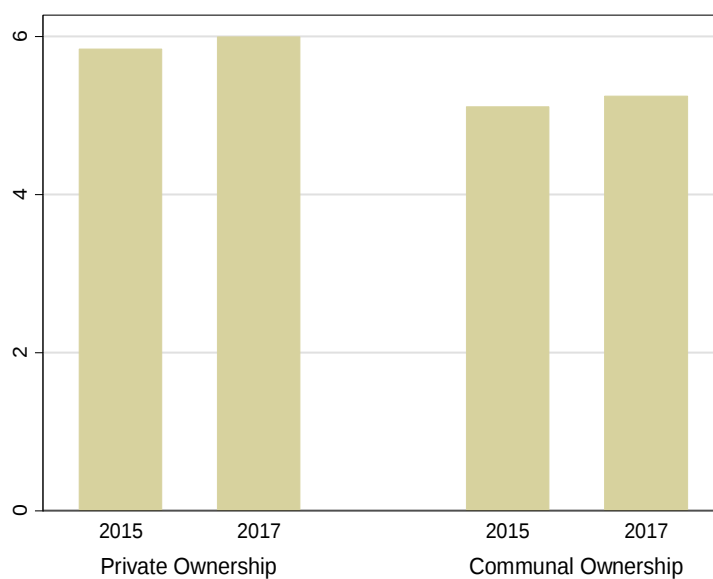
-Values in brackets indicate standard deviations

Figure 1 – Average well-being for landowners and tenure types

(a)



(b)



4. Econometric Methodology

The empirical econometric models applied in this paper are largely informed by the data used as well as the most useful ways to eliminate a number of biases associated with each model. Every model seeks to determine the effect of different tenure arrangements on subjective well-being and in this way, elements of impact evaluation will be applied- namely Propensity Score Matching and Instrumental Variable approaches. The purpose of any impact evaluation, besides achieving the most rigorous and robust statistics, is to confidently make inferences about the causal effects from any program or intervention (Khandker et al., 2010). Program participation (i.e. landownership) is thus compared to a constructed counterfactual group while also accommodating unobservable characteristics between landowners (program participants) and non-landowners (non-participants). A similar analysis is conducted between the two types of ownership structures- private land owners and communal land owners- to determine whether there are any statistically significant differences in subjective well-being between the two cohorts. Therefore, issues around non-randomisation into treatment (self-selection), unobserved heterogeneity and other important confounding factors will be progressively addressed as every model builds and improves on the previous one.

Four econometric specifications will be estimated, using a simple multivariate ordinary least square analysis as a baseline to develop deeper analysis from and address further specification complexities. The key independent variables of interest are *landowner* (an indicator variable for landowners and non-landowners), *tenure* (an indicator variable where one denotes a private landowner and zero denotes a communal land owner). With respect to the target variable of interest, there are a number of different methods to treat subjective well-being indicators. Ferrer-i-Carbonell and Frijters (2004) argue that multivariate OLS model approaches that treat subjective well-being as a cardinal variable is not statistically different from ordered *logit* or *probit* estimations that treat subjective well-being as ordinal. Tabachnick and Fidell (2001) posit that if there are more than five levels (in this case the subjective well-being levels ranges from 1 to 10) then it is acceptable to treat subjective well-being as a continuous variable. Alternatively, Ng (1997) argues that given the ordered nature of subjective well-being it should strictly be estimated as an ordinal variable. Following Cheng et al. (2016) this paper will treat subjective well-being as continuous in the initial, main estimation and, as a robustness check, employs several ordered *logit* and *probit* regressions wherein the 10 levels of subjective well-being are aggregated to 5 levels.

4.1 Model I: Baseline Specification - OLS estimation

The baseline, multivariate OLS regression function to be estimated will be:

$$SW_{i,t} = \beta_0 + \beta_1(ownership_{i,t}) + \gamma X_{i,t} + \epsilon_{i,t} \quad (1)$$

For a simple, benchmark estimate of the effect of land-ownership on subjective well-being given that:

- $SW_{i,t}$ denotes the subjective well-being for person i at time t ,
- $ownership_{i,t}$ denotes a dummy variable where 1 is assigned to a landowner and 0 is assigned to a non-landowner,
- $X_{i,t}$ denotes a vector of explanatory variables that characterize individual i at time t and,
- $\epsilon_{i,t}$ encapsulates the composite error term with both time invariant observables and the conditional error such that: $\epsilon_{i,t} = v_{i,t} + \epsilon_{i,t}$

A similar function will also be used to determine differences in subjective well-being between private landowners and communal owners:

$$SW_{i,t} = \alpha_0 + \alpha_1(tenure_{i,t}) + \alpha_2 X_{i,t} + \epsilon_{i,t} \quad (2)$$

Wherein all the variables are the same except for $tenure_{i,t}$ which is a dummy variable that equals 1 if individual i is a private landowner (with the right to sell) and zero if the individual is a communal landowner.

The control variables were selected based on individual, household and geographic characteristics that were informed by existing literature on subjective well-being (Kollamparambil, 2019; Posel and Casale, 2011 and Blaauw and Pretorius, 2013). Table A1 in the Appendix 1 lists and explains covariates included in the analysis. The OLS model provides a rudimentary estimation of the possible statistically significant associations between land-ownership on subjective well-being. Given the nature of the indicator variables of *tenure* and *ownership*, the coefficients on these variables will measure the extent to which owning land affects subjective well-being compared to those who do not own land (in the case of *ownership*) and differences in subjective well-being of those who own land privately compared to those who own it communally.

Barring the simplicity in explaining this model, the major limitations of this model is threefold. Firstly, it is likely that the coefficient of the independent variables, particularly *tenure*, is biased, as owning land is not random and thus self-selection bias may substantially confound

the results. Secondly, unobserved individual characteristics, such as personal energy levels, which may further confound the relationship between subjective well-being and income (Knight and Kingdon, 2009). For example, an uptick in a person's energy levels may cause an increase in subjective well-being which may make the person more productive thus also increasing their income. The reverse situation may also be possible as an increase in income may cause directly cause an increase in subjective well-being. This confounding relationship is not addressed in an OLS model, however Model 3 seeks to overcome this issue. Thirdly, it does not account for the panel data nature of the data as it limits the analysis to only one-time period (Wooldridge, 2002). While drawing conclusions on the change in subjective well-being due to owning land will not be useful in this paper, exploiting both waves to eliminate potential fixed heterogeneity may provide more appropriate results.

4.2 Model II: Fixed Effects estimation

The fixed effects model removes time-invariant individual characteristics as well as time-invariant omitted variables as it differences out the fixed effects over two time periods. The specification of the model assumes that unobservable characteristics that confound the relationship between subjective well-being and land ownership are controlled for, to the extent that they are fixed over time (Wooldridge, 2002). The model will estimate the following functions:

$$SW_{i,t} = \omega_0 + \omega_1 ownership_{i,t} + \omega_2 X_{i,t} + v_{i,t} + \epsilon_{i,t}$$

$$SW_{i,t} = \phi_0 + \phi_1 tenure_{i,t} + \phi_2 X_{i,t} + v_{i,t} + \epsilon_{i,t} \quad (3)$$

Where variables specified are the same as equations (1) and (2) except for the fixed effects differences between time periods. While this model may shed further light on the relationship between subjective well-being and ownership, without any possible fixed effects, a major limitation to this type of estimation is that it removes the option of assessing the influence of time invariant variables - such as gender - in explaining the impact of ownership on subjective well-being. It also assumes that the time invariant unobservables is unrelated to subjective well-being; this is unlikely as constant individual characteristics are likely to inform one's land ownership status. Violating this assumption thus results in biased, inefficient estimates (Wooldridge, 2002). Additionally, as noted in Model 1, another shortfall of this model is that it also does not address problems of unobserved heterogeneity confounding the relationship between income and subjective well-being, which Model III addresses.

4.3 Model III: Instrumental Variable estimation

The presence of endogeneity rendered the OLS and fixed estimation inconsistent given that $E(\varepsilon_{i,t} | X_{i,t}) \neq 0$ and the strict exogeneity assumption was likely to have been violated, most likely causing biased coefficients and error autocorrelation (Woolridge, 2002). Ferrer-i-Carbonell and Fritjers (2004) find that controlling for time invariant characteristics tends to reduce the size of positive coefficients on income as certain personality traits are conducive to higher subjective well-being which is also associated with a higher income. It is therefore important to control for personality and instrument for income. The former issue is controlled for by including variables such as an individual's expectations about the future. Following Cheng et al. (2016) and Kingdon and Knight, the latter issue will be addressed by implementing household consumption expenditure as an instrument for household income.

The instrumental variable model specification employs a two-stage least squares estimation wherein *log of household income*, is regressed on the instrument, *expenditure_{i,t}*, - household per capita expenditure - in the first stage:

$$linc_i = \rho_1 expenditure_i + \rho_2 X_i + u_i \quad (4)$$

The second stage regression estimates a standard linear OLS using the predicted values of the dependent variable in (4), $\widehat{linc}_{i,t}$, and inputs into the following function:

$$SW_i = \alpha_0 X_i + \alpha_1 (\widehat{\rho_1} expenditure_i + \widehat{\rho_2} X_i + u_i) + \varepsilon_i \quad (5)$$

The result is a coefficient estimate of *ownership* that is without confounding effects of the income-subjective well-being relationship posited by Ferrer-i-Carbonell and Fritjers (2004).

Reliance on instruments (Z) to identify the model requires it must satisfy the following conditions:

1. *Instrument Relevance*: The instruments used must exhibit a reasonable relationship with the suspected endogenous variable. Ideally, a strong instrument should explain a large portion of the variation in the endogenous variable.
2. *Strict Exogeneity*: the instrument, Z, must be orthogonal to the error term such that $E[u|X] = 0$ implying complete correlation with the error term. We suspect the instrument used (household consumption) will not be sufficient given that consumption is related to subjective well-being. Given this, we include another instrumental variable model using Lewbel's (2012) specification in Model in Section 4.3.1 and 4.3.2 below.

Testing the *Instrument relevance* condition is possible by examining the fit of the first stage regression by way of the R^2 as suggested by Bound et al. (2012). The full first stage regression with household income regressed on household consumption expenditure is provided in Table A3 of the Appendix. The corresponding R^2 is 0.647, suggesting a strong correlation between the consumption expenditure and household income. This is also supported by the F-statistic on the coefficient of consumption expenditure which is 159.4 as the general heuristic to determine the strength of the instrument is if the F-statistic is greater than 10 (Baum et al., 2012).

Testing the exogeneity condition requires a surfeit of instruments to directly test whether the instruments are uncorrelated with the error process. In the current analysis, a more nuanced understanding of the error process is required as only one instrumental variable is included. As Knight and Kingdon (2007: 86) argue, ‘Expenditure seems to be a reasonable instrument for income since it is unlikely that measurement error in per capita income will be correlated with measurement error in per capita expenditure’.

4.3.1 Internal instruments

Given the uncertainty of whether the exclusion restriction is met, the above IV estimation will be supplemented with an identification strategy that constructs internal instrumental variables based on the presence of heteroscedasticity in the data, first proposed by Lewbel (2012). The estimation takes the form:

$$SW_1 = \delta_1 X' + linc_2 \theta_1 + \varepsilon_1 \quad \varepsilon_1 = \alpha_1 M + N_1 \quad (6)$$

$$linc_2 = \delta_2 X' + \varepsilon_2 \quad \varepsilon_2 = \alpha_2 M + N_2 \quad (7)$$

Where M denotes the individual’s unobserved characteristics which affects both subjective well-being and income. N_1 and N_2 are idiosyncratic errors. A vector G of observed exogenous variables are then used as an instrument in the form:

$$[G - \bar{G}] \cdot \varepsilon_2 \quad (8)$$

G could be a sub-vector of X or equal to X. This instrument is only applicable as an instrument provided the following conditions hold:

$$E(X \varepsilon_j) = 0, j=1,2 \text{ and,} \quad (9)$$

$$\text{cov}(G, \varepsilon_1 \varepsilon_2) \quad (10)$$

and there exists some heteroscedasticity in ε_j . Successful identification is achieved, using (8) as an instrument, by having regressors that are uncorrelated with the product of the heteroskedastic errors. Note that ε_2 is a population parameter, as well as ε_j in equations (9) and (10); therefore, the sample estimate, $\hat{\varepsilon}_2$, obtained from the first stage regression, is used instead. This also implies that the standard assumption that the conditions denoted in equations (9) and (10) are, empirically, untestable. However, the element-wise products with the centered regressors, as in equation (8), will be non-zero, and will contain sizeable elements if there is clear evidence of ‘scale heteroskedasticity’ with respect to the regressors. This can be computed with a Breusch-Pagan test for heteroscedasticity wherein the greater the degree of scale heteroscedasticity in the error process, the higher will be the correlation of the generated instruments with the included endogenous variables. The Breusch-Pagan tests for the relationship between the residuals of the regression and the p indicator variables that are hypothesized to be related to the heteroscedasticity. This statistic is distributed as χ^2 with p degrees of freedom with the null hypothesis that there is no heteroscedasticity, and that the errors of the regression are normally distributed (Baum et al., 2012). The Breusch-Pagan test is reported in Table 6 which presents the main IV regression results and points to a strong presence of heteroscedasticity in the system.

4.4 Model IV - Propensity Score Matching

Acknowledging the possibility that the instrumental variable approach in Section 4.3 may not be capable of completely solving endogeneity in the model, a propensity score analysis is conducted to provide an internal validity of the IV estimation. Self-selection bias is still a potential source of endogeneity as it is possible that individuals with lower levels of economic well-being are more likely to not have land. Another possible source of endogeneity is omitted variable bias arising from confounding unobservable variable effects in the model. A sensitivity analysis in Section 4.4.1 will explore the robustness of the matching estimates to selection bias on unobservables (Rosenbaum, 2005).

The PSM model uses matching estimates of the average treatment effect of land ownership on life satisfaction that addresses endogeneity concerns by constructing a treatment and control group that are statistically identical. One particular advantage of estimating PSM is that it does not assume linearity and is valid even though there is little overlap between the distributions of independent variables of treatment and control groups (Arun et al., 2006) In addition, the propensity scores derived is a balancing score wherein the distributions of the observed covariates are independent of the binary treatment (Rosenbaum and Rubin, 1983). This implies

that the distribution of the covariates is the same for the treated (owning land) and control (non-landowners) units, thus resulting in more robust treatment effects.

The propensity score is the conditional probability of receiving a treatment. In this case, we estimate two separate models; one in which the total sample of landowners and non-landowners is used where the dependent indicator variable is coded as 1 if the individual owns land and 0 otherwise. The second estimation uses the sub-sample of only landowners and includes the dependent variable that is coded as 1 if the individual owns secure land rights on communal land and 0 otherwise. Given a set of pre-treatment individual and household characteristics, X , given by:

$$p(X) = \Pr(D = 1|X) = E(D|X) \quad (11)$$

where $D = (0,1)$ is a binary variable indicating whether the individual received treatment and X is a vector of pretreatment characteristics. The treatment variables in this analysis are therefore; whether the individual is a landowner and whether the individual is a communal rights owner or private land owner. The pre-treatment variables used for both models include socioeconomic characteristic variables (log of income, education years, education-squared, household size, employment status, whether the individual owns a credit or bank account) as well as demographic features (age, age², gender, race). Also included are the indicator variables for every province the individual resides.

Using the propensity scores computed in (11), the Average Treatment Effect of Treatment on the Treated (ATT) is calculated as:

$$\begin{aligned} \vartheta &= E(Y_{1i} - Y_{0i}|D_i) \\ &= E[E\{Y_{1i} - Y_{0i}|D_i = 1, p(X)\}] \\ &= E[E\{Y_{1i}|D_i = 1, p(X_i)\}] - E[E\{Y_{0i}|D_i = 0, p(X_i)\}|D = 1] \end{aligned}$$

Where, Y_{1i} and Y_{0i} are the potential outcomes (subjective well-being) such that Y_{1i} is a the counterfactual; of receiving treatment and Y_{0i} is the counterfactual situation of not receiving treatment.

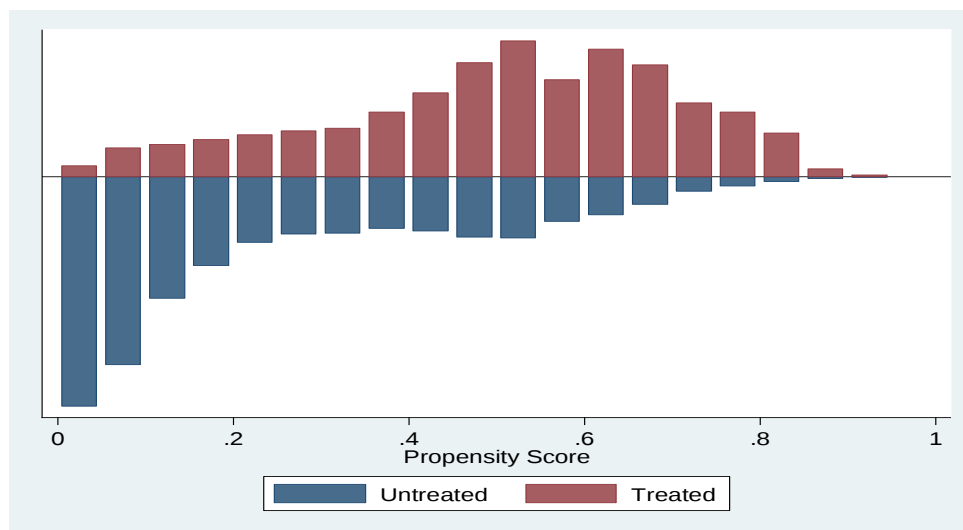
Identification using the propensity scores requires two conditions that are necessary to establish a casual effect:

- 1.) *Common Support* requires that there needs to be a sufficient number of observations after matching and the exclusion of observations that lie outside the common support.

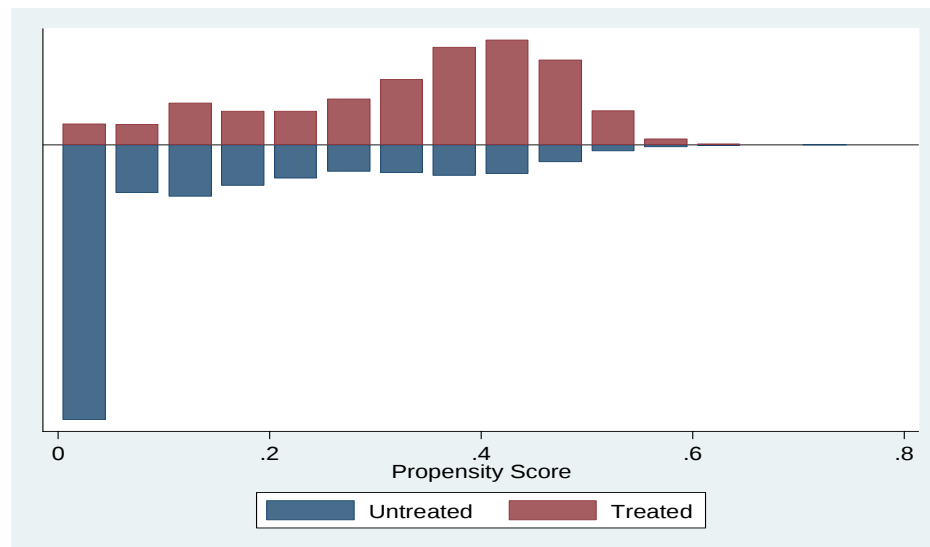
If this assumption is not met, this means that there are not enough matched samples in the data and the treatment and control groups are incomparable. After balancing the scores, observations outside of the overlap were omitted from further analysis. The histograms in Figure 2 illustrates the distribution of the treated and control group scores. The bulk of the scores in Panel (a) are distributed between 0.3 and 0.7 and contains more observations than Panel (b). Most of the scores are spread between 0.2 and 0.5. At the lower end of the score spectrum in Panel (b), there are more untreated observations. The final number of matched observations in the main sample and subsample is 7705 and 2703 respectively. The significant difference in the number of the observations for both samples may be a main contribution to the difference in histogram shape.

Figure 2 Frequency distributions of the treated and matched control subsamples along common support

(a) *Ownership: (Landowners vs. Non-Landowners)*



(b) *Tenure: (Communal rights owners vs. Private rights holders)*



2. *Conditional Independence Assumption*: this means that given the propensity scores, the included covariates fully explain the observed factors that cause differences between treatment assignment and non-treatment assignment. Thus it is assumed that all the factors that generate dependence between the outcome and the distribution of the propensity scores are identical thus the probability of receiving treatment and not receiving treatment is conceivably the same (this is similar to the parallel trends assumption which assumes that the non-treated group would follow the same trends if the treated group were not treated) (Khandker et al., 2010). This is a strong assumption given that it assumes no confounding unobservables.

4.4.1 Sensitivity Analysis

The ‘strong ignorability’ implied by the identification conditions above suggests that all differences between the treatment-control groups is fully controlled for at baseline. This means that all the included observed covariates account for all the differences between treatment and control, which is too unrealistic an assumption to make. In addition, because the Conditional Independence assumption involves unobserved potential outcomes, it is generally untestable in practice. Rosenbaum (2005) developed a useful tool to test the sensitivity of the propensity score analysis to potential non-included covariates: it computes the size the unmeasured covariate would have to be to change the conclusions of the study. This involves assessing the robustness of the estimated causal effects with respect to assumptions about an unobserved binary covariate that is associated with both the treatment and the control variables

(Rosenbaum, 2005). The higher the measure of hidden bias, Γ , the greater the odds that one individual is likely to receive treatment because of pre-treatment differences. Thus if $\Gamma = 2$, in a simple randomized experiment, one individual may be twice as likely to receive treatment based on (unobserved) pre-treatment differences and similarly, if $\Gamma=1$, every individual has the same probability of receiving treatment.

5. Results

5.1 OLS and Fixed Effects

The following section furnishes the key results of the estimation strategies discussed in Section 5, which consists of the dependent and independent variables listed and described in Table A1 of the Appendix. Every specification estimates the effects of subjective well-being on the independent variable land ownership (*landowner*) separately from the type of ownership type (*tenure*); these are the main variables of interest. Each specification includes the vector of covariates discussed in the previous section; the vector includes variables that control for household and individual indicators, geographic variables, economic and financial inclusion indicators as well as personality variables that seeks to measure individual perception.

Table 5 reports the key results for models 1 and 2 for both the dependent variables of interest, *tenure* and *landowner*. The coefficients on the OLS for the dummy ownership variable is positive and statistically significant – at a 5% significance level- strongly suggesting that an individual's subjective well-being is greater than that of a non-landowner, given the set of control variables. The coefficient on the tenure variable is also positive and statistically significant at a 10% significance level implying that private landowners' subjective well-being is greater than individuals who own communal land. From the analysis it is evident that household income per capita, an individual's relative happiness and whether the household lives in a formal housing structure remain consistent statistically significant predictors of subjective well-being.

The fixed effects model for *tenure* yields a positive coefficient, statistically significant at 10%, however the value of the coefficient declined from 0.297 to 0.160 suggesting some form of upward bias on the *tenure* variable which may have been caused by time-invariant omitted variable bias. The same phenomenon is observed on the landownership variable except both models (OLS and Fixed effects) yield stronger statistical significant values on the p-value (1% and 5% respectively). The OLS and FE provide a benchmark from which to analyse the more

sophisticated models but, as discussed in Section 4 does not provide consistent and efficient estimates due to self-selection and the presence of income as an endogenous variable.

The coefficients for *age* and *age*² are consistent across all specifications in Table 5 and unexpectedly suggests a stronger effect of age. The expected negative sign on education and negative sign on education² implies a weaker effect on well-being with added education years. A consistent, statistically significant effect on well-being is the presence of domestic violence in the neighborhood (negative effect), the importance of religion (positive effect) and relative happiness to 10 years ago (positive) which was also found in a similar individual analysis by Kollamparambil (2019).

Table 5 – OLS and Fixed Effects results for the main sample and the main sample

VARIABLES	(1)	(3)	(2)	(4)
	Main Sample		Sub-sample	
	I. OLS	II. Fixed Effects	I. OLS	II. Fixed Effects
<i>Land ownership</i>	0.466*** (0.0869)	0.370** (0.00799)	-	-
<i>Private ownership</i>	-	-	0.297** (0.151)	0.160* (0.0190)
<i>Age of respondent</i>	-0.0520*** (0.0158)	-0.0400* (0.00402)	-0.0774** (0.0346)	-0.0675* (0.00545)
<i>Age squared</i>	0.000650*** (0.000174)	0.000478* (6.41e-05)	0.000895** (0.000350)	0.000734* (6.96e-05)
<i>Education years</i>	0.0377 (0.0347)	-0.00761 (0.00943)	0.0592 (0.0560)	-0.0275 (0.0171)
<i>Education years squared</i>	-0.00111 (0.00118)	0.000294 (0.000273)	-0.00171 (0.00189)	0.00104 (0.000520)
<i>Married or living with a partner</i>	0.178** (0.0797)	0.139 (0.0538)	0.352*** (0.131)	0.253* (0.0292)
<i>Household size</i>	0.0444*** (0.0125)	0.0159 (0.00381)	0.0780*** (0.0261)	0.0398 (0.0268)
<i>Log of household income per capita</i>	0.180*** (0.0439)	0.176* (0.0232)	0.176** (0.0731)	0.214** (0.0158)
<i>African</i>	-0.136 (0.187)	0.101* (0.0144)	0.167 (0.326)	-0.0758 (0.121)
<i>White</i>	0.0594 (0.210)	0.634** (0.0410)	0.404 (0.344)	0.347 (0.0949)
<i>Coloured</i>	0.374* (0.210)	0.497** (0.0175)	0.842** (0.363)	0.327 (0.335)
<i>Gender</i>	-0.135* (0.0727)	-0.0781 (0.0311)	-0.227 (0.142)	-0.203 (0.0599)
<i>Employed</i>	-0.0810 (0.0841)	0.0742 (0.0503)	-0.250* (0.151)	0.0446 (0.0309)
<i>Religion is important</i>	0.439*** (0.117)	0.290* (0.0297)	0.285 (0.189)	0.306** (0.0158)
<i>Relative level of happiness is the same or happier in comparison to 10 years ago</i>	1.466*** (0.0795)	1.356* (0.131)	1.409*** (0.138)	1.422* (0.188)
<i>Positivity and optimism for the future</i>	0.527*** (0.0699)	0.587 (0.219)	0.519*** (0.126)	0.580** (0.0419)
<i>Household lives in a formal dwelling</i>	0.528*** (0.0808)	0.440** (0.0344)	0.333** (0.135)	0.417* (0.0373)
<i>Above average health status</i>	0.375*** (0.109)	0.124 (0.198)	0.500*** (0.155)	0.247 (0.135)
<i>Household experiences frequent domestic violence in neighbourhood</i>	-0.476*** (0.0827)	-0.421** (0.0204)	-0.438*** (0.148)	-0.439*** (0.00330)
<i>Household has flushing toilet</i>	-0.535*** (0.130)	-0.00858 (0.0541)	0.117 (0.182)	0.168 (0.0358)
<i>Crime is common in neighbourhood</i>	-0.202** (0.0792)	0.00695 (0.139)	0.0446 (0.133)	0.0596** (0.00133)
<i>Owns a Bank account</i>	0.525***	0.317	0.544***	0.339

	(0.0873)	(0.0907)	(0.158)	(0.0656)
<i>Perceived current income step</i>	0.869***	0.647*	0.797***	0.551
	(0.0937)	(0.0578)	(0.140)	(0.0884)
<i>Household has electricity</i>	-0.169*	-0.133	-0.0806	-0.140
	(0.0954)	(0.132)	(0.147)	(0.0233)
<i>Household has access to piped water</i>	0.285***	0.0968	0.123	0.0267
	(0.0991)	(0.135)	(0.157)	(0.0635)
<i>Geographic Variables</i>	Yes	Yes	Yes	Yes
<i>Constant</i>	1.209**	1.797	0.989	2.416
	(0.605)	(0.342)	(1.197)	(0.783)
<i>Observations</i>	14,498	28,266	4,885	9,080
<i>R-squared</i>	0.241	0.194	0.234	0.201
<i>Number of wave</i>		2		2

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5.2. Instrumental Variable model

Table 6 contains the main coefficient results for the *ownership* and *tenure* variables using household consumption expenditure as an instrumental variable for income in both samples. Columns 1 and 3 include the coefficients for the standard IV method whereas columns 2 and 4 include internal instrumental variables based on the presence of heteroscedasticity. The main results reflect a positive and statistically significant effect of land ownership and *private ownership* on well-being. An added advantage of using the *ivreg2h* Stata package to estimate Lewbel's method is that it allows us to estimate the Generalized Method of Moments (GMM) estimates that utilises the orthogonality conditions that generates efficient coefficients in the presence of heteroscedasticity and in the absence of knowledge of the nature of variable distribution (Baum et al., 2012). Therefore, the standard errors are heteroscedasticity consistent. In terms of the regression for landowners, this is evident in the lower standard errors for the IV-GMM estimates in columns 2 and 4.

The sub-sample results are positive and statistically significant at the 5% confidence level. The effect of the instrument slightly deflated the value of the coefficient on *private ownership* compared to the normal instrumental variable estimation but are also more efficient given the decrease in standard errors, however this causes an instrument over-identification with 34 degrees of freedom. The corresponding p-value of the j-statistic are both insignificant suggesting that the null hypothesis that the over-identification restrictions are valid is not rejected. Overall, however, the coefficients in the sub-sample IV estimation is greater than the simple OLS regressions and fixed effects methods.

Table 6 – IV regression results for ownership and tenure

VARIABLES	(1)	(2)	(3)	(4)
	Ownership		Tenure	
	Normal IV	Lewbel's IV	Normal IV	Lewbel's IV
Land ownership	0.464*** (0.0868)	0.466*** (0.0848)	-	-
Private ownership	-	-	0.347** (0.149)	0.331** (0.143)
Log of household income per capita	0.338*** (0.0824)	0.289*** (0.0693)	0.301** (0.131)	0.0842 (0.0969)
Age of respondent	-0.0488*** (0.0159)	-0.0488*** (0.0153)	-0.0780** (0.0347)	-0.0760** (0.0322)
Age squared	0.000597*** (0.000177)	0.000597*** (0.000171)	0.000878** (0.000352)	0.000869*** (0.000329)
Education years	0.0227 (0.0356)	0.0262 (0.0337)	0.0466 (0.0574)	0.0172 (0.0525)
Education years squared	-0.000650 (0.00120)	-0.000744 (0.00114)	-0.00130 (0.00191)	-0.000140 (0.00176)
Married or living with a partner	0.164** (0.0800)	0.168** (0.0760)	0.324** (0.133)	0.353*** (0.125)
Household size	0.0585*** (0.0138)	0.0580*** (0.0127)	0.0894*** (0.0293)	0.0520** (0.0238)
African	-0.0701 (0.190)	-0.123 (0.171)	0.242 (0.332)	0.176 (0.289)
White	-0.0820 (0.218)	-0.0321 (0.197)	0.289 (0.365)	0.599* (0.317)
Coloured	0.389* (0.212)	0.383** (0.194)	0.853** (0.368)	0.885*** (0.327)
Female	-0.143** (0.0725)	-0.151** (0.0709)	-0.231 (0.141)	-0.237* (0.132)
Employed	-0.140 (0.0867)	-0.117 (0.0823)	-0.285* (0.150)	-0.185 (0.144)
Religion is important	0.448*** (0.117)	0.464*** (0.114)	0.300 (0.187)	0.336* (0.184)
Relative level of happiness is the same or happier in comparison to 10 years ago	1.452*** (0.0794)	1.499*** (0.0775)	1.389*** (0.138)	1.395*** (0.132)
Positivity and optimism for the future	0.532*** (0.0695)	0.521*** (0.0676)	0.524*** (0.125)	0.503*** (0.120)
Household lives in a formal dwelling	0.502*** (0.0807)	0.476*** (0.0780)	0.306** (0.134)	0.343*** (0.130)
Above average health status	0.374*** (0.108)	0.345*** (0.107)	0.493*** (0.154)	0.450*** (0.148)
Household experiences frequent domestic violence in neighbourhood	-0.457*** (0.0835)	-0.462*** (0.0819)	-0.426*** (0.148)	-0.445*** (0.143)
Household has flushing toilet	-0.582*** (0.130)	-0.508*** (0.124)	0.0665 (0.182)	0.0364 (0.175)
Crime is common in neighbourhood	-0.209*** (0.0797)	-0.186** (0.0769)	0.0301 (0.134)	0.0891 (0.122)
Owns a Bank account	0.507***	0.527***	0.519***	0.744***

	(0.0888)	(0.0850)	(0.163)	(0.145)
Perceived current income step	0.811***	0.805***	0.739***	0.800***
	(0.0978)	(0.0936)	(0.149)	(0.136)
Household has electricity	-0.187*	-0.203**	-0.0719	-0.106
	(0.0958)	(0.0930)	(0.146)	(0.141)
Household has access to piped water	0.299***	0.245***	0.153	0.227
	(0.0992)	(0.0946)	(0.158)	(0.153)
Geographic characteristics	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes
Constant	0.315	0.646	0.418	2.030*
	(0.773)	(0.694)	(1.386)	(1.178)
Observations	14,498	14,498	4,885	4,885
R-squared	0.238	0.238	0.230	0.227
Breusch Pagan test (p-value)	315.843 (0.000)	-	-	-
Hansen J stat.	-	45.3	-	38.6
J- stat df	-	34	-	34
J-stat p-value		0.1932	0.257	0.269

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.3 Propensity Score Matching

The final model estimated is the propensity score method which constructs a counterfactual for the treatment. For the main sample, the treatment is owning land and because there are significantly more observations who are private landowners than communal land owners, the treatment for the sub-sample is the *communal owners* for ease of computation.

To derive the propensity scores, a logit model was applied and included covariates based on the probability of being treated. Only samples from Wave 5 was used to prevent inflated estimated effects. Table 7 reports the estimates of the logit regression for both samples. The variables that encompass access to electricity and piped water were excluded from both samples as its inclusion resulted in an unbalanced distribution. The logit specification in column 1 reveals a strong positive probability of being a landowner if one owns a bank and credit account, is from a higher income household, and is educated. The statistically significant variables are *age*, *age²*, *log of household income*, *male*, *owning a bank account and credit card*. Column 2 shows the computed coefficients on the logit regression of the sub-sample. The statistically significant results are *income*, *education-squared*, *education*, *whether the individual owns a bank account*, *all the provinces* and *whether the individual is employed*. The coefficients on all of the variables are negative (except for race variables, age-squared and education squared). This implies that, for example, individuals who own a credit card or bank account were less likely to be owners of secure tenure rights on communal land (compared to

private landowners) whereas married individuals were more likely to be communal rights holders. In general, the logit regression suggests that those with relatively high socioeconomic status (employed and higher income) are more likely to be private landowners than communal rights holders. This logit model is thus used to compute the propensity scores and as mentioned in Section 5, the propensity scores are balanced for the treated and control groups.

Table 7 - Logit regression for landowning and communal ownership

	Landowner	Tenure (communal ownership =1)
Age of respondent	0.2524*** (0.0106)	-0.0158 (0.0177)
Age squared	-0.0096*** (0.0001)	0.0014 (0.0018)
Education years	0.0089 (0.0178)	-0.1016*** (0.0249)
Education years squared	-0.00146 (0.0006)	0.0036*** (0.0084)
Household size	-0.0121 (0.0075)	0.0280** (0.0116)
Log of household income per capita	0.1107*** (0.0263)	-0.2908*** (0.0433)
African	0.1179 (0.1449)	17.3783 (2726.898)
White	0.2249 (0.1649)	14.5387 (2726.898)
Coloured	0.0442 (0.1622)	15.4367 (2726.898)
Gender	-0.1395*** (0.0429)	-0.0497 (0.0706)
Employed	-0.0604 (0.4913)	-0.2062 (0.0747)
Household has access to credit card	0.5421*** (0.0939)	-0.59021 (0.2466)
Household has access to bank account	0.1085** (0.0505)	-0.1203 (0.0714)
Gauteng	0.5891*** (0.0796)	-3.1511 (0.2834)
Western Cape	0.6019*** (0.0952)	-2.2955 (0.2643)
Northern Cape	0.3369 (0.1001)	-1.4037 (0.1768)
Mpumalanga	0.1213 (0.0919)	-1.2005 (0.1185)
Kwa- Zulu Natal	-0.5279 (0.0707)	1.8885 (0.1551)
Eastern Cape	-0.0954 (0.0815)	1.4946 (0.1617)
Limpopo	0.7615*** (0.0941)	0.1742 (0.1742)
Constant	-8.3655	-14.9367
Observations	14.858	9313

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Subsequent to ensuring the computed propensity scores were balanced, balancing tests were conducted by applying t-tests on pre-treatment characteristics. The results are included in Table A4 in the Appendix. All pre-treatment variables in both samples exhibit strong differences in mean, especially on income and race; these factors have a significant influence on the treatment probability. The results of the t-tests justify the estimation strategy as all covariates are rejected for treatment and control mean equivalence after matching. The matching process also led to a fall in overall mean bias due to covariate imbalances as the main- and sub-sample bias reduces from 22.3% to 1.8% and 32.9% to 1.4% respectively, suggesting that the conditional independence assumption is likely to have been met.

5.3.1. Estimates of the average treatment effects

Having satisfied the balancing requirement, Table 8 reports the average treatment effects on the treated for both samples using the STATA package *psmatch2*. It is evident from the table that the qualitative results from the IV-estimation are affirmed by the PSM model for both samples. Except for the nearest neighbour matching for the sub-sample, the average treatment effect for landowners is positive and statistically significant, irrespective of the matching algorithm used. The results for the sub-sample also reveal the same qualitative patterns as the IV regressions and basic OLS estimations, although the estimated effects are smaller in quantity than the IV regressions. The ATE suggest a negative subjective well-being effect on land right owners with secure rights on communal land over private landowners.

Table 8 - Average treatment effects for main and sub-sample

Matching method	Number of samples		Results		
	Treated	Control	Average treatment effects on the treated	Bootstrapped Standard Errors	t-statistic
<i>Full Sample</i>					
Nearest 1-to-1, caliper 0.1	5010	2695	0.354**	0.061	5.781
Nearest neighbour, random draw	5010	2695	0.354**	0.076	4.652
Kernel, bandwidth of 0.05	5010	2695	0.300*	0.074	4.664
Radius matching, radius of 0.01	5010	2695	0.327**	0.064	6.219
Stratification	5010	9545	0.348**	0.057	6.099
<i>Sub-sample</i>					
Nearest 1-to-1, caliper 0.1	1608	1095	-0.197*	0.104	-1.900
Nearest neighbour, random draw	1608	1095	-0.197*	0.102	-1.931
Kernel, bandwidth of 0.05	1608	7381	-0.284**	0.075	-3.96
Radius matching, radius of 0.01	1608	7381	-0.265*	0.065	-3.54
Stratification	1608	7381	-0.277*	0.080	-3.457

5.3.2. Sensitivity Analysis

The sensitivity analysis will assist in gauging the possible unobserved variables that may influence causal analysis between life satisfaction and landownership. The sensitivity analysis tool *rbounds* on Stata captures the gamma (Γ) for both samples; Γ represents the degree of association of an unobserved characteristic with the outcome. The extent of the effect of the unobserved characteristic would need to change the observed impact (Ichino et al., 2006). *rbounds* uses the results from the nearest neighbour matching estimates to calculate the maximum and minimum p-values from a Wilcoxon sign rank test. For every ascending gamma, the odds of the existence of an unobserved variable is rejected provided the p-value is closer to 0. Table 9 includes the Wilcoxon sign test as well as the Hodges-Lehman point estimates of the impact of the treatment on the outcome variable and their confidence intervals (95% confidence level). When $\Gamma=1.2$ in the full sample, the statistical significance of the Wilcoxon signed-rank test upper bound estimate at this level of bias is $p < 0.0238$. The estimates become increasingly insignificant from $\Gamma=1.25$ at the 95% confidence level. In line with other literature (Duvendack and Palmer-Jones, 2013) and Guo and Fraser (2010), the gamma at 1.25 is a relatively small value and suggests that the model is sensitive to hidden bias. This implies that for the full sample, the statistically significant effect of owning land on subjective well-being may be due to unobservables. This is contrast to the sub-sample, which reports a statistically significant threshold of $\Gamma = 2$ at the lower bound. This suggests that the selection bias would double the odds ratio in favour of owning land communally. Therefore, the result of the sub-sample sensitivity tests alludes to the average treatment effects of the model in Table 8 as fairly robust to unobserved characteristics.

Table 9 – Sensitivity analysis for both main sample and sub-sample

Gamma (Γ)	Significance levels (Wilcoxon signed-rank test)		Hodges-Lehmann point estimates		95% Confidence Level	
	Upper	Lower	Upper	Lower	Upper	Lower
<i>Full Sample- Landownership</i>						
1	3.7e-14	0.0000014	0.5000	0.5000	0.0600	0.5250
1.05	9.6e-10	0.0000057	0.3592	0.5432	0.0262	0.7492
1.1	2.1e-06	0.0000042	0.0780	0.9953	4.5e-07	1.3653
1.15	0.000554	0.0000033	0.0422	0.9974	0.3170	1.4224
1.2	0.023809	0.0000020	-3.4e-07	1.6782	0.05624	1.5353
1.25	0.225653	0.0000004	-3.4e-07	1.8424	-0.6735	1.5892
1.3	0.664883	0.0000003	-3.4e-07	1.8854	-0.6770	1.7556
<i>Sub-sample- Tenure</i>						
1	0.000497	0.000497	0.5000	0.500	2.7e-07	0.5000
1.5	0.04499	9.2e-06	2.7e-07	0.643	2.7e-07	0.5000
2	0.034578	1.8e-07	5.7e-07	0.1330	2.7e-07	0.6271
2.5	0.144813	2.4e-09	5.7e-07	0.2988	-2.7e-07	0.6500
3	0.369468	2.2e-11	0.05309	0.2999	-2.7e-07	0.8991
3.5	0.641564	1.4e-14	-0.04478	0.3213	-0.5000	0.9584
4	0.848822	6.7e-16	-0.0446	0.3490	-0.5000	0.9733

This table shows magnitude of selection on unobservables, range of significant level, Hodges-Lehmann point estimates and confidence intervals.

6. Robustness checks

The main identification strategies employed reveal that owning land, and owning land with the option to sell the land rights, had significant, positive impacts on subjective well-being. Despite the statistical rigour of the identification strategies used, a good way to check the validity of the model is to supplement it with other equally viable methods. Given that the landowners sample is deliberately selected from the main sample, the issue of the confounding effect of self-selection on the outcome may still be a concern. The sub-sample, all the land-owners, suffers from ‘selection on unobservables’ because there is a correlation between the errors that determine whether an individual is missing and is correlated with the errors that determine the outcome, by construction. The second tranche of models seeks deal with this concern by implementing Heckman’s ordered *probit* regression. This regression model accounts for non-random sampling specifically for ordered categorical outcomes, used under the *heckoprobit* package in Stata.

To provide further internal validity measures, in addition to including a regression that accounts for inherent self-selection, an ordered logit model that treats the subjective well-being variable

as an ordinal variable and not a continuous variable is estimated. We convert the continuous subjective well-being variable with ten categories into five categories so that it can be treated as an ordinal variable in the ordered logistic regression. One of the assumptions underlying the ordered *probit* (and *logit*) regressions is that the relationship between each pair of the outcome groups is constant. This assumption implies that the relationship between the independent variables and the dependent variable does not change for every level of the dependent variable's categories (Ari and Yildiz, 2014). This is called the parallel lines assumption and can be tested for using the Brant test for equivalence. The test for both models suggest that the parallel trends assumption for a number of variables. This is not unexpected given that, for example, it is highly likely that the *log of household income* has its greatest effect on lower levels of happiness. Given that there are 24 variables included in the model, the parallel trends assumption is also highly unlikely to hold given that the varying magnitudes and effects of every variable (Ari and Yildiz, 2014). The Brant test rejects the equivalence of *log of household income*, *education year* and *white* at the 5% significance level for the main sample. For the sub-sample, variables *Perceived income step*, *formal dwelling* and *health status* are rejected at the 5% level for the Brant test. However, the results of the Brant and Wald test for the overall models for the main sample and sub-sample are not rejected thus we report the coefficients for the ordered logit regressions and assume errors are normally and randomly distributed.

The results of the ordered logit model are presented in Table 10, with the coefficients representing the proportional odds for the main and sub-sample results in columns 1 and 2, and the Heckman ordered *probit* model is shown in column 4. The effect of owning land is positive and statistically significant at the 1% confidence level. This implies that owning land, compared to not owing land, will return a 0.170 increase in the odds of being in a higher level of happiness. The same rationale is applied to the private ownership indicator variable; returning a positive log-odds of 0.144 at a 5% statistical significance. Controlling for self-selection in the Heckman ordered selection *probit* model also affirms the main results found in the initial identification strategies. The rho value indicates that unobservables that increase subjective well-being tend to increase in tandem with unobservables of the private ownership variable. While the Heckman ordered *probit* does not directly quantify the positive effect of private ownership on subjective well-being, the model indicates a statistically significant positive effect. The Wald test is also significant indicating that the model is a good fit.

Table 10 – Robustness checks: Logit, Mixed Effects and Heckman’s selection probit models

VARIABLES	Logit regression	Logit regression	Mixed Effects	Mixed Effects	Heckman's ordered probit
	Ownership	Tenure	Ownership	Tenure	Tenure
Land ownership	0.170*** (0.0658)	-	0.372*** (0.0312)	-	-
Private ownership	-	0.144** (0.137)	-	0.166** (0.0703)	-
<i>rho</i>	-	-	-	-	0.052**
Prob >chi2	-	-	-	-	0.040
Wald chi2	-	-	6790.63	2291.66	1525.27
Prob >chi2	-	-	0.000	0.000	0.000
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

One concern following the fixed estimation in Section 5 is that the model does not account for sorting effects created by provincial effects. It may be possible that subjective well-being is correlated with different provincial land policies. To determine if this is indeed an issue, a mixed effects regression is included in Table 10, columns 3 and 4. The linear mixed effects model accounts for fixed effects and random effects that may appear in levels or clusters. In this case we suspect the cluster effect may be at provincial level (Cheng et al., 2016). We find the effects of *ownership* and *tenure* still have a positive and statistically significant effect on well-being. However, the interclass correlation between individual and provincial levels is close to zero thus we conclude no strong sorting effects on the system.

7. Discussion

The identification strategies and the robustness checks confirm that owning land, and owning land privately, contributes positively to subjective well-being. Most of the coefficients estimated are also statistically significant. A summary of the results is listed in Table 11. Based on the estimated coefficients, the average increase in satisfaction levels ranges from 0.348 to 0.466 between landowners and non-landowners. The benefits of owning land are numerous, especially for low-income households who can use the land for subsistence or agriculturally commercial purposes, both of which improve overall welfare and contribute to decreasing income inequality. There is also the ancestral attachment to land that would positively contribute to well-being.

More interestingly, another key result is the comparison between private owners and communal rights-holders. Controlling for a host of well-being factors, the average differences in

satisfaction from the identification strategies applied ranges from 0.277 to 0.331 between private ownership and communal ownership. Even when accounting for selection bias endemic in the analysis, the estimated overall effect on well-being levels is generally statistically positive.

Table 11 – Summary of results

	OLS	Fixed Effects	IV	Lewbel's IV	PSM	Ordered Logit
Ownership	0.466***	0.370**	0.464***	0.466***	0.348**	0.170***
Private Ownership	0.297**	0.160*	0.347**	0.331**	-	0.144**
Communal Ownership	-	-	-	-	-0.277*	

Barring any social, economic and personal factors that may influence well-being the only key difference between the two tenure types is that private ownership provides the option to legally sell the land and use the land as collateral. This paper hypothesizes that owning land with the option to utilize the right to sell the land or use it to access formal credit may be a significant contributing factor to the positive effect private ownership variable has on well-being. Given that land is an essential asset for the poor, ownership of formally registered property titles creates opportunities to finance productive economic activities that would otherwise not be available.

While this paper found positive effects of registered land-ownership on well-being, a limitation of this paper is that it does not account for the complexities in applying for collateral. Further research should be done in determining the best ways to make credit access more available to the poor. The foregone opportunity of receiving a collateral loan – and therefore the investment opportunities it provides – may influence perceived well-being but does little to explain the potential legal processes one would need to go through not only to register a title but also apply for a loan. An often cited reason against formalizing land rights is the detrimental effects financial market exposure may have on the poor through increased taxes, interest rates and the possibilities of foreclosure. It would be interesting to determine the number of privately-owned land owners who used their land as collateral to determine the legal, administrative and financial implications.

8. Conclusion

Access to land ownership is a vital wealth-increasing avenue for the poor, particularly for an economically unequal country such as South Africa where the distribution of asset ownership is still heavily racially skewed towards a few members of the economy. Land redistribution, as it is enshrined in the South African constitution, is central to uplifting the poor and eradicating wealth inequality. However, the slow uptake of land reform since the advent of democracy has resulted in growing political cries for the nationalization of land. A central persistent contention arising from the debate on the nationalization of land is polarized between whether all land should be held and managed by the state or, alternatively, held privately with enforced individual property rights.

Proponents of the latter policy argue that land has intrinsic economic value that should be statutorily recognized, giving right-holders the right to extract maximum benefit from the land not as a generational inheritance of an asset, but also for its financial benefits, such as selling the asset or using it as collateral. Much of the discussion on nationalization in South Africa has centered heavily on ideological assessments with very little empirical analysis.

This paper seeks to fill that gap by determining two aspects with respect to land ownership: on the one hand, the differences in the effect of owning land on subjective well-being and on the other, the effects of owning land privately, as opposed to communally, also on subjective well-being. A variety of econometric strategies were applied; an OLS and fixed effects model, an instrumental variable approach, a propensity score analysis and an ordered logit. Included in the regression models were a number of control variables including geographic variables, as well as personality and household characteristics. We found that owning land, and owning land privately, both resulted in consistent and positive effects on subjective well-being. Verifying the robustness of the results: it was found that even accounting for selection bias using a Heckman selection *probit* model and estimating a mixed effects models that controlled for both random and fixed effects, the overall effect on well-being was persistently greater than not owning land or owning land communally.

Under the normative assumption that subjective well-being is a representative measure of welfare, measures to improve well-being are central to any policy initiatives aimed at reducing poverty and improving overall welfare. The results of this paper has two policy implications: firstly, raising the living standards of the poor through wealth-creation is vital for poverty and income inequality. Land ownership creates various channels for the poor to engage in

agricultural activities, it improves household living standards and opens up financial opportunities that would otherwise not be available. On the financial opportunities of land-ownership, Deininger and Jin (2003) found that enabling unrestricted individual land rights in Vietnam improved the rental and sales market that resulted in an unambiguous positive impact on productivity. While this study looks at the direct effects of landownership on well-being, other studies of a similar nature in South Africa, like Keswell and Carters' (2014) paper found that market assisted transfer of land ownership to low-income households increased household living standards by 25% (Keswell and Carter, 2014).

Secondly, poverty reducing strategies need to consider more nuanced approaches to land reform that do not prescribe to polarizing political debates about nationalisation but rather place greater emphasis on designing economic policies that increase the welfare of the most economically marginalised. Given the comparative effect owning land privately has on well-being, policy needs an approach to tenure reform that validates tenure rights by providing enforceable and secure long-term land rights that are unencumbered by the state. Instead, freehold titles should be a viable option for the poor. This is particularly because secure and stable individual titles widen the scope of access to financial sovereignty; this includes access to formal credit and the potential for land to be used to hedge against risk and adverse household shocks.

Is private land-ownership better than traditional forms of communal ownership? As they are currently defined within the current political economy in South Africa, it is assumed that the two are at complete opposite ends of the land ownership spectrum. In its current form, given the legal limitations on communal ownership, private ownership provides greater security and freedom of use. However, this presupposes that these two forms of ownership cannot coexist; imagining alternatives where communities, families or small, stable collectives have secure rights on land that is recognized by the state, and maintaining ancestral connection to the land, should not be beyond practical reach.

Community-centered land reform in Scotland is an example of the creation of viable alternatives to mainstream understandings of land ownership. The land is managed by a community-elected board but fully owned by the community and all rents and income from the land is reinvested into social and local development projects (Hoffman, 2018). Given the findings of this paper, further experimentation should be conducted into customizing private rights according to the community's development needs.

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10. Appendix

Table A1 – Description of explanatory variables and their expected effects on the outcome

Explanatory Variable	Description	Type of Variable	Expected effect on well-being variable
<u>Demographic Indicators</u>			
Age	Age of respondent	Continuous	Positive
Age ²	Squared age of respondent	Continuous	Negative
Married	Marital Status of respondent: 1= Married or living with a partner 0= Single or divorced	Dummy	Positive
African	Race descriptor: 1= African 0=Other	Dummy	Positive
White	Race descriptor: 1= White 0=Other	Dummy	Positive
Coloured	Race descriptor: 1= Coloured 0=Other	Dummy	Positive
Indian/ Asian	Race descriptor: 1= Indian or Asian 0= Other	Dummy	Positive
Gender	Gender descriptor: 1= Respondent is female 0=Respondent is male	Dummy	Positive
<u>Economic Indicators</u>			
Ln(Income per capita)	Natural logarithm of household per capita income (deflated by CPI)	Continuous	Positive
Education	Number of years of education years completed	Continuous	Positive
Education squared	Number of years of education years completed squared	Continuous	
Employed	Employment status using the broad definition: 1= Employed 0=Unemployed	Dummy	Positive
Household size	Number of members living in the household	Continuous	Negative
<u>Personality Indicators</u>			

Incomestep	Perceived current income step: 1= Respondent indicated income step level of 4, 5 or 6 on a scale of 1 to 6 0= Respondent indicated income step level of 1,2 or 3 on a scale of 1 to 6	Dummy	Positive
Expected Income in 5 years	Natural logarithm of expected household per capita income (deflated by CPI)	Continuous	Positive
Optimism for future	Perceived positivity for the future: 1= Respondent indicated positivity and optimism for the future 0= Respondent indicated negativity and pessimism for the future	Dummy	Positive
Relative happiness	Perceived current happiness compared to 10 years ago: 1= Happier 0= Less happy	Dummy	Positive
Health outcomes	Self-assessed health level: 1= Respondents' self-assessed perception is above average health status 0= Respondents' self-assessed perception is below average health status	Dummy	Positive
Religion	Denotes the importance of religion: 1= Important 0= Not important	Dummy	Positive
Safety	Perceived safety in community: 1= Respondent feels safe 0= Respondent does not feel safe	Dummy	Positive
Domestic Violence	Measure of the frequency of domestic violence in community: 1= Domestic violence is common 0= Domestic violence is uncommon	Dummy	Positive
<i><u>Financial Status Indicators:</u></i>			
Bank	Ownership of a bank account: 1= Respondent owns a bank account 0= Respondent does not have a bank account	Dummy	Positive
Credit	Ownership of a credit card: 1= Respondent has a credit card 0= Respondent does not have a credit card	Dummy	Positive
Debt	Household has debt: 1= Yes 0= No	Dummy	Negative

Geographic and household characteristics

Provinces	9 Dummy variables for every province computed as WC, EC, NC, FS, GAU, LIMP, MP, NW, KZN	Dummy	-
Formal	Household housing structure: 1= HH lives in a formal house 0= HH lives in an informal housing structure	Dummy	Positive
Electricity	Measure of household access to electricity: 1= Yes 0= No	Dummy	Positive
Piped water	Measure of the presence of access to piped water: 1= Yes 0=Otherwise	Dummy	Positive
Toilet	Houeshold has a flush toilet facility with onsite disposal: 1= Yes 0= No	Dummy	Positive
<i><u>Geographic Type:</u></i>			
Urban Formal	Household lives in an urban formal area: 1= Yes 0= Otherwise	Dummy	Positive
Urban Informal	Household lives in an urban informal area: 1= Yes 0= Otherwise	Dummy	Negative
Tribal Authority	Household lives in a tribal authority area: 1= Yes 0= Otherwise	Dummy	Negative
Rural Formal	Household lives in an rural formal area: 1= Yes 0= Otherwise	Dummy	Negative

Table A2 - Descriptive explanatory variables for geographic type and province

	Landowner	Non- landowner	Private Ownership	Secure Rights on Tribal allocation
<i>Western Cape</i>	0.134 (0.341)	0.113 (0.316)	0.131 (0.337)	0.0100 (0.0998)
<i>Eastern Cape</i>	0.110 (0.313)	0.126 (0.332)	0.0801 (0.272)	0.386 (0.487)
<i>Northern Cape</i>	0.0152 (0.122)	0.0358 (0.186)	0.0406 (0.197)	0.00907 (0.0949)
<i>Free State</i>	0.0367 (0.188)	0.0861 (0.281)	0.0976 (0.297)	0.0210 (0.144)
<i>Kwa-Zulu Natal</i>	0.228 (0.420)	0.120 (0.325)	0.0987 (0.298)	0.242 (0.428)
<i>North West</i>	0.0605 (0.238)	0.0587 (0.235)	0.0632 (0.243)	0.0329 (0.179)
<i>Gauteng</i>	0.304 (0.460)	0.220 (0.414)	0.253 (0.435)	0.0332 (0.179)
<i>Mpumalanga</i>	0.0544 (0.227)	0.105 (0.306)	0.108 (0.311)	0.0854 (0.280)
<i>Limpopo</i>	0.0567 (0.231)	0.136 (0.342)	0.128 (0.334)	0.181 (0.385)
<i>Urban Formal (2001 census)</i>	0.570 (0.495)	0.489 (0.500)	0.565 (0.496)	0.0556 (0.229)
<i>Urban Informal</i>	0.102 (0.303)	0.0843 (0.278)	0.0943 (0.292)	0.0278 (0.165)
<i>Tribal Authority Areas</i>	0.234 (0.424)	0.356 (0.479)	0.263 (0.440)	0.879 (0.326)
<i>Rural Formal</i>	0.0938 (0.292)	0.0713 (0.257)	0.0773 (0.267)	0.0374 (0.190)
Observations	7393	3415	2753	662

mean coefficients; sd in parentheses

Table A3 - First stage regressions with log expected income as outcome variable

VARIABLES	(1) <i>Ownership</i>	(2) <i>Tenure</i>
<i>Land ownership</i>	-0.0644*** (0.0197)	
<i>Private ownership</i>		0.0649* (0.0383)
<i>Age of respondent</i>	-0.0212*** (0.00371)	-0.0137* (0.00743)
<i>Age squared</i>	0.000287*** (4.11e-05)	0.000223*** (7.79e-05)
<i>Education years</i>	0.0221*** (0.00714)	0.0260** (0.0115)
<i>Education years squared</i>	-0.000476** (0.000240)	-0.000638* (0.000385)
<i>Married or living with a partner</i>	-0.0143 (0.0185)	0.0417 (0.0310)
<i>Household size</i>	-0.120*** (0.00447)	-0.122*** (0.0106)
<i>African</i>	-0.0890* (0.0539)	-0.131 (0.0969)
<i>White</i>	0.335*** (0.0617)	0.334*** (0.103)
<i>Coloured</i>	-0.0886 (0.0567)	-0.160 (0.0984)
<i>Gender</i>	0.0587*** (0.0175)	0.0523* (0.0298)
<i>Employed</i>	0.309*** (0.0190)	0.213*** (0.0296)
<i>Religion is important</i>	-0.0198 (0.0289)	0.0192 (0.0474)
<i>Relative level of happiness is the same or happier in comparison to 10 years ago</i>	0.0314 (0.0215)	0.0305 (0.0403)
<i>Positivity and optimism for the future</i>	0.00519 (0.0183)	0.0515* (0.0308)
<i>Household lives in a formal dwelling</i>	-0.0127 (0.0242)	-0.0815* (0.0416)
<i>Above average health status</i>	0.000363 (0.0277)	0.0344 (0.0390)
<i>Household experiences frequent domestic violence in neighbourhood</i>	-0.0255 (0.0211)	0.0264 (0.0400)
<i>Household has flushing toilet</i>	-0.00249 (0.0306)	-0.0138 (0.0681)
<i>Crime is common in neighbourhood</i>	0.0147 (0.0171)	0.00572 (0.0275)

<i>Owns a Bank account</i>	0.0140 (0.0193)	-0.00134 (0.0316)
<i>Perceived current income step</i>	0.137*** (0.0277)	0.208*** (0.0519)
<i>Household has electricity</i>	0.0770*** (0.0298)	-0.0224 (0.0364)
<i>Household has access to piped water</i>	-0.00958 (0.0260)	0.0450 (0.0436)
<i>Tribal Authority Areas</i>	-0.0910*** (0.0303)	-0.0619 (0.0590)
<i>Urban Informal</i>	-0.0380 (0.0310)	-0.0368 (0.0484)
<i>Rural Formal</i>	0.0840*** (0.0263)	0.0466 (0.0578)
<i>Gauteng</i>	0.00708 (0.0296)	0.0601 (0.0497)
<i>Western Cape</i>	-0.0374 (0.0316)	-0.0965* (0.0513)
<i>Limpopo</i>	-0.0574 (0.0453)	-0.144** (0.0649)
<i>Kwa-Zulu Natal</i>	-0.0164 (0.0234)	-0.0759* (0.0398)
<i>Northern Cape</i>	-0.0659** (0.0305)	-0.0571 (0.0468)
<i>North West</i>	-0.0829** (0.0362)	-0.0862 (0.0533)
<i>Free State</i>	-0.0904** (0.0404)	-0.0929 (0.0594)
<i>Log of household expenditure</i>	0.661*** (0.0165)	0.663*** (0.0316)
<i>Constant</i>	2.376*** (0.159)	2.131*** (0.298)
Observations	14,498	4,885
R-squared	0.648	0.714
Adjusted R-squared	0.6474	0.7119
F-statistic	329.58	174.54
Prob > F	0.000	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A4 – Propensity Score Matching *t*-tests:

Ownership

Variable	Sample	Treated	Control	% Bias	[%] Bias Reduction	t	p> t
Age	Unmatched	52.582	50.271	18.2		6.91	0.000
	Matched	52.524	52.619	-0.7	95.9	-0.21	0.834
Age squared	Unmatched	2927.7	2686.5	19.0		7.24	0.000
	Matched	2921	2932.6	-0.9	95.2	-0.25	0.799
Education	Unmatched	12.602	12.728	-1.7		-0.69	0.492
	Matched	12.494	12.521	-0.4	78.2	-0.10	0.923
Education squared	Unmatched	223.71	206.12	8.0		3.26	0.001
	Matched	220.7	220.32	0.2	97.9	0.04	0.965
Log household income	Unmatched	6.8284	7.6309	-76.7		-25.94	0.000
	Matched	6.8248	6.8419	-1.6	97.9	-0.57	0.568
Married	Unmatched	0.49386	0.59661	-20.7		-7.88	0.000
	Matched	0.48756	0.47575	2.4	88.5	0.67	0.503
Household size	Unmatched	5.1132	4.4425	23.9		9.45	0.000
	Matched	5.0883	4.8943	6.9	71.1	1.91	0.056
African	Unmatched	0.986	0.73145	78.5		23.61	0.000
	Matched	0.98694	0.98259	1.3	98.3	1.01	0.314
White	Unmatched	0.00175	0.09491	-44.5		-13.13	0.000
	Matched	0.00124	0.00311	-0.9	98.0	-1.14	0.256
Coloured	Unmatched	0.01225	0.15291	-52.9		-16.03	0.000
	Matched	0.01182	0.0143	-0.9	98.2	-16.03	0.535
Gender	Unmatched	0.31914	0.40689	-18.3		-6.81	0.000
	Matched	0.30535	0.3041	0.3	98.6	0.08	0.939
Owns a credit card	Unmatched	0.0123	0.0813	-33.1		-10.01	0.000
	Matched	0.01244	0.01057	0.9	97.3	0.50	0.620
Owns a bank account	Unmatched	0.4143	0.63451	-45.2		-16.69	0.000
	Matched	0.041418	0.3806	6.9	84.7	1.95	0.052
Employed	Unmatched	0.32448	0.51232	-38.8		-14.24	0.000
	Matched	0.32152	0.31095	2.2	94.4	0.64	0.519
Presence of electricity in household	Unmatched	0.81272	0.90162	-25.6		-10.66	0.000
	Matched	0.81157	0.80846	0.9	96.5	0.22	0.822
Gauteng	Unmatched	0.01109	0.13948	-50.2		-15.20	0.000
	Matched	0.00808	0.01119	-1.2	97.6	-0.90	0.367
Western Cape	Unmatched	0.00992	0.13948	-50.8		-15.35	0.000
	Matched	0.00995	0.01119	0.5	99.0	0.37	0.714
Northern Cape	Unmatched	0.02684	0.09058	-27.4		-8.92	0.000
	Matched	0.02488	0.03109	-2.7	90.2	-1.07	0.285
Mpumalanga	Unmatched	0.05718	0.09	-12.6		-4.46	0.000
	Matched	0.05784	0.05535	1.0	92.4	0.31	0.760
Free State	Unmatched	0.01167	0.09652	-38.2		-11.74	0.000
	Matched	0.01057	0.0119	-0.3	99.3	-0.17	0.865
Limpopo	Unmatched	0.08868	0.107	-6.2		-2.27	0.000
	Matched	0.08706	0.07463	4.2	32.1	1.29	0.196
Kwa Zulu Natal	Unmatched	0.53909	0.16207	86.0		36.25	0.000
	Matched	0.53731	0.54478	-1.7	98.0	-0.42	0.671
Eastern Cape	Unmatched	0.22404	0.10933	31.1		13.07	0.000
	Matched	0.23197	0.23134	0.2	99.5	0.04	0.967
North West	Unmatched	0.03151	0.06567	-15.9		-5.45	0.000
	Matched	0.03234	0.03172	0.3	98.2	0.10	0.920
Mean Bias	Unmatched	34.3					
	Matched	1.8					

Propensity Score Matching t-tests:

Tenure

Variable	Sample	Treated	Control	% Bias	[%] Bias Reduction	t	p > t
Age	Unmatched	52.582	50.271	18.2		6.91	0.000
	Matched	52.524	51.887	5.0	72.4	1.42	0.157
Age squared	Unmatched	2927.7	2686.5	19.0		7.24	0.000
	Matched	2921.0	2855.9	5.1	73.0	1.44	0.149
Education	Unmatched	12.602	12.728	12.728		-1.7	0.492
	Matched	12.494	12.652	12.652	-26.5	-2.1	0.578
Education squared	Unmatched	223.71	206.12	8.0		3.26	0.001
	Matched	220.70	225.71	-2.3	71.5	-0.58	0.559
Log household income	Unmatched	6.8284	7.6309	-76.7		-25.94	0.000
	Matched	6.8248	6.8454	-2.0	97.4	-0.68	0.497
Married	Unmatched	0.49386	0.59661	-20.7		-7.88	0.000
	Matched	0.48756	0.49938	-2.4	88.5	-0.67	0.503
Household size	Unmatched	5.1132	4.4425	23.9		9.45	0.000
	Matched	5.0883	5.168	-1.7	92.8	-0.46	0.647
African	Unmatched	0.986	0.73145	78.5		23.61	0.000
	Matched	0.9869	0.97886	2.5	96.8	1.77	0.077
White	Unmatched	0.00175	0.09491	-44.5		-13.13	0.000
	Matched	0.00124	0.0056	-2.1	95.3	-2.12	0.035
Coloured	Unmatched	0.01225	0.15291	-52.9		-16.03	0.000
	Matched	0.01182	0.0155	-1.4	97.3	-0.91	0.363
Female	Unmatched	0.31914	0.40689	-18.3		-6.81	0.000
	Matched	0.30535	0.33022	-5.2	71.7	-1.51	0.130
Owns a credit card	Unmatched	0.123	0.0813	-33.1		-10.01	0.000
	Matched	0.01244	0.01119	0.6	98.2	0.33	0.744
Owns a bank account	Unmatched	0.4143	0.63451	-45.2		-16.69	0.000
	Matched	0.41418	0.41294	0.3	99.4	0.07	0.943
Employed	Unmatched	0.3448	0.51232	-38.8		-38.8	0.000
	Matched	0.32152	0.3408	-4.0	89.7	-4.0	0.246
Household has access to electricity	Unmatched	0.81272	0.90162	-25.6		-25.6	0.000
	Matched	0.81157	0.78731	7.0	72.7	7.0	0.086
Gauteng	Unmatched	0.01109	0.13948	-50.2		-15.20	0.000
	Matched	0.00808	0.00995	-0.7	98.5	-0.56	0.576
Western Cape	Unmatched	0.00992	0.13936	-50.8		-15.35	0.000
	Matched	0.00995	0.01182	-0.7	98.6	-0.51	0.610
Northern Cape	Unmatched	0.02684	0.09058	-27.4		-8.92	0.000
	Matched	0.02488	0.02799	-1.3	95.1	-0.55	0.583
Mpumalanga	Unmatched	0.05718	0.09	-12.6		4.46	0.000
	Matched	0.05784	0.00933	2.1	82.9	0.70	0.487
Free State	Unmatched	0.01167	0.09652	-38.2		-11.74	0.000
	Matched	0.01057	0.00933	0.6	98.5	0.36	0.722
Limpopo	Unmatched	0.08868	0.107	-6.2		-2.27	0.023
	Matched	0.08706	0.07214	5.0	18.5	1.56	0.118
Kwa-Zulu Natal	Unmatched	0.53909	0.16207	86.0		36.25	0.000
	Matched	0.53731	0.5653	-6.4	92.6	-1.60	0.111
Eastern Cape	Unmatched	0.22404	0.10933	31.1		13.07	0.000
	Matched	0.23197	0.2158	4.4	85.9	1.10	0.272
North West	Unmatched	0.03151	0.06567	-15.9		-5.45	0.000
	Matched	0.03234	0.03545	-1.5	90.9	-0.49	0.626
Mean Bias	Unmatched	34.3					
	Matched	2.9					

Table A5 - Full specification: Ordered logit and Heckman selection probit model

VARIABLES	(1) Logit regression (Full sample)	(2) Logit regression (Sub- sample)	(3) Heckman's ordered probit (Sub- sample)
Land ownership	0.170*** (0.0658)		-
Private ownership		0.144** (0.137)	-
Age of respondent	-0.0406*** (0.0113)	-0.0358 (0.0261)	-0.0316*** (0.00741)
Age squared	0.000521*** (0.000127)	0.000450* (0.000266)	0.000358*** (7.55e-05)
Education years	0.00670 (0.0235)	-0.0593 (0.0391)	-0.00467 (0.0109)
Education years squared	-5.91e-05 (0.000783)	0.00208 (0.00128)	0.000199 (0.000371)
Log of household income per capita	0.190*** (0.0345)	0.314*** (0.0606)	0.119*** (0.0168)
Employed	0.0217 (0.0613)	-0.0560 (0.114)	0.0563* (0.0306)
Married or living with a partner	0.162*** (0.0578)	0.148 (0.0970)	0.143*** (0.0273)
Household size	0.00914 (0.00856)	0.0548*** (0.0197)	0.0282*** (0.00559)
African	0.133 (0.170)	0.0468 (0.294)	-0.00513 (0.0883)
White	0.630*** (0.184)	0.214 (0.309)	0.208** (0.0953)
Coloured	0.389** (0.187)	0.252 (0.326)	0.217** (0.0957)
Gender	-0.171*** (0.0539)	-0.276*** (0.0965)	-0.112*** (0.0273)
Owens a credit card	-0.00184 (0.109)	0.160 (0.140)	0.0240 (0.0459)
Owens a Bank account	0.299*** (0.0610)	0.222** (0.107)	0.142*** (0.0316)
Perceived current income step	0.452*** (0.0675)	0.359*** (0.115)	0.238*** (0.0332)
Religion is important	0.147* (0.0884)	0.165 (0.154)	0.145*** (0.0486)
Relative level of happiness is the same or happier in comparison to 10 years ago	1.212*** (0.0710)	1.480*** (0.121)	0.678*** (0.0349)
Positivity and optimism for the future	0.225*** (0.0518)	0.409*** (0.0900)	0.320*** (0.0259)

Above average health status	0.318*** (0.0905)	0.495*** (0.125)	0.121*** (0.0339)
Household experiences frequent domestic violence in neighbourhood	-0.391*** (0.0648)	-0.474*** (0.121)	-0.196*** (0.0337)
Crime is common in neighbourhood	-0.0541 (0.0561)	0.175* (0.0912)	0.0423 (0.0266)
Household lives in a formal dwelling	0.268*** (0.0726)	0.265* (0.136)	0.175*** (0.0358)
Household has electricity	-0.176** (0.0774)	-0.253* (0.145)	-0.0332 (0.0409)
Household has access to piped water	0.125* (0.0673)	-0.0796 (0.116)	0.0536 (0.0386)
Constant cut1	1.273*** (0.447)	1.881** (0.948)	-
Constant cut2	2.954*** (0.446)	3.486*** (0.942)	-
Constant cut3	4.527*** (0.446)	4.950*** (0.942)	-
Constant cut4	6.026*** (0.447)	6.515*** (0.949)	-
<i>rho</i>			0.052**
Prob >chi2			0.040
Observations	14,483	4,877	9,105
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			