ATTRIBUTE BASED HEDONIC PRICE MODEL ON THE IMPACT OF MIXED INCOME HOUSING ON HOUSE PRICE: THE CASE OF COSMO CITY IN JOHANNESBURG.

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ABSTRACT:

RESEARCH PROBLEM: While the intended goals of Mixed Income Housing (MIH) are unquestionable as a means of deconcentrating poverty, encourage social and racial integration there is still persistence of NIMBY-ism due to the purported house-price lowering effects. The problem is that the negative perceptions that often lead to resistance of MIH are largely based on heuristic judgments, with no solid evidence of the purported negative impacts in the case of South Africa. Compared to the developed world, the nature of research in South Africa has largely been descriptive and desktop analysis hence guidelines on MIH is to the bare minimum.

METHODOLOGY: An explorative hedonic model was used to analyse the price elasticities associated with house price determinant variables of the Randburg area that received Cosmo City MIH.

FINDING: There is an overall negative impact on house prices across six out of seven suburbs close to Cosmo City. This confirms the hypothesis that a typical MIH in South Africa is not viewed favourably despite all its highlighted benefits for residential markets.

CONTRIBUTION: This study is part of a broader on going PhD research study at the University of the Witwatersrand in South Africa. It provides an empirical insight on how market perceived Inclusionary Housing (IHP) in a South African market. Upgrading infrastructure, amenities and security are some of the policy implications that could reverse the impact of such models in the future.

KEY WORDS: South Africa, Mixed Income Housing, Hedonic Model, Inclusionary Housing Policy, Deconcentrating Poverty.

RESEARCH AIM

The aim of this study is to to test the impact of Cosmo City MIH on neighboring house prices. Specifically, the study examines the perception a mixed income housing development causes house price reduction in the medium to high income neighbourhood in which it is located.

RESEARCH OBJECTIVES

- To investigate the relationship between house price and the hedonic attribute variables
- To investigate the impact of Cosmo City on house prices in Randburg area

RESEARCH BACKGROUND

Literature indicates that Not-In-My-Background (NIMBY) is a highly contested issue in residential markets making it a playground for many policies and some intended and unintended externalities. If this NIMBY issue is critical in the developed world, then how much more in the developing countries especially African countries where a huge number of people lack housing? Policies that change residential markets become vital in guiding the journey through urban poverty reduction and racial integration.

While the intended goals of mixed income housing are unquestionable as a means of deconcentrating poverty across countries, there is still persistence of NIMBY-ism due to its house-price lowering effects (Nguyen, 2011). This view is widely shared by Rate-Payers Associations and Property Owners Associations among others. The problem is that the negative perceptions that often lead to resistance of MIH are largely based on heuristic judgments, with no solid evidence of the purported negative impacts. Compared to the developed world, the nature of research in South Africa has largely been descriptive) and desktop analysis (Onatu, 2012; Smit and Purchase, 2006; Smith et al., 1988) hence giving guidelines on MIH to the bare minimum.

Despite this concept being an old contestation, many countries, including South Africa, have continued developing such housing models regardless of the fact that it is least desired in most residential markets. This lack of consensus largely ends up causing delays in courts (Klug et al., 2013). A considerable number of developments earmarked for MIH developments suffered delays due to NIMBYism. Urban Landmark (2011) indicated that Cosmo City MIH development was delayed for four years. Jerusalem Fairlands development was approved in 2005 but the residential portion took too long to be built.

LITERATURE REVIEW

Most of the research on impact measurement has been done in the US where the earliest work started with De Salvo (1974) who investigated the effects of upgrading New York City housing projects on neighboring house prices. Their findings were that locating projects in the poorest or best quality neighborhoods produces the least benefits of an upgrade. They also found that a middle income neighborhood makes the best case for upgrading an area. Ding et al (1999) in Cleveland USA assessed the impact of distance to new and rehabilitated developments on single family residential values in the inner city. They also found a positive impact due to the fact that a house could sell for about USD 5000 more because of its close proximity to a new construction and that there was a diminishing value effect just 300 feet away from it.

Quite a few empirical studies found negative impacts on surrounding house prices. Using distance variable, Newell (2009) found that the Lyon Park neighborhood was negatively impacting taxable values in Durham city, North Carolina. The reason cited was the increased supply levels that dampen house prices. He therefore recommended that mixed developments be located in places where demand is increasing. He found no positive impact on house

prices and argued that this nullified the politically popular view given for urban revitalization which is subsidized by government. However, he found that the impact on residential house prices is different when a nearby development is of a commercial nature. By applying a distance variable in a hedonics assessment done, Thibodeau (1990) was able to gauge the impact of mixed income development on house values in Dallas, Texas which were near the Lennox Center, a newly developed high rise office building. His conclusion was that there was a positive impact on the home values with properties within 1000 to 2500 meters of the building.

Conversely, home values in closer proximity to the building suffered a negative impact. This highlighted the point that the existence of associated costs and benefits calls for a holistic approach in assessing overall value of a development by comparing all benefits to all costs. Galster et al (2004) measured the impact of 'supportive housing facilities' on house prices in the Denver metropolitan areas using the 'difference in difference' method which found a positive impact on residential values. The notable negative impact was in the form of increased traffic and services flows in and out of the impacted local area. He pointed out that the negative externality of heavier traffic flows was offset by positive externalities in the form of increased property tax revenues.

In a study similar to Thibodeau (1990) and Ding (2002), Ellen and Voicu (2008) measured the impact of 'renovation' on nearby property values to assess the positive externalities in New York City and, as Galster et al (2004) had done, they used the 'difference in difference' methodology and found a positive impact on house prices. Pollakowski et al., (2008) explored the impact of newly constructed mixed income apartment developments on nearby single family houses prices. He used seven project case studies (1983 – 2003) to study the effects that high density areas had on surrounding areas with lower densities and found that such a development was considered affordable in at least 25% of the cases. Unlike Ellen and Voicu above, analysis by (Pollakowski et al., 2005a) restricted the impact area to only those homes closer to the project. They compared house price changes in the surrounding impacted area using a house price index to the remainder of municipality (as a control) before, during and after construction. They concluded that "such developments do not depress property values as feared by sitting residents in Boston area" (Pollakowski et al., 2005a, p. 1) .

Impact is often different depending on employment levels in the MIHs. Gornstein and Verrilli (2006) find no negative impact of mixed housing when all classes of people in an MIH model are employed and this led to the conclusion that impact depends on the characteristics and employment status of the people under study. Given the high unemployment levels (22% unemployment) prevalent in South Africa a study of MIHs in the country would differ from the models applicable in developed countries.

After the US trend changed from mixed income developments being located in the city periphery to vacant land within city limits, McConnell and Wiley (2010) studied the trends in property prices using traffic effects and house price index before and after developments. They also complemented the study by a survey on residents. They found that there was no substantial house price variation in the area that 'received' the development. In agreement with Thibodeau (1980), they found a negative effect in the post development phase due to an increase in traffic flows but not in house prices. They highlighted a finding which showed that residents placed value on developments that came with improved amenities.

On the other hand literature also shows that there is no evidence that mixed tenure had enhanced social capital. Ellickson (2009, p. 34) contends that "inclusionary policies, such as the federal programs in the US, are mediocre in the sense that the resources devoted to them could be far better allocated otherwise". He further argues that MIH developments actually contribute to the high cost of housing in those jurisdictions where they are developed. He instead argues for a voucher system as a way of effectively dispersing people across all sub-markets.

PREVIOUS STUDIES IN SOUTH AFRICA

Literature review indicates that Inclusionary Housing Policy (IHP) is still a debated issue in academic and policy circles as to whether such policies make economic sense or whether they should continue to be pursued. Klug et al (2013) is of the viewpoint that "the potential of IHP policy in reshaping South African cities is limited unless location is adjusted to low/middle-income neighbourhoods as a developer-led model yet relying largely

on government subsidies". One, therefore, wonders how the already built MIH developments in high income neighbourhoods have impacted property prices around them. This study follows Du Preez et al (2013) by using hedonic modelling to investigate the resultant Mixed Income Housing (MIH) developments of IHP and how the urban markets in which they are built perceives them.

Du Preez (ibid) used hedonic modelling to measure the impact of Quebera Township, a low-cost housing development in Walmer, Port Elizabeth and found "the average price of a house in the neighbourhood increasing by R228.85 for every meter further away from the development (Du Preez et al (2013, p.13). Onatu (2012, p. 9) used an exploratory study of Cosmo City and concluded that "private sector participation in housing development should be encouraged as most local authorities struggle to finance housing and services." Property price analysis is, thus, in agreement with private sector participation as it is the basis for private investments. Prinsloo (2008, p. vii) and Verster (2009) contend "… IHP is not going to drive property prices down and the requirements may be accepted by higher income households and therefore socio-economic integration may be successful only if policy remains in its current form and not become law". Questions remain as to whether the MIH concept is a race or income issue in South Africa. Notable research by Kotze (1999) found a strong negative correlation (- 0.69) between residential property prices and desegregation in Pietersburg using the product-moment correlation coefficient method.

Academic contradictions persist as to the findings of the economic impact of MIHs. In South Africa, it holds true that the higher the level of desegregation, the greater the degree of effect on hosting neighbourhoods negatively. The dearth of rigorous studies means there is less evidence to establish whether MIH is considered a 'bad' or a 'good' in economics terms and how such a policy that is responsible for so much development will influence future investment in the residential markets. But the general consensus seems to be that MIHs are a bad phenomenon because of the problems associated with low income housing as highlighted in literature.

HEDONIC PRICE MODELLING METHODOLOGY

Hedonic price modeling is a valid construct adapted for this study as it is able to evaluate each determinant factor contribution to a house price. In literature, attributes and characteristics have been summarized into structural, location, neighborhood and environment factors that determine price. For the purposes of this study, house price are determined by variables in the model and no other alternative determinants are deemed useful in this model (internal validity) as specified in equation 3; House Price = F (amenities, characteristics and attributes)

HYPOTHESIS

In light of the theories explained and the literature review section, hypothesis tested is:

$$\text{Hypothesis: } H_0: b_{MIH} > 0$$

That is to say if there is a statistically significant relationship between house price and MIH distance, the slope (implicit price) will not be zero but positive to mean price increases as distance from Cosmo City MIH increases. Following Du Preez (2013), the study used Hedonic Price Model (HPM) for testing the study's first hypothesis using ordinary least squares. The procedure is implemented independently for the surrounding neighbourhoods of Cosmo City mega MIH housing development.

THE EXPLORATORY AMENITY AND SUBURB BASED SPECIFIC MODEL

$$P = \alpha + \beta Xi + \beta Zi + \varepsilon$$

Where Pi = Price for house i
Xi = is a vector of conventional explanatory variables for house i
Zi = Peculiar explanatory variables for firms i and
βi are the estimated coefficients.

Each suburb was regressed separately so that correlation between the unobserved effect on house price and the observed independent variables is reduced in the pooled ordinary least squares approach that limits suburb heterogeneity bias. The understanding is that analysis per suburb basis deal with fixed effects issues of hedonic modelling. The coefficients denote how on average Cosmo City MIH is perceived in each neighbourhood. The conventional variables such as erf/stand size, house size, number of bedrooms provides a view on what aspects can be adjusted to suit the context of South Africa a unique country undergoing transformation to embrace the concept of the MIH under negotiation by the department of Human Settlements. A hedonic model employed follows an Ordinary Least Squares (OLS) of semi-log transformation. Variables of Interest include; Distance from Cosmo City, Event dummy variable taking (0) for before Cosmo City was built and (1) 2004 for house sold after Cosmo City was built. To better investigate which factors to include in the hedonic model and to capture South African context, the study included some rather unconventional variables that are appropriate to this case. Thus for South Africa, other peculiar variables are included as race, income and crime

DATA

A pilot study was conducted in the initial stages of data collection. This thus included site visits to enable observations and fact gathering interviews that all revealed the key price determinant factors, attributes and characteristics in Randburg area where Cosmo City MIH is situated. Generic factors from literature were adjusted with information from this study. For information that was not found in quantifiable state, extended techniques were applied using google maps, google earth to get more control variables. Lightsome Property Company based in Johannesburg, South Africa provided the main data set used for this study had a total of 12 676 house transfers. Data was captured in an excel spread sheet. Use of secondary data makes it possible to repeat the models specified in this study and this achieves some degree of reliability as explained by Straub et al (2004, p. 10) who points out that 'reliability is an attempt to find proximal measures of the true scores that perfectly describe the phenomenon'.

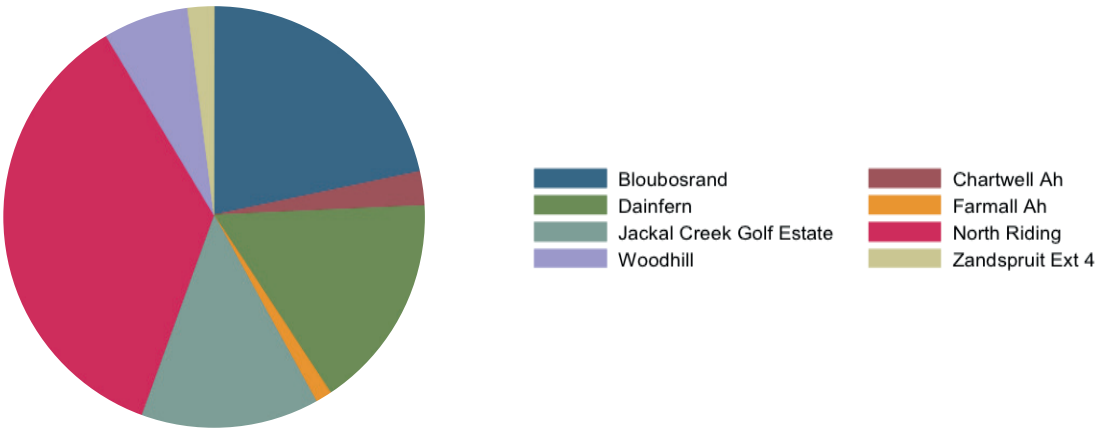
In pursuit of generalization, the impact of Cosmo City was measured through the use of seven neighbourhoods to increases external validity of the study. The intention was to check if there exist differences across neighbourhoods regarding how these different neighbourhoods perceived Cosmo City MIH.

ANALYSIS AND RESULTS

Each case study adopts the general hedonic technique specified above using generic attributes but adjusted for heterogeneity in an area. Estimation process uses STATA software. As literature reveals, other studies have used spatial distance to a development as a variable in a hedonic specification where holding other variables constant gives the impact of spatial distance. This study argue that such research construct is not appropriate for a case study of a mixed size house development that represents a multi-dimensional array of submarkets (Ball, 1973). This study maintain the assumption of homogeneity of houses in the affected suburbs - which is true for hedonic technique - and uses a dummy variable to capture the impact. (1 after the house was sold after MIH announcement or construction and 0 before. The coefficient of these time dummy variables will indicate the effect of MIH on housing prices after announcement and after construction. Two dummy variables take the value 1 after the house was sold after MIH announcement/construction and zero before.

Pie Chart or Histogram data distribution per suburb (Jackal Creek, Bloubosrand, Northriding, Zandspruit Formal, Chartwell, Farmall, Dainfern and Woodhill) (1)

Figure 1: Data per suburb



REGRESSION TESTS

Gauss Markov's assumptions of the ordinary least squares regression model need to be tested and dealt with. The crucial one being the test for normality of the error terms among Skewness, and Kurtosis tests of the data and presence of outliers.

Test for assumptions of consistent, efficient and unbiased estimators, tests include; residuals normality (P-P Plots), Goodness-of-fit assessments; R2 for model testing, testing for multi-collinearity through correlations tables, heteroscedasticity tests through Variance Inflation Factor (VIF), and autocorrelation tests though the Durbin Watson. Model diagnostics included the Variance Inflation Factors (VIFs) to test for multicollinearity. A VIF of > 5 is generally considered evidence of multicollinearity. The natural log transformed model managed to reduce most of the VIFs was used. In order to interpret the results, the coefficient estimate should be statistically and practically significant. The expected sign of the two MIH variables coefficient are presumably expected to be negative to confirm the null hypothesis. Since the model is specified in a linear form, testing for OLS assumptions (best, linear, and unbiased) is the yard stick for validation. The OLS estimators of the coefficients will be unbiased if the standard assumptions are not violated. To assess the quality of fit, we plot residuals against the predictors in the model to reveal if there are curvatures or not. Tests to determine the appropriate functional i.e. correct specification and linearity, a RESET test are conducted before adding polynomials in some variables such as number of bedrooms and age variables. A confidence a interval of the standard 95% within which measurement uncertainty lies was inferred through the p-values. In OLS regressions, error 'e' terms are normally distributed for any regression model to indicate sample statistics approximating the population parameters to test for normality. A correlation matrix of the variables for each suburb is calculated in order to judge correlation between variables that indicated form of relationship. Regression tests can be viewed in Appendix A.

Table 1: Correlation matrix

	Y	size	Area	DisFro~H	DisFro~s	DisFro~r	DisFro~D	DisFroSC	DisFro~m	DisFro~S	AGE2	ART	Sal~2004	P~drooms	P~hrooms	PROP_G~t	PROP_S~t
Y	1.0000																
size	0.6062	1.0000															
Area	0.6236	0.7014	1.0000														
DisFroScH	0.3201	0.3207	0.4224	1.0000													
DisFroHos	-0.1969	-0.0966	-0.1450	0.0098	1.0000												
DisFroChur	-0.1195	0.0352	-0.0562	0.1458	0.4072	1.0000											
DisFroCBD	0.0210	0.1042	0.0702	0.2309	0.8795	0.5068	1.0000										
DisFroSC	-0.1708	-0.0480	-0.1362	-0.0447	0.6590	0.5183	0.5636	1.0000									
DisFroCosm	0.4577	0.4288	0.5155	0.3616	-0.4586	-0.0748	-0.2800	-0.2167	1.0000								
DisFroINPS	0.4353	0.2372	0.3263	0.2475	-0.3032	-0.3090	0.0152	-0.3747	0.0789	1.0000							
AGE2	0.1063	0.4489	0.3074	0.3497	-0.0754	0.2395	-0.0068	0.0289	0.3453	-0.2399	1.0000						
ART	0.7658	0.5649	0.5415	0.2679	-0.1075	-0.0155	0.0764	-0.0900	0.3931	0.2888	0.1515	1.0000					
SaleBef~2004	-0.0993	0.1296	0.0654	0.1361	-0.0764	0.1227	-0.0548	-0.0510	0.1628	-0.1804	0.4403	-0.0395	1.0000				
PROP_NbrBe~s	0.4595	0.6141	0.5868	0.3522	-0.0531	-0.0304	0.0832	-0.0272	0.4121	0.1792	0.3576	0.4153	0.0812	1.0000			
PROP_NbrBa~s	0.5271	0.6234	0.6555	0.3866	-0.0468	-0.0243	0.1195	-0.0283	0.4577	0.2405	0.2915	0.4663	0.0391	0.8961	1.0000		
PROP_Garag~t	0.2430	0.3497	0.2050	0.1007	-0.1070	-0.0914	-0.0515	-0.0581	0.1803	0.1178	0.1611	0.2009	0.0314	0.3448	0.3263	1.0000	
PROP_Serva~t	0.1686	0.2927	0.1652	0.0673	0.0315	0.0599	0.1086	0.0358	0.1354	0.0904	0.1310	0.1585	0.0327	0.1972	0.1975	0.4141	1.0000

Source: Author's own calculations, 2015

This correlation table indicate that the variables included in the model have good some relationship between them. Taking logs for high values made the variables practically normal to use OLS variants. The robustness of a hedonic pricing model hinges on using independent variables that have significant loading on the dependent variable. Using a dependent variable of a semi log transformation is a way of introducing nonlinearity in the relationship with explanatory variables even though the model is specified as linear. The model specified for this study is a positivist construct and accuracy is measured by F test and Adjusted R2 (prediction capability) which is a standard tool in regression analysis. P-values, F values were used to measure the fitness of the sample data to the model. All regression results can be viewed from Appendix B.

RESULTS AND INTERPRETATION FOR NORTHRIDING SUBURB

For Northriding, significant variables include size of a house, are/erf, Distance to school, Cosmo City, church, CBD, hospital, informal settlement squared age and the auto regressive term. The sale time dummy, race and income were not statistically significant. The overall model is statistically significant with an Adjusted R-squared of 0.7207 and an F statistic of 0. Surprisingly income and race does not explain price movements in Northriding. What can be inferred is that proximity to places such as schools, hospitals and churches to a larger extent explain prices in this suburb. There is actually an inverse relationship between distance away from amenities and house prices. People pay for being closer these amenities overall. Location theory holds true here that a house closer to infrastructure and amenities commands more value than one farther away.

A beta value of +7.1% on the Distance from Cosmo City variable shows that a house that is situated a meter away from Cosmo city will be sold +7.1% more as closer proximity is not preferred and this confirms the hypothesis that there is a positive relation between distance away from Cosmo City and the house prices on average. The distance from Informal Settlements is also consistence with a beta vale of +1.32. The older the house, the lower the price. This is captured by -0.67% age-squared variable. An interesting variable consistent with literature is that there is an autoregressive effect of +0.0295 indicating that house prices are slightly influenced by the prices sold in previous times in close proximity

RESULTS AND INTERPRETATION FOR DAINFERN GOLF ESTATE

Significant variables for Dainfern golf estate include distance from Cosmo City, hospital and informal settlement, age and the autoregressive term. The sale time dummy, race and income and most structural variables do not explain the house prices serve for number of bedrooms and area.. The overall model is statistically significant with an Adjusted R-squared of 0.544 and an F statistic of 0. The coefficients are in agreement with expected signs from literature.

A beta value of +0.40 on the Distance from Cosmo City variable shows that a house that is situated a meter away from Cosmo city will be sold 0.40% more as closer proximity is not preferred and this confirms the hypothesis that there is a positive relation between distance away from Cosmo City and the house prices on average. This low impact is surprising given that it was most house owners in Dainfern who vehemently contested in quotes for Cosmo City not to be built. The distance from Informal Settlements is also consistence with a beta value of +0.127 indicating the dislike of Diepsloot informal settlement? An event dummy again does not explain house price movements in Dainfern. Perhaps this is because Dainfern is a gated community that is able to shut itself from its surroundings.

RESULTS AND INTERPRETATION FOR BLOUBOSRAND LOW INCOME SUBURB

For Bloubosrand, significant variables include distance from Cosmo, church, hospital, informal settlement, age, auto regressive term and size. The overall model is statistically significant with an Adjusted R-squared of 0.68 and an F statistic of 0. Surprisingly income and race does not explain price movements in Bloubosrand. What can be inferred is that proximity to hospitals and churches explain house prices in an inverse relationship indicating preference for being closer these amenities. A beta value of +1.41%% on the Distance from Cosmo City variable shows that a house that is situated a meter away from Cosmo city will be sold +1.41 more as closer proximity is not preferred and this confirms the hypothesis that there is a positive relation between distance away from Cosmo City and the house prices on average. The distance from informal settlements is actually consistent with a beta vale of -0.22 % indicating that people in this suburb do not mind being closer to an informal settlement. This could be because Bloubosrand has degenerated into a low income suburb. In this suburb, results show that the older the house, the lower the price with a beta value of -0.128. An interesting variable consistent with literature is that there is an autoregressive effect of +0.556 indicating that house prices are influenced by the prices sold in previous times in close proximity.

RESULTS AND INTERPRETATION FOR CHARTWELL FARMING AREA

Chartwell is a farming deriving its house prices mainly from four variables. A house in Chartwell increases price by 0.41% per meter away from Cosmo City and this confirms the hypothesis put forward in this study. The ART and size also have a positive effect on house prices. Location factors are unimportant for Chartwell as far as price determination is concerned. Age variable is also consistent to show that older houses are discounted by about 0.118% in price. The overall model is statistically significant with an Adjusted R-squared of 0.59 and an F statistic of 0. Surprisingly income and race does not explain price movements in Chartwell. An interesting variable consistent with literature is that there is an autoregressive effect of +0.558 indicating that house prices are influenced by the prices sold in previous times and close proximity.

RESULTS AND INTERPRETATION FOR FARMALL FARMING AREA

Farmall is also a farming area deriving its house prices mainly from just there which are distance from Cosmo City, informal settlement and the ART variables. These results are interesting as they indicate that being closeness to Cosmo City is preferred with a beta value of -0.20% while being closer to an informal settlement is not preferred. This refutes the hypothesis put forward in this study that Cosmo City is viewed as a bad phenomenon. The ART and size also have a positive effect on house prices. The overall model is statistically significant with an Adjusted R-squared of 0.65 and an F statistic of 0. Income and race does not explain price movements in Farmall. An interesting variable consistent with literature is that there is an autoregressive effect of +0.617 indicating that house prices derive their prices from comparable sales in the surrounding.

RESULTS AND INTERPRETATION FOR ZANDSPRUIT EX 4

Zandspruit Extension 4 is also a low income area deriving its house prices mainly from six variables. These results are exceptional as they indicate that being further away from Cosmo City is highly preferred with a beta value of +13.02 more so for informal settlement with a beta of 40.1. This confirms the hypothesis that Cosmo City is evaluated as a development that depresses house prices in Zandspruit. Results show that people in this suburb prefer to be closer to CBD and schools with a beta of -165.08 and -9.83 respectively whereas being closer to church is not preferred with a beta of 2.46. The overall model is not statistically significant with an Adjusted R-squared of 0.059 and an F statistic of 0.

RESULTS AND INTERPRETATION FOR JACKAAL CREEK GOLF ESTATE

The model is of good fit with an F statistic of 0 and an adjusted R squared of 0.61. For the distance variable, the above results confirm the hedonic theoretical hypothesis that Cosmo City had a price depressing effect on this suburb's house prices with a beta of 2.78. The impact is not of a high degree as expected due to the fact that Jackal Creek was built after the construction of Cosmo City alluding to the fact that sellers and buyers in this suburb did not necessarily view Cosmo City as a bad phenomenon.

RESULTS AND INTERPRETATION FOR WOODHILL GOLF ESTATE CONTROL

Woodhill is the control or counterfactual suburb. The regression model is significant with an F statistic of 0 and explaining about 52% of house prices using six variables. It shows distance from Cosmo is not statistically significant with a p value of 0.84 with a beta value of +0.43 Distance from Cosmo City. The value of distance from an informal settlement is lower than expected given the much publicity of Plastic View informal settlement located close to Woodhill golf estate. The ART, size, area and distance to hospital are consistent to literature expectations. The further away a house is from a hospital, the higher the price (beta = 0.06).

Table 2: Summary of Results

Suburb Name	Classification	Distance From Cosmo	Number of transfers	Considered Years
Zandspruit Formal	Low Income	+13.02%	305	1995 - 2016
Jackal Creek Golf Estate	Middle Income	+2.78%	2018	2000 - 2016
Bloubosrand	Middle Income	+1.41%	3231	1995 - 2016
Chartwell	Farming Area	+0.41%	395	1995 - 2016
Farmall	Farming Area	-0.2%	187	1995 - 2016
Northriding	High income	+7.11%	3911/4231	1995 - 2016
Dainfern Golf Estate	High Income	+0.4%	1539	1995 - 2016
Woodhill Golf Estate Control	High Income	+0.43% (not significant)	770	1995 - 2016
Total			12 676	

OVERALL INTERPRETATION OF THE EXPLORATORY MODEL

The positive coefficients found in most suburbs on distance from Cosmo City variable confirms confirm the hypothesis that Cosmo City is viewed as a bad phenomenon. More explicitly, a house in each suburb increases in value a meter further away from Cosmo City. The finding can intuitively be shown using the graph in figure 27.

VALIDATION OF RESULTS ON HOUSE PRICE FORMATION TRENDS USING SECONDARY REPORTS

Secondary reports provide an overall validation of study. These reports indicate that house prices were going up in control neighbourhoods when prices in the impacted suburbs were going down prior 2004/5 when Cosmo City became a reality. ABSA house price Index shows that South African house prices were rising at the time whereas Randburg area experienced decreasing house prices. This is shown in figure 2, 3 and 4.

Figure 2: ABSA house price Index for South Africa

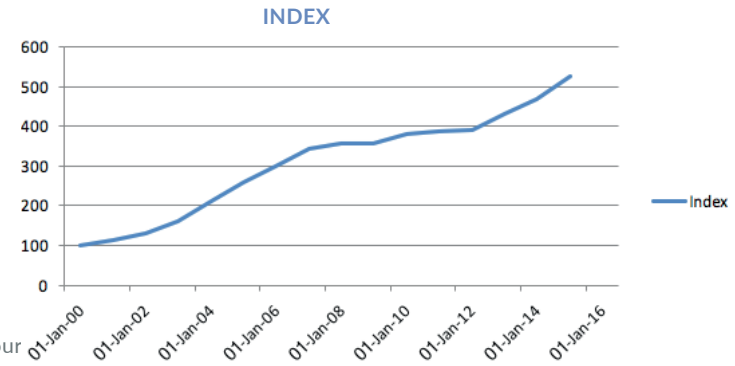


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Figure 3: Randburg House Prices

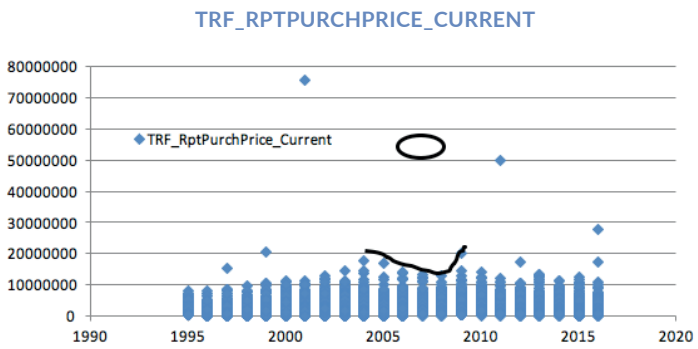
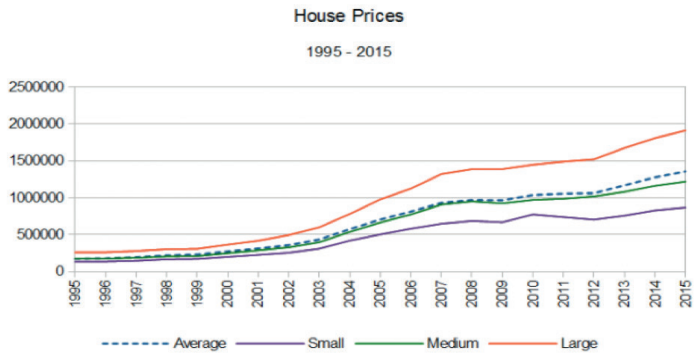


Figure 4: House Movement Trends in South Africa



Source: Business Tech (2015)

These three figures validate findings of this study that Randburg suburbs experienced a decrease in prices from 2004/5, the same time that Cosmo City was delivered onto the market as mixed income housing. The lagged manor in which the suburbs responded is the usual lagged manner in which residential markets respond to economic and environmental changes. A house price trend from Business Tech (2015) shows that South Africa house prices were in an upward movement the time when Randburg area was experiencing a downward trend as shown the figure 5. This view provides validation that the downward trend in the Randburg area could have been caused by the construction and occupation of the mega Cosmo City MIH project.

CONCLUSION AND DISCUSSIONS

The exploratory model made use of secondary data in the form of house transfers and amenity profiles in seven suburbs of Randburg area in the City of Johannesburg. The study was therefore based on Northriding, Dainfern Golf estate, Jackal Creek golf estate, Bloubosrand, Chartwell, Farmall and Zandspruit Extension 4 suburbs with Woodhill suburb used as a control suburb in Pretoria. An amenity based hedonic modelling was used in order to empirically test the impact of Cosmo City on house prices. This provided an economic evaluation of how a typical MIH was viewed by its immediate market. The paper thus carries implications on the future of inclusionary policy in South Africa as a way to integrate people of different ethnicities and income levels.

With only one exception of Farmall farming suburb, this study confirms the hypothesis that a typical MIH development will have a price depressing effect on house prices as property owners make efforts to sell their houses and move over to other places without MIHs. This study finds an overall negative impact on house prices across six out of seven suburbs close to Cosmo City. This is probably because South Africa, as a case, stands out to be the opposite of developed markets where most MIHs are built in already blighted areas which gives an obvious positive impact in such neighbourhoods. This is mainly because in developed countries, MIHs are developed in areas that need regeneration hence such developments are viewed positively where as in South Africa, it is the opposite. The impact is expected to be negative because such developments are built in affluent suburbs as a transformational tool to reverse the legacy of apartheid that removed black people away from economic hubs. Thus MIHs in developed markets are viewed as having the power to promote urban regeneration. This finding contrasts literature finding where most research finds that MIHs do not have a significant impact on house prices in the most developed world. Thus in the developed world, an MIH has the potential to revitalise neighbourhoods. In developing countries, most research find either a no substantial impact or a positive impact on house prices

(Pollakowski et al., 2005; Galster et al., 2006; Gornstein and Virrilli, 2006; Schwartz et al., 2006; Obrinsky and Stein, 2007; Voicu and Been, 2008; Ellen, 2008; Van Ham and Manley, 2009; McConnell and Wiley, 2010; van Gent and Musterd, 2013). There is few research exceptions where there is a negative impact on taxable property values and as such attributed to over supply effects rather than demand effects (Newell, 2009).

POLICY IMPLICATIONS

Apart from location and the class of housing markets, who the beneficiary is plays a significant role in the way MIHs are viewed by the hosting neighbourhoods. In South Africa, race is expected to play a significant role to the acceptance of an MIH. However race variable is not found to be statistically significant in determining price in most suburbs. An MIH in South Africa is mainly occupied by black people who are also the majority of the population. This implies that the resentment of MIHs is not a racial issue. It is the social ills that are associated with low income people that are mostly dreaded other than race perse. This gives hope that if infrastructure such as roads, schools and hospitals can be improved and crime can be reduced, an MIH can be successful in South Africa.

The fact that results did not show huge impact of Cosmo City MIH on house prices may support the idea that an unabated continuation of such developments in South Africa may not lead to too much substantial NIMBY as all residential markets in all regions will be on a massive roll out plan in support of IHP. This leads to the stabilisation of house prices across residential markets in South Africa.

RECOMMENDATIONS

A closer introspection of results show that the impact of Cosmo City on house prices is almost negligible. This is actually surprising that the impact is not of a higher degree than expected given rampant court cases against such developments in South Africa. This means there is probably just minor adjustments on MIHs needed to flip the sign of 'beta Distance from Cosmo city' variable. The million dollar question then becomes: how can we improve on the implementation of MIH in South Africa so that these developments may blend well with the receiving neighbourhoods? This is because it is clear the best strategic guiding framework has not been clearly articulated in literature.

A comprehensive feasibility study is recommended regarding what pole in the receiving neighbourhoods would want put in place for an ear-marked MIH to be successful. Compensation for house price reduction due to such MIH developments within the receiving suburbs might not work well for developing countries due to competing developmental goals that they face. What could work is compensation in the form of improving infrastructure such as road to reduce traffic, building new schools and new hospitals and shopping canters to reduce pressure for services and amenities. Improving security services through new efficient police services and neighborhood surveillance cameras may help curb fears and apprehensions towards MIHs that happen to be mostly occupied by black people and the associated problems of low income people.

LIMITATIONS AND FURTHER RESEARCH

The study used Cosmo City, as a typical and purposely selected case, yet there are many other MIHs built so far in Johannesburg and South Africa at large. The study should, therefore, be read bearing in mind the shortcomings on generalization. Other country specific variables such as inflation rates were not controlled for as all houses prices were affected by the same macroeconomic conditions such as the National Credit Act (NCA) and the global financial crises in year 2008. Adjusting for inflationary factors through House Prices Indices makes it justifiable to overlook macro-economic factors in this research. Further research into other mixed income housing developments may provide further insights into what amenities should encompass inclusionary housing policy for MIHs to be successful in South Africa.

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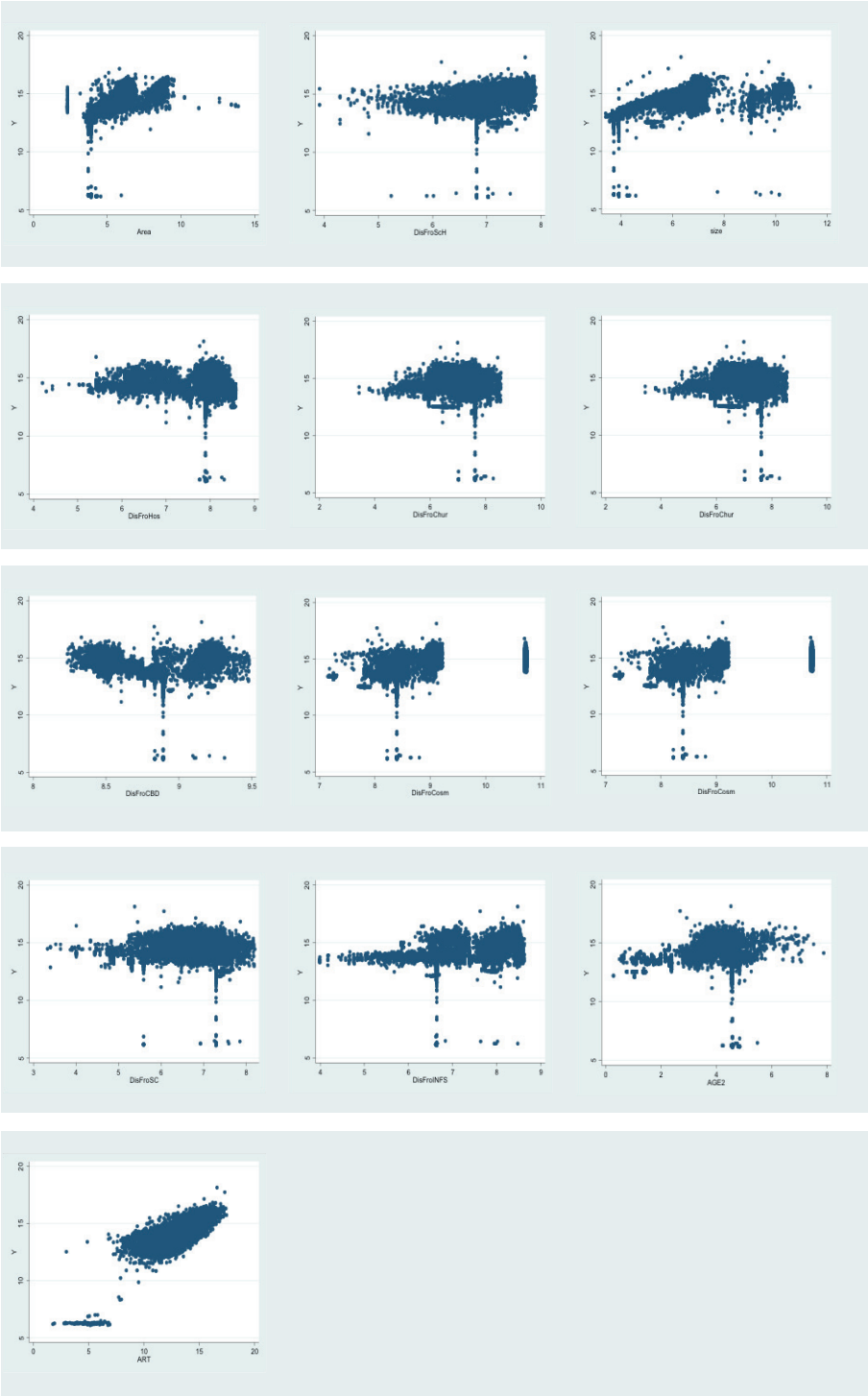
APPENDIX A: TESTS FOR LINEARITY

Test for Linearity indicated that significant variables are linear



APPENDIX B: REGRESSION RESULTS FOR COSMO CITY NEIGHBOURING SUBURBS

Northriding Results

```
. regress Y size Area DisFroScH DisFroHos DisFroChur DisFroCBD DisFroSC DisFroCosm DisFroINFS DisFroINFS AGE2
> ART if Suburb == "North Riding"
note: DisFroINFS omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    3911
-------------+------------------------------           F( 11,  3899) =  918.34
       Model |  465.152636    11  42.2866033           Prob > F      =  0.0000
    Residual |  179.537022  3899  .046046941           R-squared     =  0.7215
-------------+------------------------------           Adj R-squared =  0.7207
       Total |  644.689658  3910  .164882265           Root MSE      =  .21459

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        size |    .341823   .0077524    44.09   0.000      .326624    .3570221
        Area |   .1251989   .0068426    18.30   0.000     .1117834    .1386143
   DisFroScH |  -.1740429   .0217629    -8.00   0.000    -.2167106   -.1313752
   DisFroHos |  -.2353585   .0446331    -5.27   0.000    -.3228649   -.1478521
  DisFroChur |  -.0886716   .0105892    -8.37   0.000    -.1094324   -.0679107
   DisFroCBD |   9.951154   1.217164     8.18   0.000     7.564816    12.33749
    DisFroSC |  -.0695326    .010625    -6.54   0.000    -.0903638   -.0487015
  DisFroCosm |   7.106948   .7644791     9.30   0.000     5.608132    8.605765
  DisFroINFS |   1.320369   .0778445    16.96   0.000     1.167749    1.472989
  DisFroINFS |          0  (omitted)
        AGE2 |  -.0679336   .0062003   -10.96   0.000    -.0800896   -.0557775
         ART |   .0297512   .0033881     8.78   0.000     .0231085    .0363938
       _cons |  -140.5204   16.84206    -8.34   0.000    -173.5405   -107.5003
------------------------------------------------------------------------------
```

Dainfern Results

```
. regress Y DisFroCosm DisFroHos AGE2 ART  PROP_NbrBedrooms DisFroINFS Area if Suburb =="Dainfern"

      Source |       SS       df       MS              Number of obs =    1537
-------------+------------------------------           F(  7,  1529) =  263.51
       Model |  301.991212     7  43.1416018           Prob > F      =  0.0000
    Residual |  250.326388  1529  .163719024           R-squared     =  0.5468
-------------+------------------------------           Adj R-squared =  0.5447
       Total |  552.317601  1536  .359581771           Root MSE      =  .40462

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  DisFroCosm |   .4025176   .1692289     2.38   0.018     .0705723    .7344629
   DisFroHos |   .4746353   .1839268     2.58   0.010     .1138599    .8354107
        AGE2 |   .1381131   .0299131     4.62   0.000     .0794381    .1967882
         ART |   .2882339   .0110934    25.98   0.000     .2664741    .3099937
PROP_NbrBedrooms |   .0608835   .0096114     6.33   0.000     .0420307    .0797363
  DisFroINFS |   .1275104    .272691     0.47   0.640    -.4073776    .6623984
        Area |   .0473652   .0086164     5.50   0.000     .0304639    .0642664
       _cons |   1.321399    4.02802     0.33   0.743     -6.57963    9.222427
------------------------------------------------------------------------------
```

APPENDIX B: REGRESSION RESULTS FOR COSMO CITY NEIGHBOURING SUBURBS

Bloubosrand Results

```
. regress Y DisFroCosm DisFroINFS ART size  AGE2 DisFroChur DisFroHos if Suburb =="Bloubosrand"

      Source |       SS       df       MS              Number of obs =    3231
-------------+------------------------------           F(  7,  3223) =  982.52
       Model |  3527.20576     7  503.886537           Prob > F      =  0.0000
    Residual |  1652.92327  3223  .512852396           R-squared     =  0.6809
-------------+------------------------------           Adj R-squared =  0.6802
       Total |  5180.12903  3230  1.60375512           Root MSE      =  .71614

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  DisFroCosm |   1.411247   .9182185     1.54   0.124    -.3891042    3.211598
  DisFroINFS |   -.224813   .0652069    -3.45   0.001    -.3526641   -.0969619
         ART |    .556258   .0086792    64.09   0.000     .5392407    .5732753
        size |    .100053    .014195     7.05   0.000     .0722208    .1278852
        AGE2 |  -.1287854   .0348787    -3.69   0.000    -.1971721   -.0603986
  DisFroChur |   -1.13031   .2874954    -3.93   0.000    -1.694002   -.5666173
   DisFroHos |  -3.362946    .397354    -8.46   0.000    -4.142038   -2.583854
       _cons |   31.20803   6.915335     4.51   0.000     17.64913    44.76692
------------------------------------------------------------------------------
```

Chartwell Results

```
. regress Y DisFroCosm ART  size  AGE2 if Suburb =="Chartwell Ah"

      Source |       SS       df       MS              Number of obs =     395
-------------+------------------------------           F(  4,   390) =  146.06
       Model |  266.103257     4  66.5258142           Prob > F      =  0.0000
    Residual |  177.628632   390   .45545803           R-squared     =  0.5997
-------------+------------------------------           Adj R-squared =  0.5956
       Total |  443.731889   394  1.12622307           Root MSE      =  .67488

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  DisFroCosm |   .4154242   .2193149     1.89   0.059    -.0157633    .8466117
         ART |   .5583374   .0259213    21.54   0.000     .5073744    .6093004
        size |   .2415288   .0733323     3.29   0.001     .0973527    .3857049
        AGE2 |  -.1181915   .0439464    -2.69   0.007    -.2045931   -.0317899
       _cons |   1.325306   2.013166     0.66   0.511    -2.632709    5.283321
------------------------------------------------------------------------------
```

APPENDIX B: REGRESSION RESULTS FOR COSMO CITY NEIGHBOURING SUBURBS

Farmall Results

```
. regress Y DisFroCosm DisFroINFS ART if Suburb =="Farmall Ah"

      Source |       SS       df       MS              Number of obs =     187
-------------+------------------------------           F(  3,   183) =  116.20
       Model |  139.932509     3  46.6441696           Prob > F      =  0.0000
    Residual |   73.461086   183    .4014267           R-squared     =  0.6557
-------------+------------------------------           Adj R-squared =  0.6501
       Total |  213.393595   186  1.14727739           Root MSE      =  .63358

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  DisFroCosm |  -.2009147   .3678334    -0.55   0.586    -.9266544    .5248249
  DisFroINFS |   .5371889   .2421826     2.22   0.028     .0593598    1.015018
         ART |   .6174094   .0338209    18.26   0.000     .5506804    .6841385
       _cons |   3.324995   2.455606     1.35   0.177    -1.519945    8.169935
------------------------------------------------------------------------------
```

Zandspruit Results

```
. regress Y DisFroScH DisFroChur DisFroCBD DisFroCosm DisFroINFS AGE2 if Suburb =="Zandspruit Ext 4"

      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------           F(  6,   298) =    4.77
       Model |  .292192513     6  .048698752           Prob > F      =  0.0001
    Residual |  3.04412918   298  .010215199           R-squared     =  0.0876
-------------+------------------------------           Adj R-squared =  0.0692
       Total |  3.33632169   304  .010974742           Root MSE      =  .10107

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   DisFroScH | -9.838037   3.057186    -3.22   0.001    -15.85445   -3.821628
  DisFroChur |  2.464287   .8845743     2.79   0.006     .7234828     4.20509
   DisFroCBD | -166.0819   51.74292    -3.21   0.001    -267.9098   -64.25414
  DisFroCosm |  13.02401   3.914138     3.33   0.001     5.321151    20.72686
  DisFroINFS |  40.10459   12.91233     3.11   0.002     14.69368    65.51549
        AGE2 |  -.182155   .0519207    -3.51   0.001    -.2843326   -.0799774
       _cons |  1179.889   366.2311     3.22   0.001      459.162    1900.616
------------------------------------------------------------------------------
```

APPENDIX B: REGRESSION RESULTS FOR COSMO CITY NEIGHBOURING SUBURBS

Jacalcreek Results

```
. regress Y DisFroCosm DisFroINFS AGE2 ART size PROP_NbrBedrooms PROP_NbrBathrooms PROP_ServantRoomsCnt DisFroHos DisFroCBD DisFr
> oSC if Suburb =="Jackal Creek Golf Estate"

      Source |       SS       df       MS              Number of obs =    2018
-------------+------------------------------           F( 11,  2006) =  294.57
       Model |  113.034205    11  10.2758368           Prob > F      =  0.0000
    Residual |  69.9778284  2006  .034884261           R-squared     =  0.6176
-------------+------------------------------           Adj R-squared =  0.6155
       Total |  183.012034  2017  .090734771           Root MSE      =  .18677

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   DisFroCosm |   2.786481   .3042979     9.16   0.000     2.189708    3.383254
   DisFroINFS |   4.769611   .2491739    19.14   0.000     4.280945    5.258278
         AGE2 |  -.0591235   .0115468    -5.12   0.000    -.0817685   -.0364785
          ART |   .0320495   .0041392     7.74   0.000     .0239319    .0401671
         size |   .6744456   .0148094    45.54   0.000     .6454022    .7034891
PROP_NbrBedrooms |   .0463437   .0114163     4.06   0.000     .0239546    .0687328
PROP_NbrBathrooms |  -.0306181   .0144361    -2.12   0.034    -.0589295   -.0023068
PROP_ServantRoomsCnt |  -1.192403   .1894478    -6.29   0.000    -1.563938   -.8208679
     DisFroHos |   6.570611    .542029    12.12   0.000     5.507612     7.63361
     DisFroCBD |   21.52816   1.288957    16.70   0.000     19.00032    24.05599
      DisFroSC |  -.9157859   .1200562    -7.63   0.000    -1.151234    -.680338
         _cons |   -290.173   19.30402   -15.03   0.000     -328.031    -252.315
------------------------------------------------------------------------------
```

Woodhill Results

```
. regress Y DisFroCosm  DisFroINFS ART size Area DisFroHos if Suburb =="Woodhill"

      Source |       SS       df       MS              Number of obs =     770
-------------+------------------------------           F(  6,   763) =  139.71
       Model |   106.70937     6  17.7848949           Prob > F      =  0.0000
    Residual |  97.1312182   763  .127301728           R-squared     =  0.5235
-------------+------------------------------           Adj R-squared =  0.5197
       Total |  203.840588   769  .265072286           Root MSE      =  .35679

------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   DisFroCosm |   .4362812   2.248876     0.19   0.846    -3.978438       4.851
   DisFroINFS |    .051371   .0890397     0.58   0.564    -.1234208    .2261628
         ART |   .1723193   .0139072    12.39   0.000     .1450183    .1996203
        size |    .213043   .0292303     7.29   0.000     .1556617    .2704244
        Area |   .0384539   .0134982     2.85   0.005     .0119559     .064952
    DisFroHos |   .0626889   .0869212     0.72   0.471    -.1079442    .2333219
       _cons |   5.501111   23.22609     0.24   0.813    -40.09352    51.09574
------------------------------------------------------------------------------
```