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Predicting Safety Behind the Walls: Machine Learning Insights into Gated Communities in Urban South Africa

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Abstract: *Across the globe, gated communities have emerged as a dominant trend in residential development, particularly in urban and peri-urban settings. In the South African context, this trend has accelerated in response to rising crime levels and a perceived need for private security solutions. Using triangulated data, the paper employs traditional and machine learning models to test the hypothesis: security measures in gated communities deter property crime rates compared to non-gated neighborhoods in urban South Africa. The results show that only when neighborhoods variables, including public safety resources (i.e., police presence), temporal patterns, and suburb location, are controlled, is when living in a gated community associated with significantly lower property crime. We also find that, while police stations alone have a crime-reducing effect, the results for the interaction term between gating and police presence are counterintuitive; results show that gated communities near police stations experience higher crime than would be expected from either factor alone. Among others, we suggest that this results from the region's fragmented municipal administrative oversight and police precincts that potentially leads to certain inefficiencies, complicates equitable policing, and exacerbates disparities in crime rates and public safety. This research asserts that policymakers and other stakeholders need to recognise that private investments (i.e., gating) alone may not deter the incidence of property crime; rather, a mix of private and public safety resources could lead to less property crime.*
Keywords: *Gated communities, crime, Machine learning, Johannesburg, South Africa.*

1. INTRODUCTION

Gated communities are residential areas with restricted access in which public spaces are privatized (Blakely & Snyder, 1997a). Broadly categorized into lifestyle, elite, and security zone gated communities, they are characterized by restricted access, often surrounded by physical boundaries, such as walls or fences, and equipped with controlled entrances, and sometimes, guards or surveillance systems (Adnan et al., 2014; Grant & Mittelsteadt, 2004; Caldeira, 2000; Le Goix & Webster, 2008). With historical precedents, the modern forms of gated communities, however, have evolved significantly and have become a global phenomenon, particularly in response to broader social, economic, and cultural trends, such as urbanization, economic inequality, and rising crime rates (Tanulku, 2023; Hassan et al. 2022; Güzey, Ö. and Özcan, Z., 2010; Boonjubun, 2019; Bagaeen & Uduku, 2010; Sanchez et al., 2005). With security as a primary motivation for many residents, gated communities provide a sense of safety and protection against crime. Where residents choose gated communities for the prestige and lifestyle they offer, including high-quality housing and exclusive amenities, these urban forms inadvertently often promote social segregation, creating distinct boundaries between different economic and social classes (Ginting & Sakinah, 2018; Adnan, 2014; Boonjubun, 2019; Blandy, 2006; Roitman & Scopes, 2012).

Reflecting broader global trends, gated communities have become a significant feature of the urban landscape in South Africa, particularly since the end of apartheid in 1994 (Landman, 2004; Makhale & Landman, 2018). Typical of gated communities elsewhere in the world, the proliferation of gated communities in South Africa is a response to several factors, including heightened fear of urban crime, the desire for privacy, and

social prestige (Jürgens & Gnad, 2002; Atkinson & Blandy, 2009). Gated communities in South Africa are diverse, grouped broadly as security villages and enclosed neighbourhoods (Hamann et al., 2021), cater to specific market segments, and reflect different social and environmental priorities. These gated communities offer security and lifestyle benefits, while they also raise significant concerns about social exclusion and urban fragmentation, as well as urban planning and governance, particularly in terms of managing public services and addressing social inequalities (Landan, 2004, 2006, 2008; Lemanski, 2006; Bandauko et al., 2022; Makhale & Landman, 2018; Atanga et al. 2004).

As is well documented, South Africa has experienced a dramatic increase in crime levels since the country's democratic transition in 1994 (Spocter, 2022; Breetzke et al., 2014). With the numbers ever fluctuating, Stats SA (2022) shows that around 983,000 households were victims of housebreaking within the 2021/2022 period, whereas around 155,000 households were affected by robbery. Other crimes that affect households include assault and vehicle theft. All these changes have contributed to the gradual change in the housing landscape, with fencing and gating of residential areas a rational response (Jürgens and Landman 2006). However, the success of these responses is mixed. For example, some research has found no evidence of any general permanent reductions of crime in fully gated communities (Blakely and Snyder, 1997a, 1997b). Other research has found that gated communities did not report any significant difference in actual crime rate, such as burglary, compared to their non-gated counterparts (Wilson-Doenges, 2000; Addington & Rennison, 2015; Olajide and Lazim, 2016). Some scholars contend that living in gated communities is associated with affluence and likely to attract criminals, thus the higher probability of criminal activities notwithstanding the level of gating (Atkinson & Smith, 2012; Blakely & Snyder, 1997a, 1997b).

In China, Wang et al. (2021) found that higher entry control levels were associated with significantly lower burglary rates in gated communities, revealing for the first time a quantitative relationship between burglary and entry control level in gated communities at the city-wide scale. Additionally, other research has shown that efforts to deter crime in gated communities lead to lower burglary rates within gated communities, but such actions inadvertently push criminal activities into the neighbouring zones, raising concerns about spatial displacement rather than net crime reduction, and causing dissension and controversy in surrounding neighborhoods (Blakely and Snyder, 1997a).

In South Africa, the effectiveness of gated communities in reducing crime has been the subject of debate as well. For example, Breetzke and Cohn (2013) found that gated neighborhoods have a significant positive association with burglary rates in both day and nighttime models, suggesting that residing in a gated community increases one's risk of burglary victimization. On their part, Breetzke et al. (2014) found that gated communities (and their immediate surrounding areas) are associated with increased levels of burglary. However, they suggest that some physical characteristics of gated communities deter burglary levels.

To add to the burgeoning literature, this paper's central objective is to empirically test whether gating a community sufficiently deters property crime, using residential estates in the northern suburbs of Johannesburg. While previous studies have delved into analyzing the contribution of gated communities in deterring property crime, this paper goes further and leverages machine learning techniques to analyze how the presence of both private resources (i.e., gating) and public resources (i.e., police presence) explains property crime both singularly and jointly in Johannesburg's northern suburbs.

The rest of the paper is structured as follows. Section II offers a literature review on the meaning, types, and dynamics of gated communities, as well as empirical evidence on the relationship between gated communities and crime rates globally and in South Africa. Section III offers research methodology that outlines the study area, data, and methods utilized within this study, while Section IV presents the findings along with their discussion. The paper concludes in Section V, summarizing key insights arising from this study.

2. LITERATURE REVIEW

A Theoretical Framework

This paper is guided by two theoretical frameworks: Routine Activities Theory (RAT) and Rational Choice Theory (RCT). The relevance of the RAT in this paper is hinged on the level of space-time convergence among offenders, unguarded victims, and suitable targets. As these actors go on with their daily activities within defined mobility corridors and leading to spatial heterogeneity, the RAT suggests that an increase in human presence in a given area is expected to be associated with both an increase and a decrease in criminal activity (Boivin, 2018; Song, et al., 2019; Breetzke & Cohn, 2013).

The RCT underpins situational crime prevention, offering insights into offender decision-making models and predicting which crime prevention mechanisms may be most useful (Reynald & LeClerc, 2017). RCT underscores that offenders engage in rational decision making bounded by life circumstances, time, and availability of relevant information, and in so doing weigh the costs associated with engaging in crime against the potential benefits (Sytsma, 2020; Cornish & Clarke, 2017). The theory posits that the level of friction determines where the balance of probabilities falls, that is, to commit a crime or not, as offenders undertake cost-benefit analyses (Van Deviver et al., 2015). Based on the understanding offered by the two theoretical frameworks, the role that private resources (i.e., walling and gating) and public resources, namely police presence and visibility, play in guarding victims and suitable targets is crucial. Equally important to explore is the role played by socio-economic and community characteristics in predicting criminal activities.

B Understanding Gated Communities

1 Meaning and Dynamics of Gated Communities: A Global Overview: In their seminal work in the United States, Blakely and Snyder (1997a) defined gated communities as residential areas with restricted access in which normally public spaces are privatized. These residential areas are characterized by restricted access, often surrounded by physical boundaries, such as walls or fences, and equipped with controlled entrances, and sometimes, guards or surveillance systems (Adnan et al., 2014; Grant & Mittelsteadt, 2004; Caldeira, 2000; Le Goix & Webster, 2008). These urban forms are not entirely new and have historical precedents; they have existed for a long time as gated homesteads and cities in various parts of the world, serving similar purposes of security and exclusivity (Bagaeen & Uduku, 2010). The modern forms of gated communities, however, has evolved significantly and has become a global phenomenon, particularly in response to broader social, economic, and cultural trends, such as urbanization, economic inequality, and rising crime rates (Tanulku, 2023; Hassan et al. 2022; Güzey, Ö. and Özcan, Z., 2010; Boonjubun, 2019).

In their original categorisation, Blakely and Snyder (1997) identified three forms of gated communities; lifestyle communities, elite communities, and security zones. Blakely and Snyder (1997b, p. 5) noted:

The three major categories of gated communities – lifestyle, elite, and security zone – all reflect to varying degrees four social dimensions or values: a sense of community, or the preservation and strengthening of neighborhood bonds; exclusion, or separation from the rest of society; privatization, or the desire to replace and internally control public services; and stability, or the need for homogeneity, predictability, and similarity.

Gated communities exist for various reasons, including to provide a sense of security and privacy for their residents, often targeting upper and middle-class individuals who seek a safe and exclusive living environment. With security as a primary motivation for many residents, gated communities provide a sense of safety and protection against crime. Where residents choose gated communities for the prestige and lifestyle they offer, including high-quality housing and exclusive amenities, these urban forms inadvertently often promote social segregation, creating distinct boundaries between different economic and social classes (Ginting & Sakinah, 2018; Adnan, 2014; Boonjubun, 2019; Blandy, 2006; Roitman & Scopes, 2012; Atanga et al. 2004).

Since the 1990s, when the concept of gated communities appeared in scholarly work, this phenomenon spread to other parts of the world, including Latin America, Africa, Southeast Asia, and Europe (Atkinson & Blandy, 2013; Klaufus et al., 2017; Petrovic & Ouředníček, M., 2025). In different regions, these communities are adapted to local contexts, reflecting broader socioeconomic and cultural transformations, and diverging from historical spatial practices that emphasized social cohesion and communal interaction (Hammad et al. 2025; Petrovic & Ouředníček, 2025).

2 Gated Communities in Urban South Africa: Reflecting broader global trends, gated communities have become a significant feature of the urban landscape in South Africa, particularly since the end of apartheid in 1994 (Landman, 2004; Makhale & Landman, 2018). Typical of gated communities elsewhere in the world, where they are characterized by physical boundaries such as gates and walls, and often include security measures like guards or surveillance systems, the proliferation of gated communities in South Africa is a response to several factors, including heightened fear of urban crime, the desire for privacy, and social prestige (Jürgens & Gnad, 2002; Atkinson & Blandy, 2009).

Gated communities in South Africa are diverse, grouped broadly into security villages and enclosed neighbourhoods (Hamann et al., 2020), cater to specific market segments, and reflect different social and environmental priorities. Mostly new, *security villages* are privately developed housing complexes designed with security as a primary feature, and often include amenities such as gymnasia, walkways, golf courses, and play parks (Spoctor, 2012; Du Plessis & Jacobs, 2018). Security villages can be residential (such as townhouse complexes and high-rise apartment buildings) or mixed-use (such as vast security estates, including office blocks for businesses) constructions, where a single private developer has completely transformed the entire area. Most of the time, a private management body or homeowners' associations are responsible for infrastructure management and adherence to community guidelines (Spoctor, 2012; Du Plessis & Jacobs, 2018). In contrast, e*nclosed neighbourhoods* refer to older/existing neighbourhoods, which have been closed off for security purposes. They are closed off in retrospect, in contrast to security villages, which are a range of new private developments that have been planned (Landman, 2003; Grant, 2004).

Similar to other parts of the world, while gated communities offer security and lifestyle benefits, they also raise significant concerns about social exclusion and urban fragmentation, as well as urban planning and governance, particularly in terms of managing public services and addressing social inequalities (Landan, 2004, 2006, 2008; Lemanski, 2006; Bandauko et al., 2022; Makhale & Landman, 2018).

C Gated Communities and Crime Rates: Empirical Evidence

International research on the relationship between gated communities and crime reduction presents mixed findings regarding the effectiveness of gating in reducing crime. We review a few of them in this section. In their study in the United States, Blakely and Snyder (1997a), who examined case studies in various communities across the country, found no evidence of any general permanent reductions of crime in fully gated communities. They further suggest that not only do gated communities fail to protect residents, but they often cause dissension and controversy in surrounding neighborhoods. Wilson-Doenges (2000) in her comparative study, which focused on two gated and two non-gated communities with similar attributes, found that gated communities did not report any significant difference in actual crime rate as compared to their non-gated counterparts. This highlights the symbolic function of gates in promoting psychological comfort, even in the absence of tangible safety improvements. Addington and Rennison (2015), using data from the United States National Crime Victimisation Survey, found support for the hypothesis that housing units in gated communities experience less burglary than their non-gated counterparts.

Studies from Asia support similar conclusions with important regional distinctions. In China, Wang et al. (2021) examined whether different levels of entry controls impact burglary rates in gated communities. In their research, the authors found that higher entry control levels were associated with significantly lower burglary rates in gated communities, revealing for the first time a quantitative relationship between burglary and entry control level in gated communities at the city-wide scale.

In South Africa, the effectiveness of gated communities in reducing crime has been subject to growing scrutiny, with much of the literature pointing to nuanced and often contradictory outcomes. Breetzke and Cohn (2013) examined the relationship between residential burglary and gated communities in Tshwane, South Africa. Focusing on the effect of gating on rates of day and nighttime burglary, they found that gated neighborhoods have a significant positive association with burglary rates in both day and nighttime models, suggesting that residing in a gated community increases one's risk of burglary victimization. Breetzke et al. (2014) employed location quotient analysis, a non-econometric approach, and found that gated communities

(and their immediate surrounding areas) are associated with increased levels of burglary. They suggest that some physical characteristics of gated communities deter burglary levels.

D Machine Learning Applications in Crime Modelling

Machine learning (ML) techniques, such as Random Forest, decision Tree, and Naïve Bayes, offer powerful and increasingly accessible analytical frameworks for evaluating the spatial and socio-economic effects of urban interventions, including the presence of gated communities, on predicting crime rates and property values. ML techniques' strengths lie in their capacity to handle complex, non-linear relationships across multiple variables, revealing patterns that might be missed by traditional statistical methods (Ajitha et al., 2024; Mandalapu et al., 2023; Elluri et al., 2023).

Internationally, several authors have used Random Forest for crime prediction, acknowledging that it handles imbalanced datasets well and has been shown to outperform other techniques in forecasting future crimes (Vadav et al., 2024; Alsubayhin et al., 2024; Wheeler & Steenbeek, 2021). Several scholars show that Random Forest, compared to other supervised learning algorithms, such as Decision Tree, Extra Tree, and XGBoost, performs better and accurately predicts crimes and improves public safety (Dhanwanth et al., 2023; Abubakera et al., 2025).

Additionally, Ajitha et al. (2024) utilized San Francisco Police Department's data to investigate innovative approaches like K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and Decision Trees. They found that Decision Tree algorithm achieved the highest accuracy at 88%, with KNN following closely at 87%. SVM, although effective in other scenarios, attained a lower accuracy of 66% in this study. These findings indicate that Decision Trees and KNN are particularly effective for classifying and predicting crime data. Mwaniki et al. (2023) developed and compared the performance of the hybrid tree-based algorithm against decision trees and random forests, using data mined from National Police database and news websites. Their results revealed that the accuracy of Decision Tree classifier was 87% on the testing dataset and 94% on the training set, while the accuracy of random forests was 100% on the training dataset and 78% on the testing dataset. They argue that, while decision trees had a higher predictive value than random forests in crime data classification and prediction, the hybrid model had slightly more predictive power (94.4%), compared to Decision Trees and Random Forests, indicating potential improvements in processing speed and accuracy as a result of hybridization. Collectively, this body of work shows that ML approaches can be finely tuned to context-specific urban phenomena, offering well-suited for modelling the nuanced impact of gating and access control on crime and exploration of other urban dynamics.

3. STUDY AREA, DATA, AND METHODS

A Study Area

The study area encompasses the Randburg region, one of the seven administrative regions of the city of Johannesburg metropolitan area. The region presents a useful case study due to its diversity of neighbourhood types and its blend of established suburbs and newer lifestyle or luxury estates. Most of these suburbs are residential, with a few commercial sections. Nodes, such as North Riding, Olivedale, and Bryanston Extension, have seen a proliferation of gated developments since the 2000s. These precincts are generally characterised by middle- to upper-income households and extensive private security infrastructure.

Figure 1 shows the location of gated communities in relation to other pertinent details, such as the location of police precincts. The map shows that more gated communities are located to the north of the region. From the review of the literature, preliminary findings suggest that while reported crime levels are lower within gated zones, neighbouring areas may experience higher crime rates. The region's fragmented municipal administrative oversight and variable police precincts, as well as community policing forums' participation, further complicate efficient policing in the region and the city analysis. This underscores the need for a more granular, data-driven approach – something machine learning can support.

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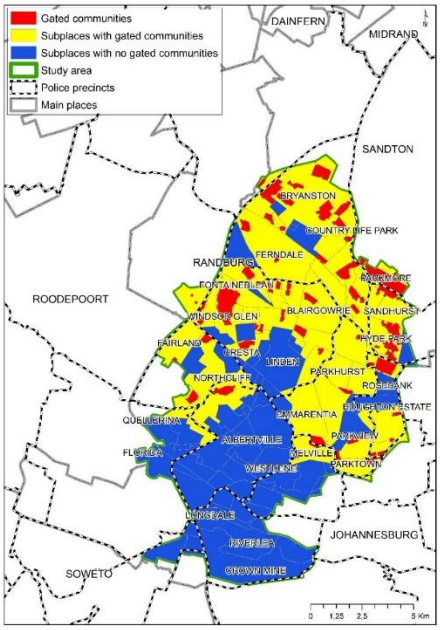

Figure 1. The study area

B Data

Drawing on real estate and police data from Lightstone Property Company and EasyData (2025), respectively, we use ArcGIS Pro software to identify house sales located within gated communities and those located in non-gated communities. We then analyzed the relationship between gated communities and both total and property crime, respectively, while controlling socio-demographic characteristics of the neighborhoods. Table 1 shows descriptive statistics for the model variables across gated and non-gated communities.

Table 1. Descriptive statistics for gated and non-gated communities in the sample

	Gated communities (N = 2,549)		Non-gated communities (N = 6,911)	
	Mean	SD	Mean	SD
Total crime	4,217.35	1,378.58	4,109.95	1,466.34
Property crime	1,170.47	275.05	1,151.28	356.45
Property size	737.78	958.19	5,442.87	312,317.81
Distance to police station	3.482	0.202	3.373	0.463
Suburbs (dummy)				
Registered years (dummy)				

C Methods

In our analysis, we employ several approaches to examine the nexus between gating and crime. We estimated equation 1.

$$Y_{it} = \alpha_0 + D_i C_{it} + \delta_{it} I_{it} + \beta_i X_{it} + \varepsilon_{it} \quad \text{(equation 1)}$$

Where;

Y_{it} is the response variable, which represents property crime, C_{it} represents the sets of categorical variables included in the analysis, which include whether a property is in a gated community (gated = 1) or not (gated = 0) or, location (suburbs), and the time trend (year of registration of property). I_{it} represents the interaction variable, meant to account for a joint effect, is a product of the gated and distance to the nearest police station variables. X_{it} represent other predictors included in the model. ε_{it} represent the disturbance term. Equation 1 was estimated using the ordinary least squares method, and subsequently, machine learning techniques, that is, Random Forest and Decision Trees.

To enhance the robustness of our predictive framework, we implement k-fold cross-validation—a resampling technique that systematically partitions the data into complementary subsets for training and validation. For quantitative evaluation, we employ distinct metrics tailored to each modelling task; root mean squared error (RMSE) and mean square error (MSR) to ensure both statistical reliability, model accuracy, and practical interpretability of our results.

4. RESULTS AND DISCUSSIONS

A Preliminary Analysis

Figure 2 shows the average number of total and property crimes, 2010-2020, per police precinct in the Randburg region in the city of Johannesburg. Figure 2a and Figure 2b show that total crimes and property crimes range from 1,238 to 11,911 and 379 to 3,802, respectively. Figure 2a shows that there are more total crimes in Honeydew, Bramley, and Florida police precincts. Administratively, larger parts of these precincts fall in Roodepoort (Honeydew and Florida) and Sandton (Bramley) regions than in the Randburg region. Langlaagte, Fairland, and Parkview police precincts have the lowest average number of total crimes. Figure 2b shows a similar pattern of average number of property crimes as Figure 2a's number of total crimes in Honeydew, Bramley, Randburg, Sophia Town and Brixton police precincts. Langlaagte and Fairland police precincts still have a lower number of property crimes compared to Figure 2a. In contrast, Figure 2b shows Linden police precinct, with a relatively lower average number of total crimes in Figure 2a, has a higher average number of property crimes, compared to the rest of the police precincts. This could be explained by the higher number of subplaces in the Linden precinct that do not have gated communities, compared to Randburg, Sandton, and Rosebank police precincts, which have more suburbs with gated communities. The relatively low levels of total and property crimes, especially in Langlaagte and property crimes in Orlando and Diepfkloof seems to support Breetzke (2010) and Breetzke & Horn (2006) observations that most property offenders reside in Black African townships located on the periphery of the city. To these authors, these offenders in the present study would need to travel long distances to the northern suburbs to target affluent neighborhoods, possibly because their motivation is profit.

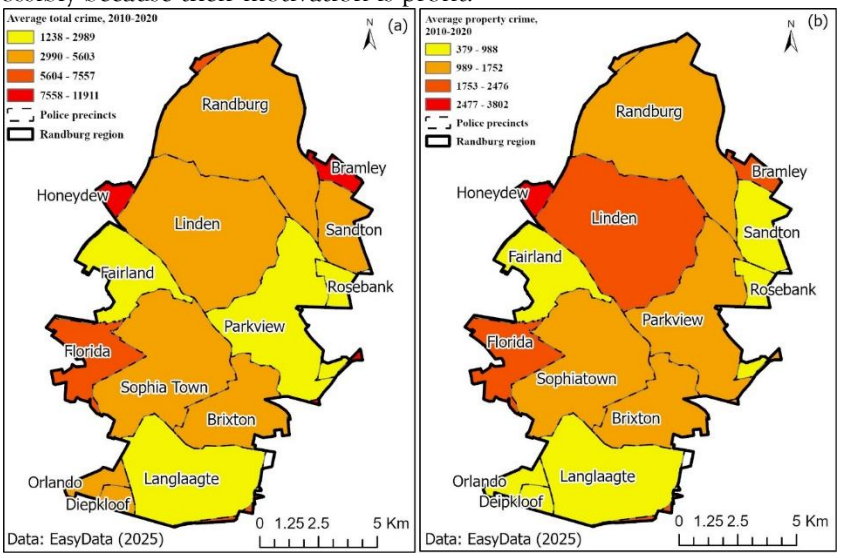

Figure 2. The average number of total crimes and property crimes (2010-2020)

Figure 3 presents a comparative analysis of crime patterns between gated and non-gated communities. Panel A displays the aggregate crime magnitude, revealing marginally higher (though statistically insignificant) crime levels in non-gated areas – a finding consistent with prior studies on neighbourhood security dynamics. Panel B examines property crime incidence per household, where gated communities demonstrate elevated rates, particularly in Suburb B. This aligns with existing literature suggesting that affluent, gated areas may present

more attractive targets for property-related offenses due to higher expected returns for criminals (Breetzke & Cohn, 2013).

The observed disparity may also reflect differential crime reporting behaviours. Research indicates that lower-income non-gated communities often underreport crimes to authorities due to distrust of law enforcement or perceived futility of reporting (Goudriaan & Nieuwbeerta, 2006; Sidebottom, 2015), potentially biasing official crime statistics. These findings underscore the need to contextualize crime data within broader socioeconomic factors when evaluating gating's security efficacy.

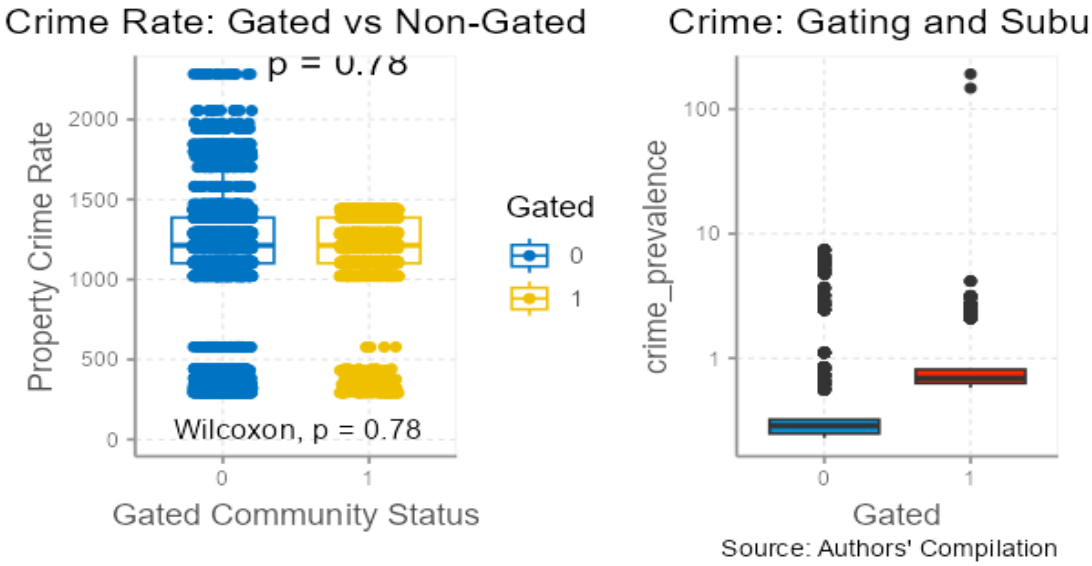

Figure 3: Crime Rates Prevalence

B Econometric Results

In this section, we test our hypothesis, restated below, using ordinary least squares and machine learning techniques.

Hypothesis 1: Security measures in gated communities deter property crime rates compared to non-gated communities.

Our analysis reveals several important insights about the relationship between gated communities, police presence, and property crime. The results present a nuanced picture that challenges simplistic assumptions about security measures.

The baseline model (Model 1) shows that gated communities experience moderately higher property crime rates (0.221 units) compared to non-gated areas, even after controlling for location. This finding aligns with existing literature suggesting that gated communities may attract rather than deter criminal activity, possibly because they contain more valuable targets. The significant variation across suburbs, with Dunkeld and Hyde Park showing substantially lower crime rates than Bryanston, further emphasizes how neighborhood characteristics independently influence crime patterns. In addition to the predictors in Model 1, Model 2 introduces police presence. However, while the police presence deters criminal activities, gating still appears to encourage criminal activities.

The most revealing findings emerge when we examine the interaction between gating and police presence (see Model 4). While police stations alone have a crime-reducing effect, the positive interaction term (38.994) indicates that gated communities near police stations experience higher crime than would be expected from either factor alone. We also observe a differential in crime rates across suburbs. This counterintuitive result suggests several possible explanations.

First, the region's fragmented municipal administrative oversight and police precincts, along with participation from community policing forums, further complicate efficient policing within the region and

city analysis. This situation potentially leads to certain inefficiencies, complicates equitable policing, and exacerbates disparities in crime rates and public safety. Second, the combination of gated communities and police presence might create particularly attractive targets, as criminals may view these areas as containing high-value properties worth the additional risk. Third, increased surveillance in these areas could result in higher reporting rates rather than an actual increase in crime incidents.

The temporal analysis reveals important context for these findings (Model 3). The general downward trend in property crime since 2010 suggests broader societal improvements in security, while the spikes in specific years (particularly 2016-2018) may reflect local economic conditions or policing strategies. Notably, these temporal patterns affect both gated and non-gated communities, similarly, indicating that the interaction effect is robust across different crime environments.

These findings have significant implications for urban security policy. First, private security measures should be implemented as part of comprehensive strategies rather than standalone solutions. Secondly, police resource allocation should account for the complex dynamics of gated communities. Third, urban planning should consider how security infrastructure affects criminal targeting patterns.

Table 2. *Regression Results: Property Crime Determinants*

	Model 1 (Baseline)	Model 2	Model 3	Model 4
(Intercept)	1241.660***	5915.317***	5911.087***	5915.245***
	[1.993]	[66.390]	[33.664]	[33.645]
Gated	0.221	0.218	-1.731	-122.764***
	[3.645]	[3.645]	[1.837]	[30.228]
Suburb (Base: Brystone)				
Dunkeld	-886.922***	-4200.730***	-4198.726***	-4200.245***
	[12.456]	[48.538]	[24.481]	[24.459]
Hyde Park	-867.417***	-1791.588***	-1779.460***	-1775.164***
	[5.526]	[13.955]	[7.035]	[7.109]
Randpark	554.504***	-	-	-
	[7.932]			
Property Size		-0.000	-0.000	-0.000
		[0.000]	[0.000]	[0.000]
Distance to police station		-1320.241***	-1307.273***	-1308.687***
		[18.888]	[9.521]	[9.518]
RegisteredYear2011			6.112	6.446
			[4.005]	[4.002]
RegisteredYear2012			-235.596***	-235.380***
			[4.021]	[4.017]
RegisteredYear2013			-160.414***	-159.875***
			[3.923]	[3.921]
RegisteredYear2014			-155.875***	-155.528***
			[3.862]	[3.859]
RegisteredYear2015			-72.118***	-71.899***
			[4.047]	[4.044]
RegisteredYear2016			115.149***	115.648***
			[3.949]	[3.947]
RegisteredYear2017			132.494***	132.830***
			[4.013]	[4.010]
RegisteredYear2018			82.364***	82.590***

	Model 1 (Baseline)	Model 2	Model 3	Model 4
			[4.022]	[4.018]
RegisteredYear2019			-39.049***	-39.084***
			[4.096]	[4.091]
RegisteredYear2020			-92.960***	-92.926***
			[4.151]	[4.147]
Interaction (Gated*Distance to police station)				34.776***
				[8.669]
Observations	7298	7298	7298	7298
Adj. R^2	0.831	0.831	0.957	0.957

Notes: Source: Author's own computation. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

We use machine learning to predict the incidence of crime based on the variables in the data. Again, we run three models: the linear regression as the baseline, the decision tree model, and the random forest model. To compare the three models, we use RMSE and MSR. We then extract feature importance of the variables to capture the variables with the highest impact in predicting the incidence of property crime in our sample.

The RMSE of 0.081 on property crime and the residual standard error of 0.08115, obtained from the trained data, suggest that the model generalizes well and there is no risk of overfitting. The MSR value obtained from the random forest estimate is 0.00018, which is significantly lower. The variance explained value of 99% suggests an extremely high prediction on training data. The RMSE value of 0.0132 obtained from Random Forest estimate suggests that only 0.0132 of the error is expected in the crime rate. This suggests that the results are generalisable than in the normal OLS estimates.

To establish, which variables play a critical role in predicting crime in our sampled data, we produce a percentage increase in MSE and an increase in Node Purity, which both capture how a random permutation of the variable influences the prediction and how total decrease in node impurity from splits of the variable. Table 3 depicts these results.

The results in Table 3 suggest that suburbs are the most influential variables, and splitting based on suburbs greatly improves the model estimates. Thus, the local area is a crucial determinant of crime levels in the Johannesburg suburbs context. The time effect captured by the year of registration, which reflects the temporal trends, has the highest predictive power in the model. This is consistent with our initial argument that crime has been on the rise over time, particularly during 2016-2018, in our study area. Regarding police influence, the results indicate that police presence significantly affects the model, as it implies an observable change in crime. The socio-economic status, as captured by property size, is also an important aspect in predicting property crime, according to these results. Thus, gated status has less significance on its own as a deterrent to property crime.

Table 3. Critical predictors of crime incidence

Variable	% increase in MSE	Increase in Node Purity
Suburb	28.46%	457.39
Registered Year	228.65	68.52
Police	20.11%	322.03
Property size	18.82%	3.38
Gated*Police	10.90%	25.36
Price	10.72%	4.15
Gated	1.78%	0.13

5. CONCLUDING REMARKS

The examined literature indicates that while gated communities may discourage certain types of criminal activity, a complex network of social, institutional, and infrastructure elements must also be considered. Our findings have policy implications, as public resources devoted to property crime prevention play a critical role in discouraging property crime, but private resources only make a minor contribution. It's crucial to remember that private resources, like gating, might not be enough to prevent crime on their own. Instead, a combination of private and public resources, like the presence of public policing, may be able to reduce crime in gated communities. These findings show that private resources (i.e., gating) may offer temporary or localized relief but are unlikely to serve as a comprehensive crime prevention strategy in the absence of systemic change.

In line with RAT and RCT, which posit that the level of space-time convergence among offenders, unguarded victims, and suitable targets and the results of cost-benefit analyses determining whether an offender may commit a crime or not, respectively (Van Deviver et al., 2015), our findings appear to concur with Breetzke (2012) who argues that the self-segregation of the minority white and high-income individuals have ironically led to areas inhabited by these South Africans not free from crime at all but rather exhibit a greater risk of victimization.

Machine learning provides a promising way forward. With the right data inputs and thoughtful modelling, it becomes possible to disentangle the influence of gating from other variables and simulate the likely outcomes of urban planning decisions. In doing so, this approach holds the potential to inform more equitable, data-driven policy in both the real estate and community safety domains.

The inability to investigate the variability of gated communities in terms of the level of access control, for example, was a limitation of this study. We were only able to differentiate between gated and non-gated communities due to data restrictions (see Wang et al., 2021). Future research can also explore heterogeneity in terms of income level; that is, does property crime vary in different income levels in gated communities? Additionally, future research could strengthen our findings by examining historical police station placement decisions in light of emerging crime imperatives and conducting victimization surveys to assess reporting differences. Besides, analysing micro-level spatial patterns of criminal activity and incorporating more detailed property data lends itself to future research.

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