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THE IMPACT OF THE INTEGRATED RESIDENTIAL DEVELOPMENT PROGRAMME ON SURROUNDING PROPERTY VALUES: CASE STUDY OF FLEURHOF, JOHANNESBURG

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ABSTRACT

South Africa is challenged with an increased backlog of adequate subsidised affordable housing for the marginalised in well-located areas that provide access to urban amenities and places of employment. However, the perception of subsidised affordable housing developments built in the urban core in close proximity to bonded properties is significantly negative. This article seeks to address whether the presence of subsidised affordable housing provided through South Africa's Integrated Residential Development Programme (IRDP) impacts on the property value of bonded properties located nearby. This article examines the impact of the subsidised affordable housing development of Fleurhof, Johannesburg, on surrounding property values. It investigates, in particular, whether the IRDP housing development decreases property values. Using hedonic pricing models (HPM) with regressions, the housing attributes (characteristics) and property price data, dating from 2001 to 2017, were used to determine the effect on the value of

properties in the suburbs of Meadowlands East Zone 1 and Orlando West in Soweto and Florida in Roodepoort, as the two closest residential communities to Fleurhof. The article reveals that the close proximity of the housing development in the initial stages (2001-2010) of the development affected property values negatively. However, in the long run, the housing development does not affect property values.

Keywords: Hedonic price modelling, housing characteristics, Integrated Residential Development Programme (IRDP), subsidised affordable housing, property value

ABSTRAK

Die agterstand in voldoende gesubsidieerde bekostigbare behuising vir gemarginaliseerders, in goedgeleë gebiede wat toegang bied tot stedelike geriewe en werkplekke, is ’n uitdaging vir Suid-Afrika. Daar is egter ’n negatiewe persepsie oor die bou van gesubsidieerde bekostigbare behuisingsontwikkelings in die stadskern naby omgewings met eiendomme waarop verbande geregistreer is. In hierdie artikel word aandag gegee aan die vraag of die teenwoordigheid van gesubsidieerde bekostigbare behuising wat deur die Suid-Afrikaanse Geïntegreerde Residensiële Ontwikkelingsprogram (IRDP) aangebied word, die eiendomswaarde van die verbandgeregistreerde eiendom wat in die naby omgewing geleë is, beïnvloed. Hierdie artikel ondersoek die impak van die gesubsidieerde ontwikkeling van bekostigbare behuising in Fleurhof, Johannesburg, op die omliggende eiendomswaardes, en veral of die IRDP-behuisingsontwikkeling eiendomswaardes verlaag. Deur gebruik te maak van hedoniese prysmodelle (HPM) met regressies, is die behuisingseienskappe en eiendomsprysgegewens vanaf 2001 tot 2017 gebruik om die waarde van eiendomme in die voorstede van Meadowlands East Zone 1 en Orlando West in Soweto en Florida in Roodepoort, as die twee woongemeenskappe naaste aan Fleurhof, te ontleed. Die studie toon dat die nabyheid van die huisontwikkeling in die beginfases (2001-2010) van die ontwikkeling eiendomswaardes negatief beïnvloed het. Op die lange duur beïnvloed die ontwikkeling van behuising egter nie die eiendomswaardes nie.

Sleutelwoorde: Behuisingseienskappe, eiendomswaarde, Geïntegreerde Residensiële Ontwikkelingsprogram (IRDP), gesubsidieerde bekostigbare behuising, hedoniese prysmodellering

1. INTRODUCTION

The South African Constitution (RSA, 1996: 11), in chapter 2 section 26, states that everyone has the right to access adequate housing. It is the responsibility of the National Department of Human Settlements (NDoHS) to ensure that this right is honoured and adhered to (RSA, 1997: 10). The delivery of sustainable subsidised affordable housing in South Africa has posed a great challenge to the post-apartheid government. The country’s ever-increasing population and a limited supply of land within the urban core have resulted in a decline in the delivery of subsidised affordable housing (Sisulu, 2016: online). In an effort to advance the delivery of subsidised affordable housing in South Africa, the NDoHS established the “Breaking New Ground” (BNG) strategy (Burgoyne, 2008: 30). The BNG policy aims to redirect and enhance already existing housing delivery mechanisms in a more responsive, sustainable and effective way (Burgoyne, 2008: 31). The policy also endeavours to “promote the achievement of a non-racial, integrated society through the development

of sustainable human settlements and quality housing" (DLGH, 2005: 8). Thus, within the BNG strategy, the Integrated Residential Development Programme (IRDP) was introduced. The IRDP is targeted towards the development of sustainable human settlements in well-located areas within the urban core whereby individuals of all socio-economic backgrounds are catered for (Van Der Byl, 2015: 10-32; NDoHS, 2010: n.p.).

The development of subsidised affordable housing in well-located areas means that such developments could be built in close proximity to high- to middle-income neighbourhoods. However, the locality of these developments raises issues whereby property owners and/or ratepayers oppose these developments because of their negative perceptions towards such developments (Cummings & Landis, 1993). These individuals are quick to conclude that subsidised affordable housing developments will ruin their neighbourhood (Usrey, 2012: 1). It is a common belief that the close proximity of subsidised affordable housing will decrease the value of surrounding property values. This is based on the idea that such developments are unattractive, poorly maintained and managed, and will, in the long run, increase traffic and the level of crime in an area (Habitat for Humanity, 2008).

Property value, as an important aspect of the property market, determines the desirability of a neighbourhood (Ge & Du, 2007: 20). Property value not only considers the price of the property, but is also dependent on various factors such as its location, the surrounding neighbourhood, its physical attributes, and accessibility (Ajibola, Awodiran & Salu-Kosoko, 2013: 195). Time-honoured residents in an area, specifically property owners, are always on guard for any possible changes that may occur in their neighbourhoods or neighbouring land uses that may impact on their property values (Scally & Tighe, 2015: 750).

Property owners who oppose subsidised affordable housing are also referred to as "Not In My BackYard" (NIMBY) home owners, and they perceive the development of subsidised affordable housing developments as a raid of undesirable neighbours into their neighbourhoods who seek to undermine their security, quality of life and property values (Tighe, 2010: 9). NIMBY home owners continually raise questions about whether or not the sale and the prices of their bonded properties are affected when a subsidised affordable housing development is located in close proximity to their properties (Scally & Tighe, 2015: 765).

Many studies (Nourse, 1963; Lyons & Loveridge, 1993; Lee, Culhane & Wachter, 1999; Bento, Lowe & Knapp, 2008; Castells, 2010) have found that subsidised affordable housing has neither a long-term nor a short-term negative impact on surrounding property values. Other studies, however, have indicated that there is a negative impact (Cummings & Landis, 1993).

In reality, many local communities still believe the fallacy that subsidised affordable housing developments in close proximity decrease property value (Nguyen, 2005: 15). It was, therefore, important to analyse the property values of properties in the suburbs of Meadowlands East Zone 1 and Orlando West in Soweto and Florida in Roodepoort, as the two closest residential communities to Fleurhof, in order to understand how the presence of the IRDP housing development affects the property value of bonded properties located around the IRDP development.

2. LITERATURE REVIEW

In order to understand how the IRDP impacts on property values, it is important to introduce the present theory on residential development and property value included in this article. The current theory focuses on integrated residential development, location, property value, housing markets, and neighbourhood character in South Africa.

2.1 Integrated residential development in South Africa

Housing development in the South African context should be introduced against the colonial and apartheid spatial planning segregated policies of the past (Malete, 2014: 20). The main features of the colonial-apartheid era such as the displacement of non-Whites, racial segregation, and the introduction of influx control laws of non-Whites brought an increased level of corruption on zoning ordinances motivated by race (Luyenge, 2011: 102-111). The legacy of the past presented the democratic government with a huge housing challenge. They thus instituted the 1994 Reconstruction and Development Programme (RDP) to address these socio-economic disparities (Koma & Joseph, 2014: 4). A key aim of this housing reform programme was to redress the country's housing debacle, prioritising the building of adequate houses for all marginalised South Africans who were previously located on the periphery away from economic opportunities (Burgoyne, 2008: 40).

RDP housing was a package involving secure tenure of land, a top structure and the supply of basic services (Burgoyne, 2008: 14). However, by the late 1990s, concerns were raised about the quality of these housing units and their locality on the periphery, with critiques indicating that the housing delivery policy further prolonged apartheid spatial planning (Koma & Joseph, 2014: 5). In 2004, in order to strengthen and update the RDP policy in the housing context, the National Department of Housing (NDoH) released the Breaking New Ground (BNG) policy – a comprehensive housing plan for the development of Sustainable Human Settlements (SHS) (Koma & Joseph, 2014: 6). This policy builds on existing housing legislation and policy and emphasises the need to accelerate the delivery of sustainable human

settlements (SHS), redressing colonial and apartheid spatial planning through the development of socially, economically and spatially integrated housing delivery processes (Langeberg Local Municipality, [n.d.]: online). In 2009, after reviewing the BNG policy, the DHS found that the key focus remained housing rather than human settlement development (Tissington, 2011: 80). The NDoH implemented the IRDP to overcome existing housing policy programmes that focus primarily on the development of subsidised housing and do not provide much scope for area-wide settlement planning and the integration of a range of housing types and price categories, together with commercial and social amenities in a project (Tissington, 2011: 81).

The programme provides for the acquisition of land, servicing of stands for a variety of land uses, including commercial, recreational, schools, and clinics, as well as residential stands for low-, middle- and high-income groups, taking an area-wide planning approach based on the needs of the community. The implementation of the IRDP aims to facilitate the development of integrated human settlements, including all the necessary land uses, housing types, and price categories, creating social, economic and spatial integration, situated in well-located areas (Chipingu, 2015: n.p.).

In this article, well-located areas refers to areas within the urban core close to economic opportunities. Subsidised affordable housing, provided through the IRDP, is defined or constitutes fully subsidised BNG housing, social housing and subsidised housing, which bridges the shortfall of housing delivered by the government and houses delivered by the private sector (referred to as Gap housing) (Rust, 2009: online).

2.2 Location theory

According to the location theory, the more accessible a location is to positive elements in the environment, the more valuable it is (Jordaan, Drost & Makgata, 2004: 533). However, this also depends on the way in which the land is used, as land calls for different uses. For instance, residential land uses desire convenient access to social amenities (Jordaan *et al.*, 2004: 533). The importance of residential land accessibility is dependent on both monetary and non-monetary factors such as the cost of travelling to work or school and the level of peace and quiet an area provides (Jordaan *et al.*, 2004: 534). Consequently, in this article, the term 'well-located' considers these factors. In an effort to reverse apartheid spatial planning, subsidised affordable housing should be located in areas with convenient access to social amenities, public infrastructure, and economic opportunities.

Location is an important factor in determining the value of a property, as it adds to the profitability of property investment (Seth, 2017: online). Location holds a time-distance relationship between a property or a neighbourhood

and all the different possible origins and destinations that people may go to or come from (Herold & Leonard, 1991: 343). Herold and Leonard (1991: 344) state that the more distance travelled to get to a location, where a property is located, and has many attractive features and amenities despite the long commute, will command more value than nearer locations that lack attractive features and amenities.

2.3 Property value and housing markets

"Property value is defined as an estimate of what a home or a piece of land is actually worth" (Sherman, [n.d.]: online). Property value or fair market value is an estimated value of a property generated from the actual price of the property that both consumer and seller agree upon when making a property transaction deal (Hummel, 2011: online). Other factors such as market demand, physical characteristics of the property, proximity of the property to amenities, and the property's location affect property value (Uchenna, 2014: 24; Goslett, 2011: online). When estimating an accurate value of a property, the main element that must be considered is current market conditions (Goslett, 2011: online).

Several methods may be used to determine property value. The hedonic valuation technique is the most common, as it considers accessibility to amenities and that housing is a hedonic good (Selim, 2008: 66). A hedonic good represents a bundle of attributes (both intrinsic and extrinsic) that contribute to a consumer's utility and are valued by the consumer (Mourouzi-Sivitanidou, 2020: 257). Intrinsic attributes are those attributes that characterise the property itself, whereas extrinsic attributes consider attributes that are external to the property, such as the environmental and locational attributes of a property and the exterior design of a property (Mourouzi-Sivitanidou, 2020: 258).

Housing markets in both the public and the private sector are interconnected (Kim, 2010). A measure of the demand and supply of subsidised affordable housing and private markets may be applied in an effort to understand the interconnectedness of these different housing markets (Kim, 2010). However, the relationship between subsidised affordable housing and bonded property values is fairly complex (Nguyen, 2005: 16).

2.4 Neighbourhood character

Neighbourhoods are characterised by their complex attributes that together determine their overall character (Botein, 2002:15). The overall neighbourhood character is made up of the neighbourhood's location, housing stock, socio-economic characteristics, and other attributes (Botein, 2002: 360). When considering the impact of subsidised affordable housing developments, housing market conditions also need to be

considered, as the development of subsidised affordable housing has a quantifiable effect on housing markets (Bento *et al*., 2008: 11). Bento, Lowe and Knapp (2008: 13) state that the number of low-income households in an area will increase with the development of subsidised affordable housing in that area. Meanwhile, the price of homes in that neighbourhood with a particular socio-economic character would eventually increase, while the size of new dwelling units would decrease (Bento *et al*., 2008: 14).

Housing, like any other land use, has an impact on the surrounding neighbourhood (Botein, 2002: 360). However, different types of dwelling units are anticipated to impact on neighbourhoods differently. This may be noted in the different types of zoning regulations used for different residential uses (Freeman & Botein, 2002: 360). The impact of subsidised affordable housing developments on property values, particularly in a depressed housing market, may, in reality, generate positive externalities that will, in the long term, improve a neighbourhood's housing prices (Woo, Joh & Zandt, 2016: 2490). A positive externality includes the benefits that bonded property home owners would gain when a subsidised affordable housing development is developed in the neighbourhood such as the revitalisation of their neighbourhood (Mourouzi-Sivitanidou, 2020: 258).

2.5 Subsidised affordable housing, neighbourhoods, and property value

A literature review on the impact of subsidised affordable housing on property values does not have a single conclusive answer to the overall impact of subsidised affordable housing on property value (Cummings & Landis, 1993). In addition, many of these studies are context-specific and, therefore, difficult to use or generalise in different contexts (Nguyen, 2005: 19). Some results found that the development of subsidised affordable housing had either negative spill-overs or externalities towards the neighbourhoods, thus affecting property values. For instance, the development brought undesirables such as noise and traffic into the neighbourhood (Cummings & Landis, 1993). In some neighbourhoods, however, the introduction of subsidised affordable housing not only increased property value, but also meant that their neighbourhoods experienced a revitalisation by eliminating disamenities (such as deteriorating buildings) in the neighbourhoods (Woo *et al*., 2016: 2490).

Accordingly, subsidised affordable housing has no impact and has indicated that it is merely about perception rather than an actual decrease in property values that is the prevalent attitude of NIMBY home owners. Woo (2014: 58) reveals that the way in which different subsidised affordable housing units are provided impacts differently on nearby property values. Woo (2014: 142) makes particular reference to the fact that the different characteristics

of each housing programme, unit, and neighbourhood environment would result differently in terms of the overall impact on property value. For instance, the single detached housing unit provided through the BNG policy would have a different impact on a neighbourhood's property value than the medium- to high-rise residential units provided through the social housing programme (Nguyen, 2005: 17).

3. STUDY AREA

Fleurhof is an integrated residential development situated south west of Johannesburg, Gauteng (Figure 1). It is located between the township of Soweto and the affluent suburb of Florida next to the already existing residential township of Fleurhof extension 1 (Dube, 2013: 62). Fleurhof is situated in the City of Johannesburg's (CoJ's) Region C and is one of the largest integrated residential developments in Gauteng (CoJ, 2017: online). The development is located in the urban core of the major urban concentration areas in the CoJ. Construction of the development began in 2011. It covers a total area of 4.4 km^2 with a total of 10 411 residential units, housing an estimated 83 000 people (Calgro M3, 2014: online). The development is a mixed mode human settlement development that includes various housing typologies and tenures, which are targeted at specific economic markets that comprise fully subsidised BNG housing, social housing, open-market rental housing, and open-market bonded housing (Khan, 2014: 16). The project started in 2011 with the fully subsidised BNG housing as the first phase, and the other types of housing happened only after two years. Hence, the project was known for some time as a subsidised BNG housing development.

This study used the property values of 1 100 bonded properties located in the neighbourhoods of Meadowlands East Zone 1 and Orlando West, which are located in the township of Soweto, and Florida, which is located in Roodepoort, which surround Fleurhof.

Figure 1: Locality of Fleurhof
Source: Google Earth

3.1 Rationale for selecting the study area

Whereas previous subsidised affordable housing developments were located on the periphery, fundamentally, enforcing the apartheid era's spatial planning, Fleurhof was considered in this study, as it is in the urban core where urban amenities are easily accessible to the residents of the subsidised affordable housing development (Sihlongonyane & Karam, 2003: 159; Khan, 2014: 8).

Housing in Fleurhof, provided in accordance with the IRDP, is sustainable and located in the urban core, and provides better social and economic opportunity for residents (Tissington, 2011: 8). Subsidised affordable housing through the IRDP is of better quality and infrastructure, thus decreasing poverty concentration in one locality, as the programme allows residents who are able to purchase property in the open private property market to build their own homes in the Fleurhof development. This promoted the integration of individuals from different socio-economic backgrounds in the same neighbourhood (Tissington, 2011: 8).

4. RESEARCH METHOD

This study assesses the impact of the integrated residential development of Fleurhof, based on property price and/or property value data, from 2001 to 2017, from the suburbs of Meadowlands East Zone 1 and Orlando West in Soweto and Florida in Roodepoort, as the two closest residential communities to Fleurhof. In this study, hedonic methods that use multiple regression techniques were used to analyse the locational value, because hedonic pricing models are essential in order to estimate the total price of the bundle characteristics of an individual property (Selim, 2008: 66). The study applied a log-log functional form, as it provides better interpretation of the beta coefficients. The dependent variable (price) was logged and regressed against 10 independent variables (attributes) that fall under the categories of structural attributes, locational amenities, and neighbourhood characteristics.

4.1 The Hedonic Price Model (HPM) and housing attributes

In order to analyse the impact of the subsidised affordable housing development in Fleurhof, it is important to briefly introduce the Hedonic Price Model (HPM) and how it works.

The HPM determines the price of a property by its internal characteristics, which include the property's size, appearance and condition, and its external characteristics, which include factors such as the property's accessibility to schools, shopping centres, and the value of other homes surrounding that residential property (Woo, 2014: 8). The method only works well on goods that have varying amounts of attributes, which, in the case of a housing unit, reflect the value of the property based on the set of characteristics that an individual would consider important or desirable when purchasing that property (Opaluch, Grigalunas, Diamantides, Mazzotta & Johnston, 1999: 2). HPM assumes that housing characteristics are traded as a bundle of inherent attributes (Woo, 2014: 8; Chin & Chau, 2003: 155). Consequently, the basic hedonic equation states that the market price (P) (dependent variable) of a property can be expressed as a function of a property's attributes such as structural attributes (SA), neighbourhood characteristics (N), and locational amenities (LA) (explanatory variables or independent variables in this study) (Equation 1) (Randeniya, Gayani & Amarawickrama, 2017: 114).

$$P = f(SA, N, LA) \qquad \text{(Equation 1)}$$

Structural attributes (SA), also referred to as the internal attributes of a residential unit, describe the physical characteristics of the house such as the number of bedrooms, bathrooms, and the size of the house)

(Xiao, 2017: 18). The value of a property is frequently related to these attributes. If a property has more desirable attributes in comparison to other properties, the valuation of these attributes would be reflected in higher market prices for the house (Xiao, 2017: 19).

Locational amenities (LA), the accessibility to urban amenities and the CBD, no matter how accessibility may be defined, directly affect the price of a property (Kohlhase, 1991: 2). Some location attributes impact positively, while others have a negative impact on the value of a property. For instance, the view of a cemetery may have a negative impact on a property's price (Randeniya *et al.*, 2017: 114). In the case of this study, the distance of Fleurhof's subsidised affordable housing development is closely considered.

Neighbourhood characteristics (N) depict the quality of economic and social characteristics of the neighbourhood such as the racial composition of a neighbourhood, in the case of this study. According to Metz (2016: 15), the concentration of race, particularly of Black people, in a neighbourhood decreases an area's property value when socio-economic conditions are controlled for. Other neighbourhood characteristics include the quality of municipal services such as schools, hospitals and places of worship located in a neighbourhood, and externalities such as the crime rate, traffic noise, and airport noise (Randeniya *et al.*, 2017: 115).

The HPM also determines how various attributes of different housing units affect the value of a property. The traditional HPM technique is based on a multiple regression model, which observes a large number of property transactions as an independent variable and the value determinant as a dependent variable (Bello, 2009: 8). Because it is impossible to sell a property's attributes separately, the regressions coefficients give way to the marginal contribution of each attribute to the sales price for the respective property. This, therefore, accounts for the differences in the way in which the price index of real estate is constructed from other property types. Hence, the use of equation 2:

$$P = f(SA\beta, N\gamma, LA\alpha) + \varepsilon \qquad \text{(Equation 2)}$$

Where

- P: a vector of observed logarithm of house values or prices
- SA: a matrix of physical attributes of the property
- N: the neighbourhood's characteristics
- LA: the distance of a property to amenities
- ε: the disturbance or the error term.

The parameters (α,β,γ) describe the relationships between property prices and the measures included in the three classified attributes (SA, N, and LA).

The incremental change in the price of the house represents the additional amount which house buyers are willing to pay for a marginal change in the attribute holding all the other attributes.

4.2 Sampling method and size

A list provided by Lightstone Property (a reliable property acquisition company) showed 1 100 complete cases of registered sales happening around the development of Fleurhof in the suburbs of Meadowlands East Zone 1, Orland West and Florida. The decision was to use all 1 100 cases, resulting in a 100% sample size. The table advocated by Krejcie and Morgan (1970: 608) for construction-related research samples recommends a sample size for a population of 1 100 as 275. This recommendation validates the sample size of 1 100 as excellent for the population of 1 100.

4.3 Data collection

Lightstone Property provided data on the year that each property was sold as well as property value records from 2001 to 2017. This is important, as it considers the time before the construction of the development of Fleurhof to where the development stands presently (pre-construction and post-construction). Neighbourhood demographic data (racial composition data) was obtained through Quantec data and Geographic Information Systems (GIS) shapefiles that were available from the University of the Witwatersrand's Geography Department in the form of qualitative data.

Property price and characteristics data (attributes) were categorised based on the three main category variables in the HPM, which include structural attributes, locational amenities and neighbourhood characteristics. The model contains the purchase price (dependent variable) and 10 independent variables, which are presented in Table 1 together with the definitions. These variables were selected, because a property is considered a hedonic good, which is impacted by both its intrinsic (structural attributes) and extrinsic (locational amenities and neighbourhood characteristics) attributes.

Table 1: Definition of selected variables descriptive statistics

Category	*Variable*	*Definition*
Dependent variable	Purchase price	The purchase price of the property
Independent variables		
Structural attributes	Erf size	Size of plot
	Bedrooms	The number of bedrooms in each individual property
	Bathrooms	The number of bathrooms in each individual property
	Property's age	The age of the property
	Year	The year the property was sold
Locational amenities	Clinic	The distance of each property to the nearest clinic
	Police station	The distance of each property to the nearest police station
	School	The distance of each property to the nearest school
	Retail centre	The distance of each property to the nearest retail centre
	Fleurhof	The distance of each property to the integrated residential development of Fleurhof
Neighbourhood characteristics	Racial composition	Constructed from the race of the property owner (Black, Coloured, White, and Indian)

Source: Authors' own

4.4 Data analysis

Descriptive statistics were used to analyse the variables for 1 100 properties before the regression analysis was done. Only the mean, maximum and minimum values were reported. In order to investigate the impact of Fleurhof's housing development on surrounding property values, a multivariable Ordinary Least Squares (OLS) regression with the use of the linear formulation and log-log formulation using STATA to run the regressions was employed. The OLS multivariable model was used in this study, as it allows for the use of more than one independent variable and allows for the determination of statistically significant variables according to the considered independent variables (Hutcheson, 2011: 224). The use of more than one independent variable provides for the best regression model in the case of this study, as it increases the robustness of the model.

The hedonic OLS model allows for the estimation of the effects of a residential property's physical characteristics, neighbourhood characteristics and locational amenities, and the distance to the housing development of Fleurhof on bonded property prices. The statistically significant variables were identified using adjusted R-squared (adj R^2) statistic and P-value. R-squared is the proportion of difference in the dependent variable (property

price), which can be explained by the independent variables (locational amenities, neighbourhood characteristics and structural attributes) (Frost, 2013: online). Adjusted R-squared regulates the R-squared for the independent variables that have a significant impact in the model. This study considers the adj-R^2 to identify significant variables in the regression. R-squared was also considered, as it is an overall measure of the strength of the regression and does not reflect the extent to which any particular independent variable is associated with the dependent variable (UCLA, n.d.: online). Essentially, adj-R^2 represents the percentage of the response variable variation, which is explained in a linear model. The percentage of adj-R^2 falls between 0 and 100%, whereby

- 0% in the regression results shows that the model does not explain the variability of the response data, whereas
- 100% in the regression results shows that the model explains all the variability of the response data (Frost, 2013: online).

The higher the adj-R^2, the better the model fits the data. However, adj-R^2 does not show whether a regression model is adequate or not. For instance, a low adjusted R-squared value may indicate a good model or a high adjusted R-squared value may be shown for a model that does not fit the data. Thus, the P-value was also used in this study to ensure that the independent variables were significant within the model (Frost, 2013: online). The p-value also measures the statistically significance (p=0.05) of each individual independent variable within the regression. The p-value shows the level of randomness: when P-value is high, the t-Stat is low, and *vice-versa*. A low P-stat means a good fit for the independent variable under analysis (Dodds, 2010: 35).

4.5 Limitations

The number of houses sold in the study area was a limiting factor. If the property market of the area was more active, it would have resulted in a larger sample. It would also have assisted in obtaining other sales for different areas that are close to subsidised housing and compare the results from Fleurhof. This makes this study limited in the scope of generalisability to other areas in South Africa. Nevertheless, the model can be used to test these results in other areas in South Africa.

5. RESULTS

5.1 Descriptive statistics

Table 2 depicts the descriptive statistics of the variables for 1 100 observations (properties) used in running the regressions. The average real

estate purchase price is R437,045.10, ranging from R222.63 to a maximum value of R6,624,090.00. The average erf size is 537m^2 and ranges from 21m^2 to 3267m^2. The year in which most of the properties were obtained was 2006, and, on purchase, properties were on average 3.45 years old. The distance to the nearest shopping centre is 4,527 km on average, whereas for clinics it increases to approximately 6,281 km.

Table 2: Descriptive statistics

Variable	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Dependent variable	Purchase price				
LNreal purchase price	1100	11.57904	2.208159	5.405511	15.70622
Real purchase price	1100	437045.10	523303.60	222.63	6 624 090.00
Independent variables	Structural attributes				
Erf size	1100	537.0364	590.2749	21	3267
LNproperty age	1100	3.456305	0.5001687	2.188296	4.47553
Bathrooms	1100	1.330909	0.5220777	1	4
Bedrooms	1100	2.468182	0.7375823	1	6
Year	1100	2006	4.24898	2001	2017
	Locational amenities				
LNdist to Fleurhof	1100	7.479643	0.0719978	7.243484	7.570777
Clinic	1100	6281.252	5520.331	1164	122199
LNclinic	1100	8.474055	0.7376852	7.059618	11.71341
School	1100	1524.925	756.4968	39	4200
LNschool	1100	7.157952	0.6817952	3.663562	8.34284
Police station	1100	2816.974	1301.336	162	6058.714
LNpolice station	1100	7.81779	5309471	5.087596	8.709253
Retail centre	1100	4527.19	2519.35	330.5654	8814
LNretail centre	1100	8.22915	0.6519196	5.800805	9.084097
	Neighbourhood characteristics				
Racial composition	1100	0.6563636	0.4751375		

5.2 Regression results

5.2.1 Model 1: Regression by suburb

The first model ran regressions on the acquired suburbs of Florida, Meadowlands East Zone 1 and Orlando West as well as a regression on all the suburbs for a final summary. This is done to test for the impact of the integrated residential development on property values of the different suburbs. The multivariable regression analysis is applied to further investigate and understand the complex relationship between the independent variables (attributes) with a keen interest on the distance to Fleurhof variable on property values.

The regression output in Table 3 shows that the 1 100 housing units that were used or observed in the regression were statistically significant, with an adj-R^2 of 0.8741 (87%). This means that 87% of the variation in the purchase price of a housing unit is explained by the independent variables that have been selected in the regression. The independent variables are statistically significant, with a p-value less than 0.05, thus indicating that the coefficients have a 95% confidence level and that the selected independent variables have some effect on the purchase price of a property. The bedroom variable has been omitted in this regression, as it neither added nor retracted from the goodness of fit of the model.

The regression output of 1 100 residential properties located in all suburbs indicated a negative coefficient or a negative relationship between the age of a residential property and property value. A beta value of -0.68 indicates that, with every year a residential property increases in age, the purchase price of the property decreases by 0.68 units, holding all other factors constant. The negative relationship of a property's age towards the dependent variable (purchase price) may be due to the concern of the state or condition of the property (as many of the properties selected in this study were built 27 years ago), as an older residential property may be perceived as old fashioned and may have dilapidated over the years. This, therefore, decreases the property's value; many home buyers may prefer newer built homes that are in style with current trends (Clarke, 2010: online). Positive coefficients such as bathrooms (0.17) and erf size (0.00) have an overall positive relationship with purchase price, essentially providing that these variables increase a residential property's value. However, this positive impact towards a property's value is significantly small. Positive coefficients, on the contrary, indicate a positive relationship with the dependent variable. Variables such as erf size and bathrooms indicate that, with every increase in the number of bathrooms or an increase in a property's size, the purchase price of a property increases. This is expected, as Tse and Love (2000: 366) state that an increase in a property's structural characteristics increases a property's value.

The distance to amenities such as schools and the police station are depicted with a positive coefficient, indicating that, with every one-metre increase in the distance to schools (specifically primary schools) or the police station, a property's value increases. This shows that properties located right next to a police station or a school have lower property values than a property located further away from these amenities. This is unexpected, as common property valuation theory states that the close proximity of schools increases the property's value (Kim, 2010: 17). However, one of the reasons the proximity to schools is considered to decrease a property's value is that the schools surrounding the suburbs selected in this study are not top-performing schools and may not be well managed aesthetically. Further, the regression depicted

Table 3: Model 1: Regression by suburb

Model 1													
Florida							Orlando West						
Regression statistics					*ANOVA*		*Regression statistics*					*ANOVA*	
Source	*SS*	*df*	*MS*		Number of obs	585	*Source*	*SS*	*df*	*MS*		Number of obs	186
					F(10, 574)	86.02						F(9, 176)	101.22
Model	174.7858	10	17.478		Prob > F	0.0000	Model	185.425	9	20.6028		Prob > F	0.0000
Residual	116.6270	574	0.2031		R-squared	0.5998	Residual	35.8231	176	0.20354		R-squared	0.8381
					Adj R-squared	0.5928						Adj R-squared	0.8298
Total	291.4129	584	0.4989		Root MSE	0.4507	Total	221.248	185	1.19593		Root MSE	0.45115
LNrealpurc~e	*Beta Coef.*	*Std. Err.*	*t*	*P>t*	*[95% Conf. Interval]*		LNrealpurc~e	*Beta Coef.*	*Std. Err.*	*t*	*P>t*	*[95% Conf. Interval]*	
LNdisttoFl~f	0.2526	0.3136	0.81	0.421	-0.363449	0.8686	LNdisttoFl~f	0.47373	1.95308	0.24	0.8090	-3.3807	4.328207
Erf size	0.000160	0.0000	4.72	0.000	0.000094	0.0002	Erf size	0.00144	0.00054	2.62	0.0100	0.00035	0.0025256
LNproperty~e	0.114741	0.0714	1.61	0.109	-0.025595	0.2550	LNproperty~e	-0.6302	0.18098	-3.48	0.0010	-0.98745	-0.2730868
Bathrooms	0.045587	0.0425	1.07	0.284	-0.037969	0.1291	Bedrooms	-0.1449	0.07509	-1.93	0.0550	-0.29318	0.003212
Bedrooms	0.038782	0.0306	1.26	0.207	-0.021455	0.0990	Clinic	-0.0017	4.18E-06	-4.24	0.0000	-0.00002	-9.47E-06
LNclinic	-1.432304	0.0834	-17.15	0.000	-1.596295	-1.268	LNschool	-0.0344	0.044595	-0.77	0.4400	-0.12250	0.0535173
LNschool	0.360048	0.06548	5.5	0.000	0.2314319	0.4886	LNpolicest~n	1.24041	0.128600	9.65	0.0000	0.9866	1.494216
LNpolicest~n	0.627336	0.06707	9.35	0.000	0.4955974	0.7590	LNretailce~e	-1.5354	0.186157	-8.25	0.0000	-1.902814	-1.168039
LNretailce~e	-0.15614	0.07893	-1.98	0.048	-0.3111802	-0.001	Racialcomp~n	-1.1504	0.282439	-4.07	0.0000	-1.707877	-0.5930677
Racialcomp~n	0.348817	0.04471	7.8	0.000	0.260993	0.4366	_cons	14.017	14.81994	0.95	0.3460	-15.23009	43.26525
_cons	15.64634	2.45999	6.36	0.000	10.81464	20.478							

Table 3: Continued

Meadowlands East Zone 1							All suburbs						
Regression statistics					*ANOVA*		*Regression statistics*					*ANOVA*	
Source	*SS*	*Df*	*MS*		Number of obs	329	*Source*	*SS*	*df*	*MS*		Number of obs	1100
					F(10, 318)	82.17						F(9, 1090)	849.16
Model	467.0098	10	46.700		Prob > F	0.0000	Model	4689.80	9	521.089		Prob > F	0.0000
Residual	180.7325	318	0.5683		R-squared	0.7210	Residual	668.883	1090	0.61365		R-squared	0.8752
					Adj R-squared	0.7122						Adj R-squared	0.8741
Total	647.7424	328	1.9748		Root MSE	0.7538	Total	5358.68	1099	4.87596		Root MSE	0.78336
LNrealpurc~e	*Beta Coef.*	*Std. Err.*	*t*	*P>t*	*[95% Conf. Interval]*		LNrealpurc~e	*Beta Coef.*	*Std. Err.*	*t*	*P>t*	*[95% Conf. Interval]*	
LNdisttoFl~f	1.415479	0.57017	2.48	0.014	0.2936933	2.5372	LNdisttoFl~f	2.24016	0.358512	6.25	0.0000	1.536709	2.943614
Erf size	-0.00018	0.00101	-0.18	0.856	-0.0021814	0.0018	Erf size	0.00056	0.000049	11.31	0.0000	0.0004636	0.0006581
LNproperty~e	-1.217175	0.39577	-3.08	0.002	-1.995838	-0.438	LNproperty~e	-0.6867	0.059900	-11.46	0.0000	-0.8042705	-0.569203
Bathrooms	0.221408	0.18055	1.23	0.221	-0.1338192	0.5766	Bathrooms	0.17071	0.051039	3.34	0.0010	0.0705676	0.270861
Bedrooms	0.010502	0.09014	0.12	0.907	-0.1668435	0.1878	LNclinic	-0.4053	0.048957	-8.28	0.0000	-0.5013965	-0.3092748
LNclinic	-0.078371	0.06857	-1.14	0.254	-0.213281	0.0565	School	0.00016	0.000045	3.53	0.0000	0.0000713	0.0002491
LNschool	-0.039582	0.09003	-0.44	0.661	-0.216726	0.1375	LNpolicest~n	1.25225	0.066920	18.71	0.0000	1.120946	1.38356
LNpolicest~n	0.687702	0.11979	5.74	0.000	0.4520035	0.9234	LNretailce~e	-1.6990	0.066479	-25.56	0.0000	-1.829485	-1.568598
LNretailce~e	-1.610518	0.15861	-10.15	0.000	-1.92258	-1.298	Racialcomp~n	0.00625	0.070893	0.09	0.9300	-0.1328431	0.1453627
Racialcomp~n	-0.953979	0.19717	-4.84	0.000	-1.341904	-0.566	_cons	4.04691	2.781751	1.45	0.1460	-1.411279	9.505107
_cons	13.77749	5.01871	2.75	0.006	3.903404	23.651							

a negative beta coefficient for the distance to the clinic and the shopping centre. This shows that, with every one-metre increase in the distance of a property from a shopping centre or clinic, the purchase price of the property decreases. This reveals that residential properties right next to a shopping centre have an increased property value, which is in alignment with Oloke, Simon and Adesulu (2013: 641) who state that the distance to amenities such as a shopping centre increases a property's value.

Racial composition indicated a positive beta coefficient with a value of (0.006), indicating that, with every increase of Black people into a neighbourhood, the purchase price of a property increases, holding all other factors constant. This is surprising as, according to Metz (2016: 22), an increase of Black people into a neighbourhood means a decline in property value. However, as mentioned earlier, Metz's (2016: 10) study was conducted in a predominantly White neighbourhood. The reason for the positive beta value may be that the suburbs used in the study have more Black people residing in the neighbourhoods than any other race. Consequently, the increase of Black people into the neighbourhood has no impact on property values.

The 'distance to Fleurhof' variable shows a positive coefficient with the dependent variable purchase price. A positive beta coefficient indicates that, with every one-metre increase in the distance of a property from the housing development of Fleurhof, a property's purchase price increases by 2.24. The beta value of 2.24 is statistically significant with a p-level below 0.05. This positive coefficient, however, indicates that the further away a property is from the housing development of Fleurhof, the higher a property's price, essentially, providing that the housing development of Fleurhof is perceived negatively the closer one's property is located to the housing development. As mentioned earlier, the reason for this negative impact on property values may be because of perceived (by the residents living around the housing development) potential spill-overs the development may bring to the suburbs surrounding the housing development, as it has been perceived as subsidised BNG housing development.

Model 1 indicates that the distance to Fleurhof has a negative relationship with property values. This indicates that the general perception of the subsidised affordable housing development is negative, with many residents preferring to be located further away from the development. Residents are, therefore, willing to pay more to be located further away from the subsidised affordable housing development. The negative perception of the housing development shows that NIMBY home-owner perceptions are prevalent towards the housing development in Fleurhof. This negative perception in relation to the development has, in turn, resulted in a decline in property values in the surrounding neighbourhoods. The reason for this is that the development of the integrated residential development has raised home owners' fears about

the potential negative spill-overs that the development may bring into the neighbourhoods such as an increased level of crime, more traffic and noise, consequently changing the character of their neighbourhoods. In addition, this study shows that the subsidised affordable housing development does not necessarily boost the property values of depressed neighbourhoods such as Orlando West and Meadowlands East Zone 1.

5.2.2 Model 2: Regression by construction time

The second model ran regressions on the time before (2001-2010) the construction of the integrated residential development in comparison to the post-construction (2011-2017) of the integrated residential development. This is done to observe the level of impact on property values after the development of the integrated residential development. This is done is an effort to understand the impact of the development over time and whether time-honoured residents' concerns are valid or not. The model also used the log-log functional form, as depicted in Equation 3.

$$\ln P = \alpha + \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \ldots \beta_{10} \ln X_{10\ldots} + \delta_1 Z_1 \qquad \text{(Equation 3)}$$

Where lnP represents the log-transformed property value of the investigated houses; X_1 to X_{10} represents the different explanatory variables that are considered which affect a property's value. Z_1 represents the perceived disamenity, which is the distance of each individual property to the integrated residential development of Fleurhof. The dependent variable used in estimating the hedonic equation was the purchase price of individual properties located close to the integrated residential development of Fleurhof.

5.2.2. i Pre-construction (2001-2010)

Table 4 shows that the 'distance to Fleurhof' variable has a positive beta coefficient. The positive coefficient indicates that the housing development of Fleurhof has a negative impact on property values. The further away a property is located from the housing development, the more the property's value increases. This, however, would mean that properties located right next to the land proposed for the integrated residential development would have had a negative property value.

With positive beta coefficients, structural attributes 'erf size' (0.00) and 'bathroom' (0.11) indicated a positive relationship with property value. This aligns with the literature. Oloke *et al.* (2013: 639) state that an increase in a property's size results in an increase in a property's value. However, 'bedrooms' indicated a negative coefficient, with a beta value of -0.15. The negative relationship between the number of bedrooms and the purchase price may be because extra bedrooms within the selected

Table 4: Model 2: Regression by construction time results

Model 2													
Pre-construction (2001-2010)							Post-construction (2011-2017)						
Regression statistics					*ANOVA*		*Regression statistics*					*ANOVA*	
Source	*SS*	*df*	*MS*		Number of obs	877	*Source*	*SS*	*df*	*MS*		Number of obs	223
					F(9, 867)	623.27						F(8, 214)	127.53
Model	3726.142	9	414.01		Prob > F	0.0000	Model	495.488	8	61.9361		Prob > F	0.0000
Residual	575.9196	867	0.6642		R-squared	0.8661	Residual	103.930	214	0.48565		R-squared	0.8266
					Adj R-squared	0.8647						Adj R-squared	0.8201
Total	4302.062	876	4.9110		Root MSE	0.81503	Total	599.419	222	2.70008		Root MSE	0.69689
LNrealpurc~e	*Beta Coef.*	*Std. Err.*	*T*	*P>t*	*[95% Conf. Interval]*		*LNrealpurc~e*	*Beta Coef.*	*Std. Err.*	*t*	*P>t*	*[95% Conf. Interval]*	
LNdisttoFl~f	1.428326	0.41024	3.48	0.001	0.6231367	2.23351	LNdisttoFleurhof	-0.7445	0.69863	-1.07	0.288	-2.1217	0.6325239
Erf size	0.000464	6.27E-05	7.41	0.000	0.0003415	0.00058	Erf size	0.00044	0.00009	4.87	0.000	0.0003	0.0006263
Bathrooms	0.112895	0.06956	1.62	0.105	-0.0236332	0.24942	Bathrooms	0.15376	0.09296	1.65	0.100	-0.0295	0.3370038
Bedrooms	-0.156658	0.048705	-3.22	0.001	-0.2522523	-0.0610	LNclinic	-2.2172	0.22285	-9.95	0.000	-2.6566	-1.778013
LNclinic	-0.333211	0.05247	-6.35	0.000	-0.436194	-0.2302	School	0.00062	0.00012	5.01	0.000	0.0004	0.000873
LNschool	0.166835	0.053067	3.14	0.002	0.0626804	0.27099	LNpolicestation	0.76920	0.28644	2.69	0.008	0.2046	1.33382
LNpolicest~n	1.465826	0.068975	21.25	0.000	1.330449	1.60120	LNretailcentre	-0.9389	0.22462	-4.18	0.000	-1.3817	-0.4962054
LNretailce~e	-1.82553	0.073873	-24.71	0.000	-1.97052	-1.6805	Racialcomposition	0.17515	0.14726	1.19	0.236	-0.1151	0.4654247
Racialcomp~n	-0.202120	0.08713	-2.32	0.021	-0.37313	-0.0311	_cons	35.8211	5.65279	6.34	0.000	24.6789	46.96347
_cons	6.191663	3.276326	1.89	0.059	-0.2387952	12.6221							

suburbs between 2001 and 2010 were not demanded by consumers, thus affecting property values negatively. Distance to the clinic and retail centre indicated a negative beta coefficient, indicating that the further away a property is located from these amenities, the more a property's value decreases. This shows that properties located within close proximity to these amenities have an increased property value. The ease of access to these amenities thus makes the property attractive to consumers and, therefore, increases such a property's value. Distance to the police station and schools, on the contrary, have a positive beta coefficient, indicating that, with every increase in the distance of a property from the police station or a school, a property's value increases.

5.2.2. i Post-construction (2011-2017)

Table 4 shows that the 'distance to Fleurhof' variable has a negative beta coefficient. The negative coefficient indicates that the integrated residential development of Fleurhof impacts on property values positively. The further away a property is located from the housing development, the more a property's value decreases. This means that perceptions have changed over time, and the housing development is viewed positively, possibly with the start of the building of bonded housing after 2013.

The variables 'erf size' and 'bathrooms' are depicted with a positive beta coefficient indicating a positive relationship with the dependent variable purchase price. The locational variables 'clinic' and 'retail centre' are presented with a negative coefficient, indicating that the further away a property is located from these amenities, the more a property's value decreases. Distance to the clinic and retail centre are presented with a negative coefficient, indicating that the further away a property is located from these amenities, the more a property's value decreases. Distance to the police station and schools, on the contrary, have a positive coefficient, indicating that, with every increase in the distance of a property from the police station or a school, a property's value increases. Racial composition is presented with a positive coefficient, indicating that the more Black people that move into the neighbourhood, the more the property values will increase.

In comparison to Model 1, Model 2 presented different outputs – the post-construction regression presented a negative beta coefficient for the 'distance to Fleurhof' variable. The negative beta coefficient indicates that the property value of properties after the development witnessed an increase in property value in comparison to property values of properties sold before formal construction began on the housing development. This shows that, following the announcement that the integrated residential development was to be constructed in 2009, property owners might have raised concerns about the possible negative externalities that may result from the development.

However, once construction began, the development was viewed positively, and such concerns may have decreased as property values located right next to the development had an increased property value. The reason for this may be that, before the start of the development, the land may have been used as a dump site that would change the environment of the neighbourhood, thus impacting on property values negatively.

In addition, the study discovered that the presence of locational amenities such as a police station and a school in close proximity to properties impacts on property values negatively. This may be because the quality of the schools in the selected suburbs may not be good quality schools. Thus, the schools may be viewed as a disamenity rather than an amenity. Furthermore, the police stations may be perceived negatively by residents, as they may increase noise and traffic into the area. This is why people may prefer to be located further away from the police station.

6. CONCLUSION

Although the results of this study may not be generalised and may not be easily adapted to other subsidised affordable housing developments across South Africa, as the study is focused on Fleurhof, literature dictates that minor differences in the neighbourhood such as the locality and the type of housing development may change the results of the impact of the housing development on property values (Woo, 2014: 39). The study may help understand the effect of subsidised affordable developments on surrounding communities. A change in the general perspective of subsided affordable housing developments may also see a change in the overall impact on property values.

Table 5: Summary of results on property values

Model		*Property values*
Model 1 – Suburb	All suburbs	Negative
	Meadowlands East Zone 1	Negative
	Florida	Negative
	Orlando West	Negative
Model 2 – Construction time	Pre-construction (2001-2010)	Negative
	Post-construction (2011-2017	Positive

Results in Table 5 show that the subsidised affordable housing development had a negative impact on surrounding house prices in all the suburbs, however, at varying levels, indicating subsidised affordable housing developments impact different neighbourhoods differently. For instance, Meadowlands East Zone 1 had a higher impact in comparison to Florida with a lower impact. This may be due to the difference in the socio-economic

standing of the two suburbs. Meadowlands East Zone 1 is a lower income suburb and Florida is more affluent. Furthermore, the suburb of Florida may have taken more measures such as building higher fences and hiring more security companies around their houses and in the neighbourhood in an effort to keep themselves safe from potential perceived negative externalities that the residents may have thought the subsidised affordable housing development may bring such as an increase in crime.

The negative impact of the housing development suggests that bonded property home owners perceive subsidised affordable housing development as an undesirable development rather than an instrument for poverty de-concentration and housing assistance for the marginalised citizens of South Africa. In addition, as noted with Low-Income Housing Tax Credit housing developments in America, the negative impact of the development on property values indicates that the development is built in a prosperous housing market (Woo, 2014: 50). Because of the increased NIMBY concerns preeminent about the subsidised affordable housing development, the development faces residential segregation, with many of the residents preferring to be located further away from the development and disagreeing with a mix of income backgrounds in one neighbourhood. The negative perspective of the housing development, in turn, reflects negatively on the property values of bonded properties surrounding the development.

The results of this study showed that the property values in the selected suburbs are uniquely impacted by the independent variables (housing attributes) selected in the study. For instance, the distance to the locational amenities such as the police station and the clinic proved to decrease a property's value the closer a property was to that amenity. In addition, an increase of Black people into a neighbourhood proved to impact on a property's value positively, indicating that it may not be Black people moving into a neighbourhood that raises concerns, but rather the socio-economic background of the individuals moving into the neighbourhood, as noted with the distance to Fleurhof, who bring a different socio-economic image into the neighbourhood.

However, the results of the second model, specifically post-construction (2011-2017) of the subsidised affordable housing development results, indicate that the neighbourhoods may have witnessed increased property values, despite the fact that the subsidised housing development of Fleurhof was being constructed. This shows that, as the development was being constructed (and still in the process of completion), residents have grown accustomed to the development and have realised that the development does not hold the characteristics of older subsidised affordable housing developments such as the construction and poor quality of housing structures. The properties used in this model may have

viewed this development as a neighbourhood revitalisation project rather than a deterioration of the neighbourhood.

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