

Research paper



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The Impact of Moving from an Informal Settlement to a Formal Settlement on Life Satisfaction: A Difference in Difference Analysis

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Abstract

The aim of study was to trace the life satisfaction of three different groups over four periods of time. The study investigates the impact of moving from an informal settlement to a formal settlement on life satisfaction. Three groups were studied, namely, the treated group, government housing dwellers and private dwellers. The life satisfaction of the three groups is traced using the following five econometric models; Pooled Ordinary Least Squares (POLS), fixed effects, difference in difference (DID), ordinal logit and propensity score matching (PSM).

The study results show that the life satisfaction of the government housing dwellers diminished after moving to government housing and was significant throughout DID, ordinal logit and PSM. The private dwellers demonstrated a negative relationship with life satisfaction for the OLS and fixed effects models, DID, nonlinear logit and PSM reported positive with coefficients. The paper found that the location, scale and size of the government houses played an important role in determining life satisfaction.

Table of Contents

1. Introduction	3
1.1. Background to the study	4
1.3. Research question and aim of the study	5
1.4. Research question and research hypothesis	6
1.5. Definitions	6
2. Literature review	8
2.1. Introduction	8
2.2. legislative framework	8
2.3. Conceptual studies on life satisfaction and housing	11
2.4. Empirical studies on life satisfaction and housing and contribution to knowledge	12
3. Data and methods	15
3.1. Introduction	15
3.2. Data	15
3.3. Methods	16
3.3.1. Model specification 1:	16
3.3.2. Model specification 2 (fixed effects)	17
3.3.3. Model specification 2.1 (random effects)	18
3.3.4. Model specification 3 (difference in difference)	18
Table: 3 Parallel trend assumption results	19
3.3.5. Model specification 4	21
3.4. Limitations	22
4. Descriptive statistics	24
Table 4.1: Descriptive statistics	24
Figure 4.1: Life Satisfaction For The 3 Groups	27
4.2. Empirical findings	28
Table 4.2: Reported life satisfaction for the control group	28
Table 4.3: Reported life satisfaction for treatedgvtH group	31
Table 4.4: Reported life satisfaction for treated private group	33
4.3. Comparison of results between the three groups	38
Table 4.5: Binominal Life Satisfaction Results- robustness checks	40
5. Recommendations and conclusion	43
5.1. Recommendations	43
5.2. Conclusion	44
Reference list	46
Appendix	50

1. Introduction

The wrongs of the apartheid system continue to haunt South Africa. Even today South Africa is facing socio-economic inequalities which are the legacy of the apartheid system. Before the advent of democracy South Africa was racially divided. In addition, the apartheid system ensured that the white population benefited from the country's resources while the black population was prevented from such benefits. Today South Africa continues to experience a significant income gap between the rich and the poor. Cities and towns are still divided with many of the black population still residing in informal settlements while most of the white population resides in urban areas. The income gap has slowed down the process of upgrading black South Africans out the informal settlements and, as a result, many black South Africans still reside in areas that lack infrastructure, sanitation and service delivery (Bailey, 2017).

In 1994, the ANC government formulated the Reconstruction and Development Programme (RDP). The aim of the programme was to correct the imbalances that had been created by the apartheid system and to redirect economic development. In other words, the programme aimed at redirecting the country's resources to the black population and upgrading the living standards of black South Africans. The focus was on reducing both the unemployment rate and poverty and providing better health, sanitation, electricity, education, housing and transportation, (Bailey, 2017).

However, the rate at which the above goals have been realised has been slow. One of the biggest challenges that the South African government faces is providing South Africans with adequate housing. Despite various policies that have been implemented to try to move the people out of the informal settlements, millions of South Africans still live in informal dwellings.

The aim of this paper is to focus on one specific component of the RDP, namely, the housing component. Accordingly, the aim of this study is to use subjective well-being (SWB) as a measure of development to study the impact of moving from an informal settlement to a formal settlement on life satisfaction. The study aims to analyse the success of the current housing strategies and determine whether, as promised by the government, the strategies have improved the lives of South Africans. The global life satisfaction question is used to measure the progress of current housing policies. This analysis is conducted by employing five

econometric models. The benchmark model is known as the Ordinal Least Squares model, the second is the fixed effects or random effects model, the third model is the difference in difference model, the fourth model is the propensity score matching model while an ordinal logit is employed to validate the difference in difference model.

The study will make recommendations on how to improve current housing policies. The requisite data will be obtained from the National Income Data Survey (NIDS), for the period 2008 to 2015. The study further aims to contribute towards the existing body of knowledge as no study has been conducted using econometric techniques to investigate the relationship between life satisfaction and moving from an informal settlement to a formal settlement in South Africa.

1.1. Background to the study

Given South Africa's past, informal settlements in South Africa have a distinctive history. During the apartheid years there were acts that were introduced that restricted the movement of black South Africans. There was the Native (Urban area) Act which gave local authorities the power to demarcate and establish African locations on the outskirts of the white urban areas and industrial areas. Millions of South Africans were forcefully removed from the white areas and were placed in the homelands, where poverty was at its highest. The homelands were characterized by poor housing, no service delivery, sanitation and infrastructure. Many black South Africans did not live legally in major cities such as Cape Town and Johannesburg, because black South Africans needed to support their families and work, many of them moved to illegal squatter camps outside the white areas, (Joyce, 2003).

Political and economic reasons are the main contributors for the influx control. The economic reasoning comes from the fact that the white population believed that wealth should not be distributed to any other race. From the political perspective, the apartheid government wanted to protect their power and ensure that the black population had less power and less education than all other races. If the black population had power they would start demanding political rights which would lead to demanding economic rights to employment, access to municipal services and rights to property, (Gelderblom & Kok, 1994).

However, democracy was achieved in 1994 and the ANC came into power. The main aim of the government was to replace the apartheid policies and implement new policies that would uplift and empower the people of South Africa. Part of the new policies that were implemented was the new Housing Act of 1997, Housing Code of 2000, and Breaking New

Ground of 2004. All these policies were implemented to improve the housing environment of South Africa. The National Department of Human Settlement further initiated the 'upgrading of the informal settlement programme. The main aim of this policy was to facilitate the structured incremental upgrading of informal settlements in cases where possible. Where implementation was not possible the last resort would be to relocate communities. The primary goal of the programme was to promote tenure security, health and welfare and bring about empowerment amongst those living in the informal settlements, (Department of Human settlement, 2011).

Despite the implementation of the above policies, millions of people are still living in informal settlements with no government services, due to the large increase in demand for urbanisation. In 1995 about 90% of the whites, coloureds and Indians lived in cities or towns outside of the homelands, about 28% of blacks were living in the homelands, the remainder lived in the rural areas, (Morris, 1998).

1.3. Research question and aim of the study

One of the biggest challenges facing South Africa is providing adequate low-cost housing for its people. Over the years the number of people living in informal settlements has decreased and, at the time of the study, there were approximately 1.2 million informal dwellings in the country. South Africa has provided about 2.7 million housing opportunities. Nevertheless, housing in South Africa remains to be a problem. Increasing property prices affect the lower income bracket because they are unable to purchase a house while supply side constraints include suitable land, finance and basic service infrastructure (National Treasury, 2016).

The main reason why South Africa is experiencing housing issues is the rise in urbanisation. This phenomenon is not only peculiar to South Africa but is found throughout the world. Monsma (1980) highlights that cities are growing rapidly and will continue to grow for the foreseeable future with cities throughout the world facing an unprecedented growth explosion. The percentage of people living in urban areas in South Africa grew from 25% in 1921 to 50% in 1980. It is further argued that the white population had already reached an urbanisation ceiling of 91% in 1980, while 37% of the black population was urbanised during this period (1921 to 1980) and 78% of the coloureds had been by 1980. Over the years this percentage has doubled for the black population (Burgoyne, 2008).

With such a rapid increase in urbanisation, it is important that more research is conducted into housing policies. This will not only improve the lives of the current generation but will

play a vital role in ensuring that housing policies in the future are successful and better than the current policies.

There has been extensive research in the past into the effectiveness of housing policies in South Africa. Although these studies have provided policy recommendations most of such studies have not used subjective well-being to evaluate the current housing strategies. The motivation for this study stems from the fact that there has been limited research in South Africa that uses subjective well-being to measure and evaluate whether the current housing strategies have improved the lives of South Africans.

1.4. Research question and research hypothesis

Main research question: What is the impact of upgrading from an informal settlement to a formal settlement on life satisfaction?

Sub-question

- 1) Are there differences in the life satisfaction of those individuals who moved to private housing and those who moved to government housing?

It is anticipated that answers to the above questions will lead to a better understanding about the quality of life in South Africa while also providing policy makers with a better perspective of the issues that fall beyond social and economic indicators.

Research hypothesis: The life satisfaction of those individuals who moved to government housing will reduce while the life satisfaction for those individuals who moved to private housing will increase.

1.5. Definitions

Informal settlement – The Housing Development Agency (2013) defines an informal settlement as an unplanned settlement on land which has not been surveyed or proclaimed as residential. These consist mainly of informal dwellings which may be defined as makeshift structures which have not been approved by the local authority. The properties are not intended as permanent dwellings and are further characterised by inadequate access to safe water, sanitation, poor quality housing, overcrowding, insecure residential status, no electricity supply and no infrastructure.

Formal settlement – A formal settlement may be defined as a legal land tenure framework, which is characterised by the planned provision of services and infrastructure. Formal dwellings include a flat in a block of flats, a dwelling on a separate stand, a backyard

dwelling, a rented room/flat and a town/-cluster and semidetached house (Housing Development Agency 2012).

Subjective well-being – Subjective well-being is a measure of an individual's cognitive and affective reactions to his/her whole life, also including specific domains of life. It is further argued that subjective well-being is made up of three interrelated components, namely, life satisfaction, pleasant affect and unpleasant affect. All the pleasant and unpleasant moods and emotions that a person experiences influence affect. On the other hand, life satisfaction refers to the cognitive sense of satisfaction with life. This implies that people's evaluation of life and experiences are determined by both affect and reported satisfaction. Studies such as those of Bradburn (1969) and Diener and Emmons (1985) show that subjective well-being includes both the positive and negative experiences that affect an individual.

Control group – In this study the control group will comprise those individuals who have not moved to the formal settlement throughout the four periods.

Treated group – For the purposes of this study the treated group will comprise those individuals who moved to the formal settlement between periods 3 and 4.

Treated_{govtH} – The group consisting of those individuals who moved to government housing between periods 3 and 4.

Treated_{pvt} group – The group consisting of those individuals who moved to private housing between period 3 and 4.

2.Literature review

2.1. Introduction

The aim of this section is to analyse South Africa's current housing strategies and the challenges facing these housing strategies. The literature review will further focus on both international and local literature that links housing and life satisfaction and will also seek to ascertain whether there are any gaps in the existing literature.

In the year 2000, the world population was growing at a rate of 1.2% (77 million people) per year while, in 2008, approximately 3.3 billion people were living in urban areas. Because of the increase in both the population and in urbanisation, there has been added pressure on providing adequate housing. This plays a huge role in meeting the needs of society. For example, Maslow's hierarchy of needs shows that the need for shelter is fundamental and that this need must be satisfied first before other needs are satisfied (Burgoyne, 2008).

2.2. legislative framework

This section shall focus on housing policies that have been implemented over the years to address housing issues.

The National Housing Policy stems from the constitution with the Housing Act, the Reconstruction and Development Programme (RDP), the Growth, Employment and Redistribution (GEAR) strategy, the Urban and Rural Development Framework (Department of Housing 2004) constituting some of the main policies that have been introduced by the government.

The Housing Act

The Housing Act stipulates the role of the various government levels in delivering housing for South Africans; (Department of Housing 2004):

- 1) National government needs to ensure that the establishment and facilitation of housing policies are sustainable to the development of the housing process.
- 2) It is the duty of the provincial government to create an environment that promotes and guides the provision of adequate housing.
- 3) Municipalities must ensure that the issues of land, services and infrastructure are addressed.

The Reconstruction and Development Programme (RDP)

This programme is aimed at the poor as the programme was implemented to try reducing the number of people living in informal settlements. The government conceptualises housing delivery based on the following goals, namely, meeting the needs of the people, promoting and developing human resources, building the economy and ensuring that fairness is both the state and society (Department of Housing, 2004).

The Growth Employment and Redistribution Programme

The main purpose of this programme is to increase economic growth, reduce unemployment, manage the redistribution of economic opportunities, build a society in which services in health, education and other services are available and provide funds for housing programmes (Department of Housing, 2004).

The National Housing Policy

The main aim of this policy is to improve the lives of those South Africans who were previously disadvantaged. The housing component includes values such as sustainability, viability, integration, equity, reconstruction, holistic development and good governance. Furthermore, the policy aims to target the housing backlogs by delivering up to 350 000 houses per year (Department of Housing, 2000). The government aims to achieve these goals by providing national housing programmes such the public-sector hostels redevelopment programme, the discount benefit scheme to promote home ownership and the housing subsidy scheme.

Government Subsidy Housing (RDP)

This programme is aimed at providing housing for low income families who earn less than R3500 a month. These houses are owned by the beneficiaries and not rented to them (Ground Up, 2017).

Community Residential Units and Housing Programme (CRU)

This programme is also aimed at low income families with an income of R3500 a month. However, the only difference between this programme and the previous programme is that the houses are rented and not for sale. The programme was aimed at refurbishing the inner-city buildings and hostels (Ground Up, 2017)

Upgrading of Informal Settlement Programme (UISP)

The focus of this programme was not on providing housing but on providing water, sanitation, electricity and roads to the informal settlements. The only way in which an individual may apply for housing in an informal settlement is if the informal settlement receives UISP funding, the person can apply for housing construction from other housing programmes. To qualify for this programme, the individual must meet the National Housing Subsidy Scheme criteria. One such criterion is that the individual must earn an income of more than R3500 a month. This programme is aimed at people without dependents, child headed households and people who wish to own their own property (Ground Up, 2017).

“Gap” Housing Programme

This programme is intended for all those individuals who earn more R3500 but less than R15 000 per month. If an individual meets this criterion there are state-driven housing initiatives for which the individual may apply, for example, Financial Linked Individual Subsidy Programme (FLISP). The FLISP applies to those individuals who qualify for a home loan. If the individual qualifies for a home loan, then the FLISP will give that individual a grant which will reduce the amount to be paid of the house. These grants may further be used for existing houses and for building new house.

Sadly, even though the above-mentioned policies are good in theory, there is a gap between the goals of the housing policies and the implementation of these policies. This gap is evident in the protests that have taken place over the years with regards to housing. The main reason for this unrest in communities is the slow rate of both service delivery and the delivery of houses. The apparent lack of policy implementation skills may be the central problem in the slow delivery of adequate housing (Isaac, 2009). It is further argued that the lack of implementation has caused the unrest in communities. Nengwenkulu (2009) argues that there are deeper issues surrounding the delivery of houses and that the shortage of skills is not the only factor as there are also other factors at play that are contributing to the slow service delivery. Thus, Burgoyne (2008) points out that the housing programmes also face a financial constraint with capacity restrictions, limited resource allocation and the lack of sustainable land.

The South African Human Rights Commission highlights that there are approximately 2.2 million households in South Africa without access to decent housing and the pace of delivery is well the rate at which low-income households are evolving (Tshitereke, 2009).

2.3. Conceptual studies on life satisfaction and housing

Campbell et al (1976a) developed a model to investigate life satisfaction. This model included demographic, social, economic and environmental indicators and considered satisfaction with the various levels of living or domains of life. The model is based on the following four principles. The first principle refers to the experiences of individuals are determined by their interaction with the community and is based on the type of environment surrounding the individual. The second principle states that there are differences between the subjective and objective experiences of individuals while the third principle assumes that the environment determines the way in which people respond to their experiences and the last principle states that the level of satisfaction obtained from the different life domains contributes to overall life satisfaction.

Marans and Rodgers (1975) further developed a model that explains both the relationships between the different residential domains of urban environment and how those domains, including other domains, contribute to overall life satisfaction. The model is based on the following assumption, namely, when measuring the quality of a dwelling, multiple measures of the attributes of the environmental setting in question may be used. Moreover, according to the model, quality of life corresponds with subjective phenomena which reflect the life experience of the individual's setting.

The advantage of using Campbell's model is that the model caters for several indicators that affect the level of satisfaction with urban living as personal characteristics of individuals. The model further allows a comparison of the different geographic levels of urban living. This is very important because the policies for planning, urban development and service provision may have to differ in targeting the various levels of urban living.

Wokekora (2015) conducted a study which investigated the relationship between resident satisfaction and residential quality of life in two informal settlements, namely, Port Harcourt and Rivers State, in Nigeria. The main aim of paper was to determine the residents' satisfaction with the neighbourhood attributes, sanitation and residential quality of life. The neighbourhood attributes were studied in situ without experimental manipulation and within one period only. The paper used both primary and secondary data. The primary data was collected through face to face interviews which were conducted with about 191 respondents. The paper revealed that the residential quality of life in the Port Harcourt municipality was low. The reason for this was because the municipality had allowed garbage to collect on the streets and in the neighbourhood. Furthermore, the results showed that the residents had a low

residential quality of life because of the lack of electricity, water and waste collection and disposal. The paper concluded that neighbourhood residential conditions are vital in enhancing residential quality of life.

Mojtabakhanian (2013) conducted a similar study on the relationship between informal settlements and quality of life based on the informal settlement of Haneaan in Iran. The data was collected through questionnaires and analysed using the structural equation model (SEM). The outcomes of the study reveal that factors, such as housing, recreation and health (mental and physical state), are important in determining quality of life with housing having the most significant impact. The reason for this is that ownership of a house in Iran is viewed as a family asset and a sign of financial security.

2.4. Empirical studies on life satisfaction and housing and contribution to existing knowledge

There had been very limited local research into the relationship between formal settlements and life satisfaction although there have been similar studies, such as that of Westawag (2001) who focused on the satisfaction with the personal and environmental quality of life of 487 black adults who were residents of an informal settlement in South Africa. The aim of the study was to ascertain the level of satisfaction with the personal and environmental quality of life. The paper assumed, firstly, that health status and life satisfaction were the main indicators of personal quality of life and, secondly, that there is a strong relationship between health status and satisfaction with the personal quality of life. The study used a structured questionnaire which was developed to obtain information on demographic variables, health status and satisfaction with the personal and environmental quality of life. The results proved that the assumptions on which the study was based were correct. The paper further concluded that life satisfaction and satisfaction with the environment both have good reliability and that good health is a more important predictor of personal quality of life than the environmental quality of life.

Westawag (2006) conducted another study, namely, a longitudinal investigation of the level of satisfaction with the personal and environmental quality of life in the informal settlement of Doornkop in Soweto. The aim of the study was to analyse satisfaction in terms of the personal and environmental satisfaction of various groups. The sample consisted of four groups of residents – group one had relocated, group two was waiting to relocate, group three was the site tenure allocated group and group four was from the squatter camps. The study used primary data with questionnaires being administered to residents to ascertain and rate

their satisfaction with their personal and environmental domain. They were also asked to rate their overall life satisfaction. The results showed that the group from the squatter camps demonstrated the lowest life satisfaction. This was understandable in view of the fact the residents of squatter camps are the most disadvantaged with regards to their personal and environmental quality of life.

Another interesting study conducted by O’Leary, Richards and Mutsauizwa. The study was based on the quality of life experienced in metropolitan areas in South Africa. The study focused on Durban for the period from 1998 to 2005. The main aim of the study was to investigate life satisfaction, aspirations and everyday problems to serve the needs of the people. A second study was conducted by the same researchers in which they studied the quality of life in informal settlements of South Africa, focusing mainly on areas such as Alexandra Township which is in Johannesburg, Buffalo City which is in East London and Durban. The results showed that service delivery and the fulfilment of election promises relating to housing, clean water and electricity play a vital role in determining quality of life. The paper further investigated community life and its impact on life satisfaction. The paper reported that both social connectivity and feelings of belonging are important in determining well-being.

Moller et al (1987) studied people’s perception of well-being and life satisfaction. The main aim of their study was to provide a basis for the observation for future trends in the improvement of the standard of living and people’s assessment of their life circumstances. The researchers further introduced an instrument that monitors changes in an individual’s quality of life based on experiences. The paper focused on the overall quality of life and various factors that affect quality of life. The results showed that quality of life is affected by the ability to provide for family, health, food consumption, income, wealth, financial security in old age, type of dwelling, education and employment.

Moller (1996) further studied household satisfaction in terms of past, current and future — satisfaction. The focus of the study was on the relationship between different levels of satisfaction, household level of income and expenditure. The results showed that there is a positive relationship between level of satisfaction and household income and expenditure.

Using the individual level National Income Dynamic Survey (NIDS) of 2008, Casale and Posel (2010) studied the effects of relative standing on subjective well-being. The paper used an ordered probit model, further controlling for unobservable characteristics at a community

level by using the cluster fixed effects estimation with a different regression being used for different race groups, given South Africa's history. The study found significant differences in subjective well-being between individuals from the same household. Based on the economic reported income, South Africans provided different perceptions of their relative economic ranking. Finally, the study found that perceived economic ranking is the best predictor of SWB.

Lastly, a study conducted by Mulcahy and Kollamparambil (2016) examined the impact of migrating from a rural area to an urban area in South Africa. The paper used econometric techniques to investigate the effects. NIDS data was used in the study which used the global life satisfaction question as a measure of SWB. The study concluded that migrating to an urban area reduces life satisfaction. The researchers concluded that false expectations and aspirations and the social and emotional costs of such migration are the main contributing factors to such reduced life satisfaction.

Research conducted previously that investigated life satisfaction using primary data and analysis is based on specific locations in South Africa. However, no study has been conducted that applied causal econometric techniques to investigate the impact of upgrading from an informal settlement to a formal settlement on life satisfaction in South Africa.

Westawag is the only study found that compares the life satisfaction of two groups, but the study did not use econometric techniques and was limited to Soweto only. This study aims to compare the life satisfaction of individuals who have moved to government housing and to private housing. Previously conducted studies did not use the global life satisfaction question to study the life satisfaction of individuals but, instead, focused on residential life satisfaction.

Nevertheless, a study conducted by Mulcahy and Kollamparambil (2016) did use the global life satisfaction question to study the impact of migration from a rural area to an urban area. In addition, the study used econometric techniques to study this relationship. Although like the study by Mulcahy and Kollamparambil (2016), this study focuses on moving from an informal settlement to a formal settlement. It was not possible to find a study that had used the global life satisfaction question to evaluate prevailing housing policies and offer recommendations based on the study findings.

3. Data and methods

3.1. Introduction

This section details the data and econometric techniques that were used to study the impact of moving from an informal settlement to a formal settlement on life satisfaction.

3.2. Data

If research is to be successful and accurate, the ability to trace the treated and control group over time as well as rich data are necessary. This study used the National Income Dynamic Survey (NIDS) data. The NIDS data were developed by the South African and Development Research Unit (SALDRU) at the University of Cape Town. Individuals between the ages of 16 and 64 will be included in the study. The SALDRU is classified as a panel dataset which includes individuals, households and derivable district variables which are traced over four periods, each lasting for two years. The first period began in 2008 and ended in 2009, the second from 2010 to 2011, the third from 2012 to 2013 and the fourth from 2014 to 2015. In total, approximately 29,733 sample individuals were tracked from period 1 to period 4 (Chinhema et al, 2006:6). Treatment began between periods 2 and 3, thus implying that the treated group would comprise those individuals who moved to the formal settlement between period 3 and 4 while the control group comprised be those individuals that did not move throughout the four periods.

The NIDS data utilises primary sampling units (PSU). The reason for this is because the NIDS survey is conducted at a national level and, therefore, the probability of everyone being surveyed must be determined while considering geography. This implies that individuals are weighted based on this probability (Monhajer et al, 2013). This allows for the correction of any possibility of over or under concentration within a certain locality.

Nevertheless, there are disadvantages to the dataset because the survey design, non-response, attrition and household changes may result in a certain bias. However, the SADRU has calculated sample weights to try to correct these biases. Accordingly, this research study applied wave 4 panel weights to waves 1, 2 and 3 variables. To ensure that the panel data reflected a complete and balanced panel of observations, all individuals with missing observations were dropped. In addition, to ensure robustness, all standard errors were clustered at a PSU level as this prevented serial correlation, which is caused by any bias on the part of the individuals (Angrist & Pishcke, 2008).

3.3. Methods

The paper utilises four econometric models with the Pooled Ordinary Least Squares (POLS) as the base model. However, there was a disadvantage to using this model for studying the impact of moving from an informal settlement to a formal settlement and, hence, the fixed effects model, difference in difference model and propensity score matching model were also used. These three models account for the counterfactual effect, unobserved effects and individual effects.

3.3.1. Model specification 1:

Pooled Ordinary Least Square (POLS) multivariate model.

$$life\ satisfaction_{it} = \beta_0 + \beta_1(treated_{it}) + \delta X_{it} + \epsilon_{it}$$

$$life\ satisfaction_{it} = \beta_0 + \beta_1(treatedgvtH_{it}) + \delta X_{it} + \epsilon_{it}$$

$$life\ satisfaction_{it} = \beta_0 + \beta_1(treatedpvt_{it}) + \delta X_{it} + \epsilon_{it}$$

Where;

$treated_{it}$ – Is a dummy variable equal to 1 if the individual lives in a formal settlement in periods 3 and 4.

$treatedgvtH_{it}$ – Is a dummy variable equal to 1 if the individual lives in government housing in periods 3 and 4 and 0 if otherwise.

$treatedpvt_{it}$ – Is a dummy variable equal to 1 if the individual lives in private housing in periods 3 and 4, and 0 if otherwise.

δX_{it} – Is a vector of explanatory variables which describe the individual in periods 3 and 4. The explanatory variables are listed in the appendix.

OLS regression contains an element of bias because it does not allow one to analyse the counterfactual effect, which is very important when studying impact evaluation. The counterfactual effect demonstrates what could have happened to the participants the programme if they had not participated in the programme. In the context of the study this refers to what would have happened to those individuals who did not move to either government housing or private housing between periods 3 and 4. The counterfactual effects work as follows, namely, two groups with similar characteristics need to be considered (Khandker et al. 2010).

Before treatment could begin, both groups would be residing in the informal settlement, thus implying that both groups shared similar characteristics. The two groups remained in the informal settlement between periods 1 and 2. However, between periods 2 and 3 treatment began. Treatment means that between these periods, a group moved from the informal settlement to a formal settlement. The group that moved to the formal settlement is known as the treated group and the group that remained in the informal settlement throughout the four periods is known as the control group (Khandker et al. 2010).

The following models will enable the study to analyse the counterfactual effect as well as the other effects mentioned above.

3.3.2. Model specification 2 (fixed effects)

To try control for individual fixed effects and allow for multiple time periods, the fixed effect method is applied. This technique enables one to control for both unobserved time-invariant heterogeneity and for heterogeneity in the observed characteristics over multiple periods.

When applying the fixed effect method, it is assumed that everyone has unobserved characteristics that may bias the outcome variable and, thus, it is essential that this is controlled for. This notion stems from the assumption that there is a correlation between the error term and the life satisfaction variable. Hence, the fixed effect methods remove the time-invariant characteristics. The fixed effect method is also based on the assumption that the time-invariant characteristics are unique to the individual and cannot be correlated with the other individual characteristics. Everyone is different and, hence, the entity error term and the constant, which consider that there are individual differences, should not be correlated.

This means that Y_{it} may be regressed on T_{it} , a range of time varying covariates and unobserved time-invariant individual heterogeneity, n_{it} may be correlated with the treatment and other unobserved characteristics ε_{it} . However, this method is not able to review how the time invariant variables explain the impact of upgrading to a formal settlement on life satisfaction (Khandker et al, 2010).

$$Y_{it} = \phi T_{it} + \delta X_{it} + n_{it} + \varepsilon_{it}$$

After differencing both sides;

$$\Delta Y_{it} = \Delta \phi T_{it} + \Delta \delta X_{it} + \Delta \varepsilon_{it}$$

3.3.3. Model specification 2.1 (random effects)

The concept behind random effects differs from fixed effects. The concept stipulates that the variation across individuals is random and is not correlated with the outcome variable. The main difference between random effects and fixed effects is whether the unobserved characteristics contain an element that is correlated with the regressors in the specified model or not. If the differences across individuals have an impact on the outcome variable, then one should employ the random effect method. One advantage of the random effects is that it includes time-invariant variables. The fixed effect model absorbs these effects in the intercept.

The following model symbolises the random effects model;

$$Y_{it} = \beta X_{it} + \delta + u_{it} + \varepsilon_{it}$$

Where u_{it} is known as the between-individual error and ε_{it} within the individual error.

The random effects model assumes that the individual error term is not correlated with the outcome which would lead to the time-invariant variables acting as dependent variables.

In deciding whether to use fixed effects or random effects a Hausman test is utilised. The null hypothesis states that the preferred model is random effects while the alternative hypothesis states that the preferred model is fixed effects. The main purpose of this test is to ascertain whether the unique errors are correlated with the regressors. For the purposes of this study, the test stipulated that fixed effects were the preferred model, thus rejecting the null hypothesis.

3.3.4. Model specification 3 (difference in difference)

To solve the problems inherent in the previous model, it is possible to employ the difference in difference method. This model allows one to study two-time periods and analyse the different treated and control groups at the same time. There may be unobserved characteristics that exist between the groups and, thus, DID caters for unobserved heterogeneity and controls for time-invariant selection bias. The DID method depends on the parallel assumption of the estimates being accurate and not biased. The parallel assumption states that, in the absence of treatment, the treatment group will follow the same trends as the control group. Therefore, it is essential that both the treatment and control group have the same time trend as, if not, the treatment effects will be biased; (Khandker et al. 2010).

Various methodologies may be applied to test whether the assumption holds. This study shall use Autor (2003) as the methodology to test whether the assumption holds. Since the study is based on four periods, the parallel trend shall use periods 1, 3 and 4. Dummy variables for each period will be created and each time dummy will be interacted with the control group. An OLS regression will be estimated with all three interactions and covariates. Period one interactions should be statistically insignificant to show that there are no differences between the control group and the treatment group.

Table: 3 Parallel trend assumption results

Variable name	P- value
period 1	-0.483
period 3	0.044
period 4	-0.202
control	-0.098
Income indicators	
Income per capita	0.000*
school	0.697***
employment	0.453***
Household size	0.009
Perception indicators	
Income step today	0.633***
Expected income in 5 years	8.22e-07
Health	0.740***
Religion	0.72***
Safety	0.080
Household indicators	
Access to electricity	0.168
Access to water	0.179

Access to toilet	0.531***
Access to streetlight	0.139
Rubbish removal	-0.103
Geographic indictors	
Gauteng	0.403
Western cape	0.666
Kwazulu natal	0.357
Eastern cape	-1.60***
Demographic indictors	
Age	-0.076**
Age squared	0.000**
White	-0.521
African	-1.136***
Indian	-0.332
Married	0.089
Female	-0.171***
Sample size	8190
R^2	0.6394
Wald test prob> chi2	0.0000

Source: Authors calculations based on NIDS data

The parallel trend assumption shows the trends before treatment, the control and the treated group should share the same characteristics. This, in turn, means that the coefficient for period one should be insignificant to prove that there are no differences between the control and treated groups. The above results report an insignificant coefficient which means that the parallel trend assumption holds, and the results obtained by the simple DID estimate are accurate.

The study estimated three separate DID regressions. Treatment began at periods 2 and 3. The first group was the treated group that moved to the formal settlement in periods 3 and 4. The second group was the treated group that moved to government housing between periods 3 and 4. The last two groups include all those individuals who moved to private housing and government housing between periods 3 and 4. Using three groups enabled the researchers to determine whether there are differences between the life satisfaction of government housing residents and the private housing residents over time.

The following models will be estimated;

$$life\ satisfaction_{it} = \beta_0 + \beta_1 treated + \beta_2 post_t + \delta_1 treated_i * post_t + \delta X_{it} + \varepsilon_{it}$$

$$life\ satisfaction_{it} = \beta_0 + \beta_1 treatedgvtH_i + \beta_2 post_t + \delta_1 treatedgvtH_i * post_t + \delta X_{it} + \varepsilon_{it}$$

$$life\ satisfaction_{it} = \beta_0 + \beta_1 treatedpvt_i + \beta_2 post_t + \delta_1 treatedpvt_i * post_t + \delta X_{it} + \varepsilon_{it}$$

Where;

Post = 0 for pre-treatment and 1 for post-treatment.

To validate the results obtained by model 3, an ordinal logit model was estimated. The aim of this was to increase the accuracy of the results by controlling for time-invariant, unobserved individual differences and omitted variables (Verbeek, 2012). Furthermore, the results obtained by the DID model could have suffered from self-selection and unobserved biasness and this may, can potentially, have led to differences between the characteristics of the *treated*, *treatedgvtH* and *treatedpvt* groups (Rosenbaum & Rubin, 1983). Hence, an ordinal logit model is estimated to check the robustness of the DID regression estimates.

3.3.5. Model specification 4

Propensity score matching may be used to evaluate the counterfactual effect. A treatment group and a control group may be created using Propensity Score Matching (PSM). PSM refers to the probability of participating in treatment which is conditional on observed characteristics, for example, race, employment, income, education, etc.

However, for PSM to work, it depends on two important assumptions. The first such assumption is conditional independence which states that, given a set of observable covariates that are independent of the treatment potential outcomes Y, then both the *treated* and *treatedpvt*, *treatedgvtH* groups may be matched based on PS. In short, the rule states that,

if Y_i^T stands for outcomes for the treated and Y_i^C is the outcome for the control group, the assumption implies $(Y_i^T, Y_i^C) \perp T_i | X_i$.

The second assumption is known as the common support assumption which assumes that $0 < P(T_i = 1 | X_i) < 1$. This assumption ensures that the treated group has comparable observations in the PS distribution. PSM constructs a statistical comparison group that is based on a model of the probability of participating in the treatment, using observed characteristics (Khandker et al. 2010).

For the purposes of this study PSM was used through the kernel-based Propensity Score. The model works as follows: the model uses the `diff` command in Stata which helps the study to calculate the kernel-based PS DD. The first stage involves running a separate probit or logit model with the treated groups and controls. This estimation generates the weights of the variables which are derived from the kernel density function. The second stage involves the `diff` running a regression by applying Stata's `average weights` option which would be obtained from the PS. Finally, the kernel type and bandwidth are specified. One advantage of using kernel weighting is that this method uses the weighted averages of all the observations in the control group to create a counterfactual and it may further reduce variance. However, this may also be a disadvantage as using all the observations could lead to bad matches.

3.4. Limitations

There are certain limitations to the study that must be mentioned. The first such limitation has to do with the fact that those individuals who moved to government housing could not be broken down according to the various housing schemes. For example, one cannot distinguish between those individuals who live in government housing and those individuals who receive housing subsidies from the government. This means that it is not possible to compare their life satisfaction levels. Breaking down the government housing individuals into the various schemes would help when providing policy recommendations as researchers would be able to form a clear picture of the programmes which need to be improved. Thus, the recommendations offered by the research at hand may be said to be a generalisation of government housing policies only and do not provide specifics.

The second limitation is that life satisfaction after treatment could be traced only from 2012 until 2015 – a short time frame for tracing migration. It may be argued that, when individuals migrate to different areas, it takes more than five years for those individuals to fully transition

and to feel comfortable. Thus, as treatment could be traced for a short period of time only this may have impacted negatively on the results. For a true reflection of happiness after treatment, the study would need to be conducted again after some years.

4. Descriptive statistics

The tables below depict the descriptive statistics for all the variables used in the study. Panel weighting was applied to account for attrition between the different periods as well as survey design and sample response bias. The results below show that there are differences between the three groups.

Table 4.1: Descriptive statistics

Variable	Sample	Mean	Std.Error
Age	control	37.42138	0.3875631
	TreatedgovtH	37.72187	0.5300964
	Treated private	37.20734.	0.4332831
Age squared	control	1637.83	32.32616
	TreatedgovtH	1637.064	44.05455
	Treated private	1610.697	36.05726
Employment	control	0.4024776	0.0122287
	TreatedgovtH	0.4776355	0.0147305
	Treated private	0.4396465	0.0124389
Income per capita	control	2096.805	392.9083
	TreatedgovtH	2275.138	456.6426
	Treated private	2777.877	583.4694
Household size	control	5.060201	.1115024
	TreatedgovtH	4.554358	1402615
	Treated private	4.826022.	1234759.
white	control	0.0582075	0.0116288
	TreatedgovtH	0.0671258	0.0135884
	Treated private	0.0858794	0.0174928
Indian	control	0.0254297	0.0119208
	TreatedgovtH	0.0289838	0.0175458
	Treated private	0.0138221	0.0370813

African	control	0.8414025	0.0225473
	TreatedgvtH	0.7646248	0.0330455
	Treated private	0.8157003	0.0261719
Coloured	control	0.0748361	0.0174939
	TreatedgvtH	0.1086875	0.0250034
	Treated private	0.09247	0.0212978
Dwelling type	control	0.9212136	0.0096383
	TreatedgvtH	0.8939773	0.0164326
Water source	Treated private	0.8924335	.08984263
	control	0.0132801	0.0136125
	TreatedgvtH		
	Treated private	0.7891154	0.0196764
Flushing toilet	control	0.5588191	0.0284828
	TreatedgvtH	0.8196309	0.0270263
	Treated private	0.6574245	
Rubbish disposal	control	0.5191241	0.0304539
	TreatedgvtH	0.7837657	0.0264966
	Treated private	0.6374415	0.028536
streetlights	control	0.4825077	0.0264329
	TreatedgvtH	0.690996.	0.0249934
	Treated private	0.5789871	0.0256591
Health	control	0.9594027	0.0024793
	TreatedgvtH	0.9607518	0.0032851
	Treated private	0.9527608	0.0030541
Expected income today	control	2.228091	0.0554335
	TreatedgvtH	2.410457	0.059382
	Treated private	2.386427	0.0477141
Expected income in 5 years	control	43242.05	8146.968
	TreatedgvtH	52242.68	11917.97
	Treated private	42652.04	9368.811

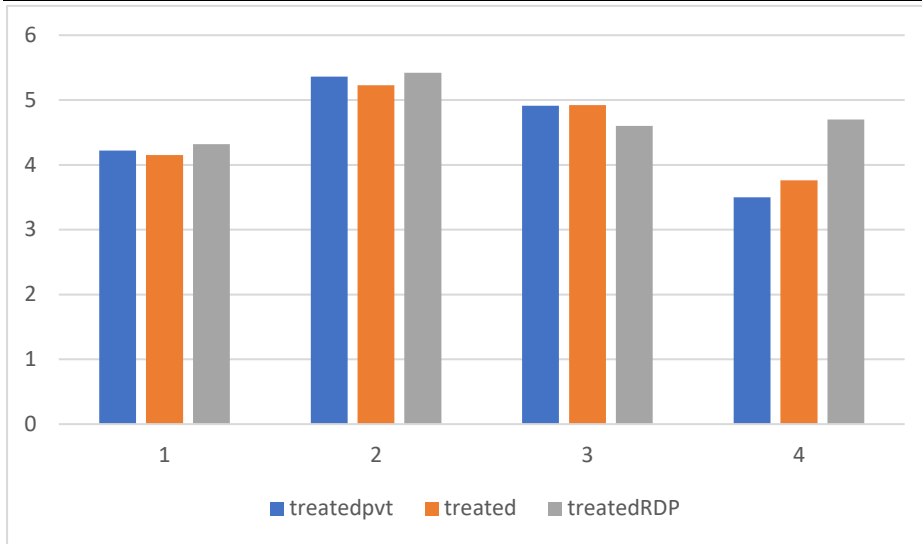
Religion	control	0.0337052	0.028545
	TreatedgovtH	0.0340944	0.039195
	Treated private	0.0353473	0.0032762
Safety	control	1.364909	0.0237575
	TreatedgovtH	1.340096	0.0272006
	Treated private	1.397425	0.0225106
Gender	control	1.607346	0.0095771
	TreatedgovtH	1.591934	0.0128533
	Treated private	1.601289	0.0104561
Marital status	control	3290616	0.0138366
	TreatedgovtH	0.3446804	0.019168
	Treated private	0.3297644	0.0155514
Education	control	0.9253326	0.0054906
	TreatedgovtH	0.9575719	0.0042445
	Treated private	0.9411311	0.0042796
Electricity	control	0.3868917	0.055692
	TreatedgovtH	0.3900052	0.078622
	Treated private	0.4901899	0.0117812
Observations	control	15446	
	TreatedgovtH	17827	
	Treated private	18074	

Source: Authors calculations based on NIDS data

Figure 4.1 below shows the average mean for life satisfaction within each period for the three groups. The figure shows that, before treatment, all three groups demonstrated a high life satisfaction with the *treatedgovtH* with the highest life satisfaction level, followed by the other two groups. However, after treatment, the life satisfaction for of all three groups declined drastically, with the life satisfaction of the treated private group declining more than that of the other two groups. The group that moved to government housing also experienced a

decline the life satisfaction for this group is greater than that of the other two groups in period 4.

Figure 4.1: Life Satisfaction for the 3 Groups



4.2. Empirical findings

The aim of this section is to analyse the results which presented in the tables below. Hence, the section will examine the differences between the three groups using the models described in the discussion on methodology. The section shall further provide explanations for the results and provide policy recommends.

The variables that were considered in the study include economic, perception, geographic, housing and demographic indicators. The main variables of interest were the *treatedgovtH*, the *treated group* and the *treated private group*. Model 1 runs a normal POLS regression and the main variables of interest are *treated*, *treatedgovtH* and *treatedpvt* while model 2 runs a fixed effect regression with the variables of interest being the same as those for model 1. Models 3 to 5 use the DID, logit DID and PSM methodology with the main variables of interest being *treated*post*, *treatedgovtH*post* and *treatedpvt*post*.

Table 4.2: Reported life satisfaction for the treated group

Variable name	Model 1	Model 3	Model 3 (logit DID)	Model 4 (PSM)	
Control*post	-	-	-0.145 [0.201]	0.561 [0.469]	0.045 [0.388]
Control	0.340 [0.107]	-0.018 [0.041]	-0.293* [0.166]	-0.165** [0.080]	0.339 [0.361]
Post			0.615* [0.317]	4.395*** [0.357]	0.294** [0.140]
Income indicators					
Income per capita	2.31e-06 [6.20e-06]	1.83e-06 [9.12e-06]	-0.000 [0.000]	1.63e-06 [9.58e-06]	-0.009* [0.006]
education	0.5583** [0.1882]	0.0470** [0.0192]	0.343*** [0.085]	0.235*** [0.056]	0.192 [0.153]
employment	0.2129** [0.0729]	0.2829*** [0.0768]	0.344*** [0.053]	0.246*** [0.033]	0.084 [0.075]
Household size	0.01782 [0.0140]	0.0377** [0.0158]	0.015* [0.008]	0.000 [0.005]	0.014 [0.017]
Perception indicators					

Income step today	0.2728443*** [0.0268]	0.3065*** [0.0161]	0.320*** [0.013]	0.247*** [0.012]	-0.0159 [0.015]
Expected income in 5 years	2.42e-07*** [4.24e-08]	3.11e-08** [1.48e-08]	0.000* [0.000]	2.05e** [1.03e]	2.05e-08** [1.03e-08]
Health	0.9024*** [0.1379]	0.6654*** [0.1405]	0.781*** [0.111]	0.365*** [0.0749]	0.331 ** [0.132]
Religion	-0.1842 [0.2155]	-0.5793** [0.1774]	- 0.718*** [0.141]	-0.318*** [0.093]	-0.318** [0.093]
Safety	0.2941*** [0.0508]	[0.2195] *** [0.02841]	0.204*** [0.023]	- 0.008 [0.015]	0.053*** [0.029]
Household indicators					
Access to electricity	0.6294*** [0.1282]	-0.3519] *** [0.0534]	- 0.704*** [0.053]	0.240*** [0.033]	0.240*** [0.033]
Access to water	-0.0139 [0.1282]	0.0007 [0.1035]	0.236*** [0.066]	0.097** [0.042]	0.099 [0.131]
Access to toilet	0.0838 [0.1658]	[0.1061] [0.1327]	0.356*** [0.081]	0.143*** [0.050]	0.674*** [0.102]
Access to streetlight	0.2597** [0.1262]	0.3592*** [.0915]	0.319*** [0.066]	0.125*** [0.040]	0.231*** [0.085]
Rubbish removal	-0.0155 [0.1461]	-0.0738 [0.1145]	0.020 [0.078]	0.014** [0.049]	0.966*** [0.126]
Geographic indicators					
Gauteng	0.6517* [0.3923]	0.3284 [0.6184]	0.563 [0.415]	0.167*** [0.069]	0.171** [0.082]
Western cape	.4184 [0.4305]	- [0.0607] [0.8183]	1.116*** [0.136]	0.601*** [0.085]	0.215** [0.097]
Kazoku natal	-0.0051 [0.3971]	0.2904 [0.7211]	0.627*** [0.088]	-0.013 [0.056]	-0.219** [0.075]

Eastern cape	0.01467 [0.4061]	- [0.6040] [0.7290]	0.242*** [0.101]	-0.026 [0.065]	-0.292*** [0.084]
Demographic indicators					
Age	-0.0687*** [0.0123]	0.1443*** [0.0254]	- 0.046*** [0.008]	-0.034** [0.005]	0.009 [0.012]
Age squared	0.0007*** [0.0001]	0.0009** [0.0002]	0.001*** [0.000]	[0.003*** [0.005]	0.003** [0.005]
White	0.0624 [0.3340]	-0.3720** 0.1822]	0.119 [0.173]	0.462*** [0.121]	0.422*** [0.122]
African	-1.128*** [0.3118]	-0.7883*** [0.1072]	- 0.869*** [0.085]	-0.485*** [0.064]	-0.593*** [0.068]
Indian	1.4198** [0.5008]	0.3912 [0.2777]	0.359 [0.259]	0.620*** [0.175]	0.437** [0.179]
Married	0.2883*** [0.0861]	-0.0087 [0.1363]	0.106* [0.058]	0.153*** [0.036]	-0.077 [0.085]
Female	-0.0555 [0.0648]	-0.1438 [0.0516]	-0.120** [0.051]	-0.020 [0.032]	-0.029 [0.071]
Sample size	14883	21672	21672	21672	15639
R²	0.2322	0.0907			
Pseudo R²				0.086	0.1233
F- Statistic	33.37***	47.90***			
LR chi2				2518.43***	
229.08***					

Source: Authors calculations based on NIDS data

Note: ***Significant at the 1% level. ** Significant at the 5% level. *Significant at the 10% level. All standard errors are heteroscedasticity-consistent, White standard errors and are clustered at the PSU level.

Table 4.3: Reported life satisfaction for treatedgvtH group

Variable name	Model 1	Model 2	Model 3	Model 3 (logit DID)	Model 4 (PSM)
TreatedgvtH*post	-	-	-0.717** [0.252]	-0.854** [0.285]	-0.689** [0.279]
treatedgvtH	0.146** [0.067]	0.544 [0.046]	0.771** [0.245]	0.878** [0.279]	0.755*** [0.271]
post			0.807** [0.182]	0.909*** [0.220]	0.066 [0.070]
Income indicators					
Income per capita	-9.38e-06 [7.55e-06]	1.82e-06 [9.11e-06]	-0.000 [0.000]	4.33 [9.70]	1.58e-06 [4.73e-06]
education	1.07314*** [0.301]	0.0471] ** [0.019]	0.344*** [0.085]	0.240 [0.056]	0.235*** [0.056]
employment	0.3649*** [0.0982]	0.2813*** [0.0768]	0.336*** [0.053]	0.249*** [0.033]	0.191*** [0.031]
Household size	-0.0014 [0.019]	0.0397** [0.015]	0.016* [0.008]	0.003 [0.005]	0.019*** [0.004]
Perception indicators					
Income step today	0.3121*** [0.030]	0.3061*** [0.016]	0.318*** [0.013]	0.256*** [0.013]	0.021*** [0.006]
Expected income in 5 years	2.75e-07*** [4.80e-08]	3.10e08** [1.48e-08]	0.000*** [0.000]	1.97* [1.02]	1.24e-08 [3.42e-08]
Health	1.474*** [0.286]	0.6661 [0.140]	0.781*** [0.111]	0.376*** [0.075]	0.007 [0.060]
Religion	-0.2551 [0.286]	0.5864*** [0.177]	-0.728*** [0.140]	-0.286 *** [0.094]	-0.110 [0.073]

Safety	0.2823*** [0.052]	0.2197*** [0.028]	0.207*** [0.023]	-0.015 [0.015]	-0.002 [0.012]
Household indicators					
Access to electricity	-0.8147*** [0.1661]	0.3470*** [0.0535]	-0.679*** [0.053]	0.230*** [0.033]	0.213*** [0.028]
Access to water	0.1178 [0.189]	-0.0068 [0.103]	0.202*** [0.066]	0.027 [0.042]	0.106*** [0.033]
Access to toilet	0.0482 [0.212]	0.0711 [0.133]	0.277*** [0.085]	0.073 [0.054]	1.211*** [0.0417]
Access to streetlight	0.4245** [0.158]	0.3497*** [0.091]	0.314*** [0.065]	0.087** [0.040]	0.222*** [0.038]
Rubbish removal	-0.1538 [0.203]	-0.0923 [0.114]	-0.072 [0.079]	-0.035 [0.050]	0.936*** [0.043]
Geographic indicators					
Gauteng	0.5491 [0.4119]	0.2644 [0.6178]	0.026*** [0.007]	0.159*** [0.069]	0.169** [0.082]
Western cape	1.0753** [0.504]	-0.0744 [0.817]	0.021** [0.008]	0.599*** [0.084]	0.213** [0.097]
Kwazulu natal	0.0384 [0.419]	0.3211 [0.720]	0.013** [0.005]	-0.014 [0.056]	-0.222*** [.075]
Eastern cape	-0.5352 [0.463]	-0.5042 [0.730]	-0.010 [0.006]	-0.027 [0.065]	-0.295*** [0.085]
Demographic indicators					
Age	-0.0917*** [0.0176]	0.1403*** [0.0255]	-0.048*** [0.008]	-0.034*** [0.005]	-0.016*** [0.004]
Age squared	.0010*** [0.000]	0.0009*** [0.000]	0.001*** [0.000]	0.003*** [0.005]	-0.000*** [0.000]
White	-.3053 [0.405]	-0.3725 * [0.182]	0.126 [0.173]	0.456*** [0.121]	0.094. [0.265]

African	-1.088** [0.320]	0.7408*** [0.107]	-0.823*** [0.086]	-0.479*** [0.064]	-1.608*** [0.080]
Indian	1.324** [0.563]	0.3467 [0.277]	0.340 [0.259]	0.611*** [0.175]	0.440 [0.363]
Married	0.2731** [0.127]	-0.0063 [0.136]	0.118* [0.058]	0.1567*** [0.036]	-0.146*** [0.035]
Female	-0.1804* [0.094]	- 0.1427*** [0.051]	-0.117** [0.051]	-0.018 [0.032]	-0.016 [0.029]
Sample size	14883	21672	21672	21672	30275
R^2	0.1552	0.0909	-		
Pseudo R^2				0.0869	0.4821
F- Statistic	29.72***	48.04***	-		
LR chi2				2522.73***	
	9921.44***				

Source: Authors calculations based on NIDS data

Note: ***Significant at the 1% level. ** Significant at the 5% level. *Significant at the 10% level. All standard errors are heteroscedasticity-consistent, White standard errors and are clustered at the PSU level.

Table 4.4: Reported life satisfaction for treated private group

Variable name	Model 1	Model 2	Model 3	Model 3 (logit DD)	Model 4 (PSM)
Treatedpvt*post	-	-	0.197 [0.471]	0.004 [0.069]	0.277 [0.526]
Treatedpvt	-0.541* [0.201]	-1.338** [0.598]	-0.789** [0.409]	-0.427 [0.201]	-0.791* [0.478]
Post			0.413 [0.457]	0.541*** [0.169]	-0.515** [0.218]

Income indicators					
Income per capita	-8.68e-06 [7.49e-06]	1.81e-06 [9.11e-06]	-0.000 [0.000]	3.48e-06 [9.67e-06]	4.00e-06 [5.14e-06]
education	1.0192** [0.302]	0.0462** [0.019]	0.339*** [0.085]	0.241*** [0.056]	-0.097 [0.047]
employment	0.3972*** [0.099]	0.2984 [0.076]	0.355*** [0.053]	0.250*** [0.033]	0.222*** [0.033]
Household size	-0.0043 [0.019]	0.0336** [0.015]	0.013* [0.008]	0.003 [0.005]	-0.006 [0.004]
Perception indicators					
Income step today	0.3205*** [0.030]	0.3134*** [0.016]	0.326*** [0.013]	0.257*** [0.013]	0.039*** [0.005]
Expected income in 5 years	2.70e-07*** [4.83e-08]	3.14e08*** [1.48e-08]	0.00*** [0.000]	1.98e-08* [1.02e-08]	2.18e-08 [3.16e-08]
Health	1.4651*** [0.287]	0.6584*** [0.140]	0.777*** [0.111]	0.378*** [0.075]	0.060 [0.066]
Religion	-0.2071 [0.283]	-0.5621** [0.177]	-0.705*** [0.140]	-0.286*** [0.094]	0.095 [0.077]
Safety	0.2791*** [0.052]	[0.2184]*** [0.028]	0.204*** [0.023]	-0.016 [0.015]	-0.001 [0.011]
Household indicators					
Access to electricity	-0.7285*** [0.190]	-0.2133*** .0598556	-0.598*** [0.057]	0.212*** [0.036]	1.744 *** [0.035]
Access to water	0.0857 [0.191]	-0.0068 [0.103]	0.221*** [0.06]	0.034 [0.04]	0.150 [0.035]
Access to toilet	0.3102 [0.2141]	0.1059 [0.1325]	0.423*** [0.081]	0.086* [0.052]	0.992*** [0.049]
Access to streetlight	0.4439* [0.156]	0.3606*** [0.091]	0.319*** [0.06]	0.086** [0.040]	0.125*** [0.044]
Rubbish removal	-0.0083 [0.202]	-0.0664 [0.114]	0.031 [0.07]	-0.024 [0.040]	0.582 *** [0.050]

Geographic indicators					
Gauteng	1.6515*** [0.362]	0.3615 [0.616]	0.008* [0.004]	0.158** [0.069]	-0.1649** [0.082]
Western cape	1.0891** [0.505]	-0.0768 [0.816]	0.028*** [0.005]	0.599*** [0.085]	0.220** [0.097]
Kwazulu natal	1.091** [0.343]	0.2338 [0.720]	0.014*** [0.003]	-0.016 [0.056]	-0.218** [0.075]
Eastern cape	0.5239 [0.438]	-0.6237 [0.728]	0.031*** [0.00]	-0.026 [0.065]	-0.285*** [0.085]
Demographic indicators					
Age	-0.0915*** [0.017]	0.1402*** [0.025]	-0.046*** [0.008]	-0.034*** [0.005]	0.004 [0.004]
Age squared	0.0010*** [0.000]	0.0009*** [0.000]	0.001*** [0.000]	.0003816*** [0.000]	-0.000 [0.000]
White	-0.3126 [0.405]	-0.4242** [0.179]	0.110 [0.173]	.4586326*** [0.121]	0.211 [0.278]
African	-1.1376*** [0.319]	0.8904*** [0.100]	-0.916*** [0.085]	-0.490*** [0.064]	-1.134*** [0.086]
Indian	1.3634** [0.579]	0.4059 [0.277]	0.365 [0.259]	0.617*** [0.175]	0.443 [0.392]
Married	0.2726** [0.127]	-0.0017* [0.136]	0.107* [0.058]	0.155*** [0.036]	-0.021 [0.037]
Female	-0.1790* [0.095]	-0.1412* [0.051]	-0.117** [0.051]	-0.0196 [0.032]	0.0214 [0.031]
Sample size	14883	21672	21672	21672	30398
R²	0.1561	0.0924			
Pseudo R²				0.0868	0.4068
F- Statistic	29.64***	48.90***			
LR chi2				2518.48	6747.97

Source: Authors calculations based on NIDS data

*Note: ***Significant at the 1% level. ** Significant at the 5% level. *Significant at the 10% level. All standard errors are heteroscedasticity-consistent, White standard errors and are clustered at the PSU level.*

Model 1, 3.1 and 4 shows that life satisfaction for the treated group shows positive signs and is insignificant however model 2 and 3 show contradicting showing, life satisfaction is negative and insignificant. When analysing the explanatory variables, the results reveal that schooling and employment have a positive and significant impact on life satisfaction.

The perception indicators, income step today, health and safety show a positive relationship with life satisfaction and are significant throughout the four models.

Previous studies, such as the study by Mulcahy and Kollamparambil (2016), show that perception indicators play an important role in determining the life satisfaction of individuals. Studies show that people tend to focus more on expected income in the future than income today and, hence, expected income in the following five years is positively related and is significant with the coefficients being greater than the coefficients for income step today.

The household indicators show that access to electricity and streetlights and having piped water positively affects life satisfaction. Access to water appeared to be positive in the DID model and DID logit model only.

The geographic indicators show that a positive relationship with life satisfaction for individuals residing in informal dwellings in Gauteng and Western Cape with the DD logit and PSM showing that the coefficients are significant. This positive relationship may be explained by the fact that both Gauteng and the Western Cape provide more job opportunities than other areas and the informal dwellings close to the city are filled. This implies that finding jobs and travelling to work are found to be easier than in other areas. However, KZN and the Eastern Cape are predominantly rural provinces which means that some of the informal settlements are located far from the cities, thus implying that finding employment or travelling to work is more difficult than in the more urban areas.

The demographic indicators show mixed results. However, it is worth noting that Africans who reside in informal dwellings demonstrate a lower life satisfaction level as compared to the White and Indian populations in general. This may be explained by the fact Africans were suppressed in the past and were forced to move to areas outside of the urban areas.

Table 5.3 shows all the individuals who moved to government housing. The results show that models 1 and 2 have a positive impact on life satisfaction. However, models 3, 3.1 and 4 show that moving to government housing had a negative impact on the life satisfaction of all the individuals who had moved to government housing and is statistically significant. Models 3 and 4 may be regarded as more robust than the other models because these models consider individual effects, time-invariant characteristics and the counterfactual effect. Model 3 shows that life satisfaction reduced by -0.717 and is statistically significant. To demonstrate the robustness of model 3 an ordinal logit DID is estimated to validate the results obtained by model 3. The ordinal logit shows that life satisfaction reduced to -0.854 and is statistically significant at 5%. The PSM model shows that life satisfaction decreases to -0.689 at a 5% significant level.

The explanatory variables show that variables such as schooling, employment, household size, income step today, health, safety and expected income in the next five years are positively related to life satisfaction and are statistically significant. This means that, although people care about income today, they pay more attention to income to be received in the future. Furthermore, people care about health and safety. When analysing household indicators, the results show that access to pipe water, electricity and streetlights positively affect life satisfaction with the results being statistically significant.

In relation to Gauteng and the Western Cape models 3 and 4 show a positive relationship with life satisfaction and that the same reasoning applied to the treated group may be applied to the government housing individuals with regards to the differences in provinces. In respect of KZN the results are mixed with models 1 to 3 showing that living in KZN positively affects life satisfaction although the logit DID and PSM show a negative relationship. Eastern Cape show a negative relationship between living in this province and life satisfaction and are significant in respect of the PSM model. The demographic indicators show that Africans are less happy with life as compared to the other race groups and that this effect is statistically significant whereas results for the white population are both positive and significant for the fixed effects model and the logit DID model.

The *treatedpvt* group refers to the group that did not receive government subsidies and, thus, the members of this group reside in private housing. Model 1 and 2 shows that life satisfaction decreases and is statistically significant. Model 3-4 say otherwise; life satisfaction is positively related with private housing however this effect is insignificant.

Similar to the *treatedgovtH* group variables, such as schooling, employment, income step today, expected income in five years, health, safety, access to electricity and streetlights, the findings for Gauteng and the Western Cape are both positive and significant while the same reasoning as applied to the *treated* and *treatedgovt* may be applied to the treated private group since the signs and significance were the same throughout.

4.3. Comparison of results between the three groups

The results above show that there were certain variables throughout the three groups that demonstrated the same signs, and which were statistically significant. Variables, such as schooling, employment, income step today, expected income in five years, health, safety, access to electricity and streetlights, for KZN, Gauteng, the Western Cape and the Eastern Cape had the same signs and were significant. This shows that, although there are differences between the three groups, the similarities between the results show that the determinants of life satisfaction are the same for all three groups with the determinants of life satisfaction being consistent throughout. In other words, everyone wants to receive an education, find employment, live in a safe neighbourhood and have access to electricity, piped water and streetlights.

Logit DD will be used to compare the three groups as this is the most accurate model. Both the *treated*post* and *treatedpvt *post* show that life satisfaction is positive however this effect insignificant. Government housing dwellers are the worst off. Various studies and reports have discussed possible reasons for the failure of the government housing policies. This failure may possibly provide reasons for the reduced life satisfaction of the government housing dwellers. For example, the Consumer Survey (2017) argues that, although the government has done sterling work in building houses for the poor, quality of life of these individuals has not, however, improved.

One of the reasons for this may be that approximately R21 billion has been spent in the last three years repairing RDP houses that have been poorly constructed. In 2013 several RDP residents submitted complaints about the quality of the RDP housing, mainly in respect of the walls and roofs.

Approximately 367 743 complaints referred to issues with the walls and about 354 176 complaints were about the roofs. The main reason why RDP houses are of such poor quality is because the contractors who are contracted to build these houses do not possess the required skills to build quality houses. And the reason for this could come from the result of corruption within government, government preferring to contract cheap labour to profit from the tenders. The reason stated above may possibly be contributory factor to the reduced life satisfaction of the government housing dwellers. Nobody wants to live in a poor-quality house, especially if the households concerned do not have the necessary funds to repair their homes.

Another possible reason for the reduced life satisfaction of government housing dwellers may be that people who reside in government housing are not permitted to either sell or rent out their properties and, thus, are not able to realise any investment opportunities. People residing in government housing may generate an income by renting out the property and finding employment elsewhere.

The law states that government householders will have to wait eight years before they can consider selling or renting out the property. This requirement could possibly reduce life satisfaction because government housing dwellers are not able to generate income through property or they live in fear that they might go to jail if they sell or rent out property before the eight years (*Business Day*, 2016).

Researchers such as Manomano, Tanga and Tanyi (2016) argue that the size and spacing of government housing should ensure the privacy of families living with children or other family members. This further impact on the growth and development of children. However, the reality is that most of the RDP houses that are built are too small and do not promote privacy and hygiene. In addition, it is difficult for families to extend their houses because there is not sufficient space to do so. Furthermore, most poor households usually include several family members because this is more financially sustainable. However, the RDP houses offer two bedrooms only and this may possibly reduce life satisfaction. These families have no privacy and most households are crowded because the houses are too small.

Another issue that has been raised by various researchers, such as Bailey (2017) and Manomano, Tanga and Tanyi (2016), relates to the fact that most RDP houses are built in

areas that lack infrastructure such as shopping centres, factories and other forms of business that would provide employment. This assertion is supported by figure 7.2 which presents the transportation cost to work for four periods. The figure highlights that, when treatment began in period 3, transportation costs increased for those individuals who had moved to government housing.

This provides further support for the assertions of Bailey (2017) and Manomano, Tanga and Tanyi (2016) state that government houses are often located far from the cities with this having a significant impact on life satisfaction. In addition, schools, clinics and other local government institutions are not readily accessible in areas where RDP housing has been built while RDP housing areas often experience problems in respect of clean running water, sanitation and electricity. Despite programmes such as the Integrated and Development Plan (IDP) that aims to ensure human settlements are integrated there appears to be a gap between what the aims of these programmes and their problem between what’s written on paper and implementation.

Aigbavboa (2015) found that the quality of life of government subsidised housing dwellers was impacted upon by the problems they experienced with the solar heaters that were installed. The government has installed solar water heaters for low income households. However, over the years there have been complaints about leakages from the solar heaters and insistent noises emanating from the heaters whenever the hot water taps were opened. This may have a negative impact on the quality of life of government housing dwellers.

Table 4.5: binominal life satisfaction results- robustness checks

	Model 3.1	p-value
Control*time	Margins	
0 0	0.356 [0.034]	0.0000
0 1	0.435 [0.031]	0.000
1 0	0.269 [0.078]	0.000

1 1	0.462 [0.005]	0.000
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	Model 3.1	P- value
TreatedgvtH*time	-0.177 [0.002]	0.0208
Predicted margins	Margins	
Treated*time		
0 0	0.267 [0.038]	0.0000
0 1	0.457 [0.013]	0.000
1 0	0.450 [0.047]	0.000
1 1	0.463 [0.006]	0.000

	Model 3.1	
Treatedpvt*time	0.108 [0.108]	0.3147
Predicted margins	Margins	
Treated*time		
0 0	0.509 [0.091]	0.0000
0 1	0.533 [0.051]	0.000

1 0	0.327 [0.033]	0.000
1 1	0.460 [0.005]	0.000

Source: Authors calculations based on NIDS data

The table above presents the results obtained from the logit DID model. It is important to highlight that the results reported in table 4.2-4.4 (logit DD) are not the focus of interest when interpreting the logit DD model. The important results are those results that are reported in figure 4.5 which are the estimates used to validate the DID results. The purpose of reporting these results is to validate the results obtained from model 3, namely, the DID model. When analysing *control*time* the results for the informal settlement dwellers show that the intervention led to increased life satisfaction, with life satisfaction increasing to 0.356. Nevertheless, this is insignificant. These results differ from the results obtained by DID model; the life satisfaction variable is -0.145 and insignificant. The results obtained in table 4.5 are more accurate than the results obtained by model 3.

The results obtained by the *treatedpvt*, the *time*treatedpvt* variable, show that life satisfaction increases to 0.108 and is insignificant. The logit DID are consistent with the results obtained from the simple DID regression, thus implying that the results obtained by model 3 are both robust and valid.

The *treatedgovt* shows that life satisfaction reduces to -0.177 and is significant. These results are like the results obtained from the simple DID model, thus implying that the results obtained from this model are both robust and valid.

5. Recommendations and conclusion

5.1. Recommendations

The government should consider expanding its housing policies. The results shown that merely providing shelter is not sufficient and, hence, government needs to look at other options for improving the lives of South Africans. For example, government should build communities which would enable the community members to commute to work with relative ease and which would give them access to shopping centres and easy access to schools.

For example, a person who resides in Sandton is close to work, shopping centres, entertainment and schools and, thus, the person does not need to go outside of Sandton because everything is provided in the area. However, an individual who lives in Sterkspruit in the Eastern Cape must travel outside of Sterkspruit to go to work while there are also no big shopping malls there. Thus, most of activities of an individual who lives in Sterkspruit take place outside of Sterkspruit. Thus, the government should think beyond providing basic housing services and should also consider other options that may increase the happiness of the people. In addition, the private sector should become more involved in the construction of government housing and ensure that the houses that are built are close to employment opportunities, schools and shopping centres.

The government should consider relaxing the restrictions on not being allowed either to sell or rent out an RDP house for the first eight years of residing in such a house as this would provide both investment and employment opportunities. The restriction could be reduced from 8 years to 1 year. In addition, this would encourage households to further develop and upgrade their neighbourhoods because of possible income that may be generated.

As mentioned above poor households tend live in large groups because this is financially sustainable. Accordingly, the government should expand the size of RDP houses to at least three bedrooms to try to overcome the problem of overcrowding. In addition, the distance from one house to another should be far enough to ensure privacy.

Finally, the Public Protector Commission should become more involved in the implementation of housing policies to ensure that corruption is reduced and ensure all government houses that are built meet the standards as stipulated in the initial policy. Quality checks should be conducted, and the houses should meet the standards set by the United Nations Habitat Institution. Quality assessments should be conducted before construction,

during construction and after construction this would ensure that poor quality houses are not built and reduce the repair costs.

5.2. Conclusion

The main aim of the research study was to investigate the impact of moving from an informal settlement to a formal settlement on life satisfaction. The study analysed differences between the life satisfaction of individuals who had moved to government housing and that of individuals who had moved to private housing.

The study first conducted a review of previous studies relevant to the research topic and found that no research had been conducted that explored various econometric methodologies used to study the impact of moving from an informal settlement to a formal settlement on life satisfaction. It was found that previous research had used primary data, it had focused only on specific areas in South Africa and had studied just two groups, namely, informal settlement dwellers and formal settlement dwellers. Finally, no research was found that had used the global life satisfaction question to determine the happiness.

The study used five econometric models, namely, the OLS, fixed effects, DID, logit DID and PSM models. The POLS model was the base model. However, there are disadvantages to this model as it does not consider the counterfactual effect, fixed effects, unobserved effects and time-invariant characteristics. Hence, the other models were used to overcome these disadvantages of the POLS model. The results obtained by the nonlinear model found that the life satisfaction for the *treatedgvt* group declines and this effect was statistically significant. The *treated* and *treatedpvt* showed that life satisfaction increase however this effect is insignificant. The study found that life satisfaction reduced for the *treatedgvtH* because of the following factors; transportation cost, size and scale of RDP houses, quality of RDP houses, restrictions on property rights and installation of solar heaters.

Finally, the study provided possible recommendations for policy makers. These recommendations included the following: the government should expand its housing policies in terms of going beyond merely providing shelter and, instead, build communities with easy access to shopping centres, schools, entertainment and work opportunities, the government should try to ensure greater involvement on the part of the private sector in the process, restrictions on property rights should be relaxed to provide employment and investment

opportunities and, finally, the Public Protector Commission should become more involved in the implementation of housing policies in order to reduce corruption and provide transparency.

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Appendix

Table 9.1: Description of control variables

Variable	Description	Type
Economic indicators		
<i>Income per capita</i>	Natural logarithm household per capita income.	Continuous
<i>Schooling</i>	Number of schooling years completed	Continuous
<i>Employment</i>	1= employed 0=otherwise	Dummy
Household size	Number of individuals in a household	Continuous
Perception indicators		
Income step today	Perceived income for today: 1= where respondent indicated income step level of 4, 5 or 6 Long a scale 1-6. 0= where respondent indicated income step level of 1, 2 or 3 on a scale 1-6	Dummy
Expected income in 5 years	Natural logarithm of expected household per capita income	Continuous
Health	Health status: 1= if health status is above average 0= otherwise	Dummy

Religion	Importance of religion: 1= if important 0= otherwise	Dummy
Safety	Does the individual feel safe? 1= safe 0= otherwise	Dummy
Household indicators		
Access to electricity	Does the household have access to electricity 1=yes 0= otherwise	Dummy
Access to water	Does the household have access to piped water within the dwelling? 1= piped inside the dwelling & piped water outside the dwelling 0= otherwise	Dummy
Access to a flushing toilet	Does the household have a flushing toilet? 1= flushing toilet onsite & flushing toilet offsite 0= otherwise	Dummy

Streetlight	Are they streetlights in the neighbourhood: 1= yes 0= otherwise	Dummy
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Rubbish removal	Rubbish is removed weekly by local authorities: 1= yes 0= otherwise	Dummy
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Geographic indicators

WC prov	Living in the Western Cape: 1= yes 0= otherwise	Dummy
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Gauteng prov	Living in Gauteng: 1= yes 0= no	Dummy
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KZN prov	Living in KZN: 1= yes 0= no	Dummy
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EC prov	Living in the EC: 1= yes 0= no	Dummy
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Demographic indicators

Age	Age of individual	Continuous
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Age squared	Age of individual squared	Continuous
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White	Race descriptor
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African	Race descriptor
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Indian	Race descriptor
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Coloured	Race descriptor
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Gender	Gender descriptor	Dummy
Married	Marital Status	Dummy