Closing the Gateway: Street Closures, Bisected Geography, and Crime in St. Louis, MO

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Abstract
Unlike most American cities, St. Louis, Missouri has a highly bisected street grid. Where intersections would typically be open to two-way traffic, in hundreds in cases in St. Louis they have been closed using concrete barriers or cul-de-sacs. These street closures are the outgrowth of a 1970s-era “defensible space” strategy to address rising crime rates. Oscar Newman, who is most closely associated with this paradigm, developed it while a faculty member in St. Louis. The city therefore is not only the birthplace but also one of the most significant test cases for its implementation. In this paper, we provide the most comprehensive data set of closures available, evaluate their location in the city, and assess their association with contemporary violent crime patterns. We find that barriers are located in neighborhoods that lost significant population between 1970 and 2016, particularly in North City and the northernmost reaches of South City. Critically, though the barriers are imagined as crime reduction tools and justified as such in City legislation, we find that they are associated with elevated violent crime rates at the neighborhood-level. This finding suggests significant limitations with “defensible space” strategies in St. Louis and elsewhere for addressing crime.

Keywords
defensible space, urban geography, St. Louis, street closures, crime
Traversing any city can be a challenge for visitors and locals alike — one-way streets, limits placed on making turns at particular intersections, and poor signage can stymie even seasoned navigators. In St. Louis, it can be even more challenging still. Spread throughout neighborhoods in the city’s midsection and in what locals call “North City” are concrete barricades that prevent the flow of traffic in one or both directions through certain intersections. They have been the subject of local fascination for decades. The City first installed many barriers in the mid-1970s under the administration of Mayor Vincent Schoemehl. Locals now refer to the barriers in some areas as “Schoemehl pots” (Thorsen 2015; see FIGURE 1), paying homage to the man who helped create what one local website called a "city body at war with itself" (Allen 2014).

The closures' manifest function is popularly understood as a crime prevention tool in the tradition of Oscar Newman’s theory of “defensible space” (Allen 2014). Indeed, in recent legislation authorizing new closures, Board of Aldermen bills typically note that closing a street will increase the safety of the surrounding neighborhood. Though they are authorized through legislation, the city does not retain a systematic list of closures made by public works employees (Thorsen 2015). Systematically tracing the installations, therefore, has been difficult for local reporters and writers interested in the phenomenon.

We, therefore, have two aims with this paper. First, we provide the most specific accounting to date of how St. Louis's urban geography has become a tangled web of closed streets. Alongside this paper, we have published a dataset of all known current and former closures within the city. Second, we offer two sets of statistical analyses that empirically evaluate the demographic characteristics associated with barrier density within neighborhoods and then test the relationship between violent crime rates for St. Louis in 2016 and barrier density at the neighborhood level.

The relationship between barrier density and crime is most important because it speaks to the justification for the very existence of the street closures. We find that increased barrier density in neighborhoods is associated with higher violent crime rates, which suggests that, whatever the past...
successes barriers may have had in addressing violent crime, they do not appear to be associated with lower crime rates today. While no other city has implemented barriers in the numbers that St. Louis has, this finding speaks to the tenability of defensible space strategies more generally as a means for addressing violent crime. As we will outline, this paper revisits the notion of defensible space in the very place where the concept originated.

Background

St. Louis thus has the unique distinction of being not just the site of a large-scale implementation of Oscar Newman’s ideas about defensible space, but also as the birthplace of these ideas themselves. The proliferation of street closures in St. Louis is the product of a marriage between a city's declining demographic trajectory and a theory about how to create greater control of public space for residents. Oscar Newman is well known both for his theory of “defensible space” and his involvement in Yonkers’ housing desegregation court case. He began his career as an academic in St. Louis during the mid-1960s, teaching architecture at Washington University. He placed the origin of defensible space in St. Louis, noting that the idea of defensible space arose from the demise of the City’s Pruitt-Igoe public housing project. Newman's suggestion of street closures as an anti-crime tactic also developed in St. Louis based on his observations of private streets that had been closed by residents to thru traffic (Newman 1996).

Defensible Space

Following Newman (1972, 1996), we understand the intended function of street barriers and road closures as a means of increasing control over behavior within residential spaces. Delineating between private and public areas of cities is a core aspect of Newman's broader theory of defensible space. In seeking a clear distinction between public and the private space for both inhabitants of a neighborhood and outsiders, Newman hopes to instill a home-grown sense of ownership and control for residents. As we have already noted, this need to control public space is a byproduct of an oft-repeated narrative about the infamous Pruitt-Igoe public housing complex. Looking at Pruitt-Igoe, Newman argued that:
“Because all the grounds were common and disassociated from the units, residents could not identify with them. The areas proved unsafe. The river of trees soon became a sewer of glass and garbage. The mailboxes on the ground floor were vandalized. The corridors, lobbies, elevators, and stairs were dangerous places to walk. They became covered with graffiti and littered with garbage and human waste. The elevators, laundry, and community rooms were vandalized, and garbage was stacked high around the choked garbage chutes.” (Newman 1996: 10)

Changes to the built environment, Newman argues, can increase the territoriality of the space—strengthening the sense of ownership residents have over their communities. He posits that residents are better positioned to both be aware of and act against crime within their neighborhoods (Newman 1972). Newman does not stop at advocating for changes within the design of public housing. Creating "controlled enclaves" (Newman 1996: 13) is another way to introduce a sense of ownership over public space for neighbors. Writing specifically about street closures, Newman argues that:

“One of the benefits of street closure and the creation of mini-neighborhoods is that it brings neighbors together in unified action to address their joint problems. It also focuses their attention on removing criminal activity from their communities.” (Newman, 1996: 52)

He thus ties street to closures directly crime reduction and the management of public (or heretofore public) space, connections he made in initial research based on private streets in St. Louis (Newman, Grandin, and Wayno 1974; Newman 1980).

Newman was not the only person to make these types of arguments in the 1970s. Criminologist C. Ray Jeffery, also calls upon design disciplines to mitigate criminal activity through physical changes to space. With his intervention of Crime Prevention Through Environmental Design (CPTED), Jeffery (1971) suggests that crime occurs when presented with an opportunity. By limiting these opportunities, neighborhoods are less likely to become targets of criminal activity. Therefore, defensible space and CPTED aim to not only fortify the built environment but also to increase opportunities for natural surveillance—drawing inspiration from Jane Jacob’s idea of eyes on the street (Jacobs 1961).

Principles of Defensible Space and CPTED, since emerging in the 1970s, have increased in popularity. By the mid-1990s, the United States Department of Housing and Urban Development heralded these methods as effective measures in small public housing sites, even commissioning Newman
to compile case studies to demonstrate their efficacy (Cisneros 1996; Newman 1996). During this period, neighborhoods began to feature iron gates, dead-end streets, and flower-beds as both real and symbolic barriers separating their communities from others.

Despite the propagation of defensible space as a design strategy, the efficacy of 'designing out crime' remains contested. Studies suggest that while these crime prevention initiatives may impede crime within one community, crime still often occurs but is displaced to an adjacent space (Gabor 1981; Reppetto 1976). Furthermore, due to their reliance on residents to come together to reduce crime, defensible space features have proven less effective in spaces where individuals have not developed a sense of belonging or connections to other residents (Merry 1981). Individuals are less inclined to protect communities of which they do not believe they are a member.

Moreover, individual familiarity with neighborhoods may pose a challenge for defensible space interventions. While changes to the built environment indeed may assist in separating public and private spaces, individuals who identify themselves as a part of the community or frequent the area and wish to commit crime may not be deterred (Brantingham and Brantingham 1993; Cohen and Felson 1979). Others (Atlas 1991; Mawby 1977) go further, arguing that defensible space and CPTED features may work to create offensive space for individuals committing illicit acts. Here, individuals still develop a sense of ownership of their neighborhood but use the defensible built environment for surveillance to work against other residents of the community.

**St. Louis**

One possible explanation for the mixed track record of defensible space could lie in St. Louis itself. Defensible space seeks to address what Newman (1996), along with others (Blake 1977; Jencks 1977), sees as the monumental failure of design in Pruitt-Igoe. There is, however, a counter-narrative that the demise of Pruitt-Igoe was not the ultimate failure of design, but the predictable outcome of structural inequality. St. Louis has been a laboratory for housing segregation, the victim of significant population loss (see FIGURE 2; by 2017, St. Louis ultimately lost two-thirds of the 855,000 resident population in 1950) and white flight, and a perpetually limited municipal budget that has made maintaining public
housing difficult (Gordon 2009; Tighe and Ganning 2015). These dynamics, combined with a lack of sufficient federal funds for maintenance, it can be argued, all but ensured the demise of not just Pruitt-Igoe but the Robert Taylor Homes, Cabrini Green, and others (Bristol 1991; Heathcott 2012). They also help us understand the pattern of rising crime over the same period (see FIGURE 2), and suggest that defensible space may have an inconclusive track record because the design of public space is not the core issue, but rather the structure of society within which that design is realized.

<<<FIGURE 2 ABOUT HERE>>> 

The idea that Pruitt Igoe’s design was to blame rapidly took hold (Bailey 1965; Blake 1977; Jencks 1977), despite alternative possibilities in St. Louis and elsewhere, thus creating a market for Newman's ideas. In the shadow of Pruitt-Igoe's final destruction at the hands of dynamite and the wrecking ball, 1970s St. Louis became not just the inspiration for Newman's work but the site of an early, vigorous implementation of these ideas. From 1977 through the early 1990s (and sporadically after that), St. Louis erected at least 325 barriers, closing streets to through traffic with the intention to “enhance and increase the stability of the neighborhood adjacent to said street” (St. Louis City Ordinance 62459). The City made these installations in response to what Newman described as:

“St. Louis in the mid-1960s was a city coming apart...It had one of the Nation’s highest crime rates, but the private streets appeared to be oblivious to the chaos and abandon-ment taking place around them.” (Newman 1996:13)

City planning documents from the early 1970s note both of these trends. The 1973 St. Louis Development Program lays out in stark terms the dramatic population loss many cities were experiencing, including growing rates of vacancy and tax delinquency, and increasing crime rates. Critically, the report also notes:

“There are many streets whose primary purpose is not to carry through traffic. Their function is to serve residential neighborhoods safely. In recent years...there has been a growing tendency for extraneous traffic to usurp these local streets... [and this] has contributed to the debilitation of many residential neighborhoods. Consequently, new methods must be found to correct this unsatisfactory traffic condition” (City of St. Louis 1973: 76).
Within approximately a year of the initial publication of Oscar Newman’s (1972) work about St. Louis then, there is a deliberate expression of the need to close residential neighborhoods to traffic by the City of St. Louis that endorsed the use of closures as a crime prevention strategy. This is followed by a second Newman publication specifically discussing the use of road closures a short time later (Newman, Grandin, and Wayno 1974).

Importantly, the City has not maintained a master list of these closures (Thorsen 2015). Our first aim presently is, therefore, descriptive — to understand the geography of street closures in St. Louis. Our second objective is analytical and has two facets. Given the location of these barriers, we seek to understand what commonalities exist between communities with a high density of barriers and to discern whether or not barriers do have an impact on specifically violent crime within these communities. We hypothesize that if street barriers are a successful policy tool for designing out crime, there should be a negative relationship between the number of barriers in a neighborhood and the number of violent crimes.

Data and Methods

Data

Our data set is the product of four individual data sources. To locate street barriers, we identified an initial list of street barriers from a Washington University in St. Louis) term paper that examined the barriers phenomenon (Waldron 2010). From this list, we used the City’s orthoimagery, Google Street View, and fieldwork visits to identify which barriers are still in place. Checking against these additional sources resulted in a publicly available data set of point data describing the locations of barriers,¹ which in turn was subset to create a data set of barriers known to remain in existence in 2016 (n = 280).²

Second, publicly available address-level crime data were obtained from the St. Louis Police Department. Third, census tract-level data from the 2016 American Community Survey 5-year estimates were procured. These data were used to construct explanatory variables for modeling the locations of both barriers and violent crimes. Fourth, to measure census tract-level changes over time, we utilized the Brown University Longitudinal Tract Database (LTDB; Logan, Xu, and Stults 2014; Logan, Stults, and Xu 2016). Census tract boundaries often shift from census to census, making it difficult to measure
temporal variation at the census tract level. The LTDB solves this problem by interpolating historical census tract data for current census tract boundaries, providing researchers a stable areal unit throughout time.

Census tracts can be a problematic unit of analysis because they are drawn irregularly and therefore are prone to wide variation in the number of adjacent units associated with each census tract (Maimaitijiang et al. 2015). To achieve a relative normalization of the number of neighbors across each unit of analysis, we spatially interpolated tract-level data into one-square kilometer grid squares, estimating grid-level data based on the census tracts that intersected with each grid square and the size of those intersections. The creation of the grid "fishnet" yielded a dataset with 205 grid squares with corresponding demographic attributes as well as a count of barriers known to still exist within each grid. This analytical data set is also available for public download as part of this manuscript's Open Science Framework repository.3

Methods

We conducted our initial descriptive analysis by mapping the point data for barrier locations using kernel density techniques in ArcGIS Desktop. We also used ArcGIS for producing interpolations and grid square mapping. To address our second aim, we conducted ordinary least squares (OLS) and spatial regression analyses using the pysal package (Anselin and Rey 2014) for Python to understand which social factors are associated with the current placement of street barriers, as well as to determine whether or not barriers have been an effective policy tool for designing out violent crime. Spatial regression analysis is a useful method because, unlike OLS, it can account for spatial autocorrelation or the correlation of a variable with itself throughout space.4

For these analyses, our two dependent variables were street barriers per grid square and violent crimes that occurred in the year 2016 per grid square. Because each variable was already spatially normalized by virtue of the uniform size across each areal unit (with the exception of grid squares on the city’s edges, which are smaller than a full square kilometer grid square and vary in size), we opted to
preserve each dependent variable in count form rather than convert them into rates. With each model, we aimed to ascertain the social variables associated with barrier placement and violent crimes as of 2016.

Due to the racialized development history of St. Louis, in which African American residents have been particularly marginalized (Gordon 2009; Tighe and Ganning 2015), we included proportion African American residents in each grid square as a predictor. We reason that perceptions of racial threat (e.g. Eitle, D’Alessio, and Stolzenberg 2002; Parker, Stults, and Rice 2005), in addition to the persistent marginalization of African American neighborhoods throughout the history of St. Louis, has made grid squares with significant proportions of African American residents the target of more barrier installations. Given St. Louis’s systemic population loss since the 1970s, we also controlled for proportional population change since 1970 and the 2016 vacancy rate, a known outcome of systemic urban decline (Prener, Braswell, and Monti 2018; Silverman, Yin, and Patterson 2013). Finally, total population and the 2016 poverty rate are included as control variables. For the violent crime models, we regress on the same predictors used in the street barrier models, with the addition of barrier counts per grid square. We include descriptive statistics for all variables in TABLE 1.

\[<<<\text{TABLE 1 ABOUT HERE}>>\]

Results

Spatial Distribution of Barriers and Violent Crimes

Both street barriers and violent crime are unevenly distributed in St. Louis. Though the mean street barrier count per grid square is 1.37, the standard deviation is more than double it at 2.77. The kernel density map shown in FIGURE 3 provides visual specificity, showing that barriers are densely concentrated in areas proximate to both sides of Delmar Boulevard, whereas barrier distribution in the northernmost and southeastern parts of the city are far more sparse. FIGURE 4, which shows the distribution of street barriers and violent crimes across grid squares, tells a similar story—the grid squares with the highest concentration of obstacles either straddle or are proximate to Delmar Boulevard. The mean number of violent crimes per grid square is 28.07, but a standard deviation of 33.28 shows a
similarly high level of variability. FIGURE 4 shows an overwhelming concentration of violent crime in North City and pockets of the southwestern portion of the city. Large swaths of the southeastern part of the city are devoid of barriers and have relatively low rates of violent crime.

Modeling Street Barriers Locations

TABLE 2 presents regression models for street barrier location. To deal with heteroskedastic errors, all models use White standard errors. The OLS results shown in Model 1 show a positive, significant association between proportion African American and street barrier counts. Population change since 1970 yielded a negative relationship with street barrier counts ($b = -3.929, p < .001$), whereas population in 2016 was positively associated with barrier counts ($b = -0.0007, p < .001$).

However, in addition to evidence of heteroskedasticity shown by the statistically significant Breusch-Pagan test ($56.390, p < .001$), diagnostics for spatial dependence suggest the presence of spatial autocorrelation, a known source of statistical bias. Therefore, Model 2 shows a generalized method of moments (GMM) spatial lag model, which is robust to heteroskedastic errors and can account for spatial autocorrelation (Anselin and Rey 2014).

The statistically significant spatial lag variable in Model 2 ($b = 0.504, p < .05$) shows that street barriers are indeed spatially correlated, meaning that grid squares with high street barrier counts are likely to be located next to other grid squares with street barriers. Proportion African American residents lost statistical significance, while population change since 1970 maintained both its statistical significance and directionality ($b = -2.421, p < .05$). Of note, the pseudo R-squared of .443 shows significant improvement over the OLS model, but the spatial pseudo R-squared of .189 is still indicative of a relatively poor model fit.
**Modeling the Relationship Between Barriers and Violent Crime**

TABLE 3 shows regression models for violent crime counts. Model 3 is a bivariate regression in which the only predictor is the number of street barriers per grid square. The results yield a positive, strong relationship between barriers and violent crime, with the addition of a street barrier associated with an additional 3.85 \((p < .001)\) violent crimes per square mile. However, with an R-squared of .103 and evidence of spatial dependence, the model is underspecified.

Model 4 includes the remainder of the regressors, showing positive relationships between proportion African American residents, the vacancy rate, and total population with violent crime. Street barrier count narrowly lost its statistical significance \((p = .058)\). With over 60 percent of the variance in violent crime explained, model fit improved significantly but continued to show signs of spatial dependence, as well as the presence of heteroskedastic errors.

To account for these issues, Model 5 is a GMM spatial lag model. The statistically significant spatial lag variable indicates that grid squares with higher crime rates are predictive of high crime rates in neighboring grid squares. The measure of the proportion of African American residents lost its statistical significance, whereas the vacancy rate remained a strong predictor of violent crime \((b = 85.217, p < .01)\). Population counts remained positive and statistically significant \((b = 0.015, p < .001)\). Street barrier counts returned to statistical significance, with an increase per street barrier associated with an increase in violent crimes \((b = 1.277, p < .05)\). The statistically insignificant Anselin-Kelejian test indicates that the inclusion of the spatially lagged variable eliminated further concerns of spatial dependence, and the pseudo r-squared (0.6893) and spatial pseudo r-squared (0.6136) show relatively strong model fit.

<<<TABLE 3 ABOUT HERE>>>
narrow area of St. Louis along Delmar Boulevard. Delmar Boulevard, is a widely recognized line of demarcation in the geographic imagination of many St. Louis residents. The ‘Delmar Divide’ thus represents the spatial segregation of North City, which is predominantly African American, from the integrated communities of the central corridor and the predominantly white communities of South St. Louis. Analytically, we also aim to understand the relationship between neighborhood demographic factors and barrier density. We find the strongest evidence for neighborhood population loss, suggesting that barrier installation may have been motivated in part by the ongoing shrinkage of the city's population. Population loss in St. Louis has been widespread but is mainly concentrated in the same North City neighborhoods where barrier density is also high.

Our other analytical goal is to understand the degree to which barrier density affects violent crime within neighborhoods. Our hypothesis, following the longstanding aim of the barriers articulated both in policy documents and the local media, anticipated a negative relationship between violent crime and barrier density at the neighborhood level. Counter to this hypothesis, we find evidence that not only are barriers not factors in decreasing crime, but they are associated positively with violent crime rates holding other factors related to crime rates constant.

It is possible that there is no causal relationship between barriers and crime. In this narrative, obstacles happen to be located in neighborhoods with higher crime rates and are merely ineffective at limiting crime within these spaces. Such an argument, however, would contradict their reason for existing as expressed in the City's Board of Alderman bills that have authorized recent closures. Whether barriers are, at worst, associated with higher crime rates or, at best, ineffective, they present a contradictory face — their official reason for existence as a crime prevention tactic does not hold with contemporary crime patterns, yet they remain entrenched throughout the city.

The persistence of St. Louis's street closures in this light are intriguing and an avenue for future work. It is likely that residents remain mostly unaware of their effectiveness (or lack thereof). It is also possible that the barriers' creation of cul-de-sacs appeals to residents for traffic safety reasons or because they desire the feel of a more suburban neighborhood. Both would provide strong public motivations for retaining the barriers despite their lack of impact on violent crime.
Nevertheless, we believe that our findings raise important questions for City officials. While there may be second-order benefits for residents who live on closed blocks, it is also possible to have second-order negative consequences. The City of St. Louis’s Fire Chief, for example, explicitly condemned the closures in 2009 after a shooting on a closed street: “This has been an ongoing concern of the fire department's. We don't like [the barriers]. They severely impede what we do” (Allen 2014). In light of our findings, City officials would do well to question whether the possible unintended consequences of delayed first responders are worth the continuation of these closures.

City officials should also consider what other unintended consequences of closures might exist, including inefficient public transit and school bus routes, the viability of businesses within neighborhoods with higher densities of closures, and the capital costs associated with maintaining and upgrading barriers over time. Given the significant challenges facing St. Louis, including segregation, vacancy, and population loss (Gordon 2009; Prener, Braswell, and Monti 2018; Tighe and Ganning 2015) as well as continuing elevated rates in crime, we wonder if more active crime prevention strategies including those that address deep-seated social issues deserve priority over the cost of maintaining these street closures.

Beyond the City of St. Louis, our findings suggest that cities should implement defensible space strategies like street closures with caution. They are in line with other analyses (e.g., Reppetto 1976; Gabor 1981) that question the efficacy of defensible space as a method for controlling crime. These data also provide a telling example of how even well-meaning interventions to reduce crime may not be able to "design out" crime if they do not deal with more fundamental factors that drive violence in cities.

Limitations

One important caveat for our analyses is that we do not have address-level crime data from the period when the most significant number of barriers were installed (from 1977 through the early 1990s). Thus, we are unable to measure the degree to which the barriers themselves worked or did not work early in their existence. The overall trend in crime (see FIGURE 1) did continue, mostly unabated, after the barrier installations began. A second essential and related caveat is that we do not measure the hyper-local effects of barriers. It is possible that, while there is a positive relationship between barrier density and
crime rates at the neighborhood level, closed blocks themselves experience less crime. This second caveat is the direction we intend to take in future research. A third caveat has to do with the spatial maldistribution of both population and violent crime in St. Louis, which leads to high standard deviations for both measures. These variations are an important feature of our data that shapes our final results.

A fourth and final source of error lies within our demographic data. The American Community Survey’s (ACS) five-year estimates are subject to a degree of error, and this can be compounded by the simultaneous aggregation and disaggregation of count data through the areal interpolation process. While we have tools to express the margin of error within the ACS, we lack similar ways to express the uncertainty of estimates created using areal weighted interpolation. This unquantified error is also an important source of limitation for our results.

Conclusion

Oscar Newman’s defensible space theory is a product of St. Louis’s mid-century history. It is perhaps unsurprising, therefore, that St. Louis also offers a large-scale implementation of defensible space in the street barriers that constrict swaths of the city’s geography. The barriers scattered across the city’s landscape are a testament not only to former Mayor Vincent Schoemehl, the elected official most closely associated with the barriers, but to Newman himself. We have developed the most comprehensive known list of closures in the city, and find that the density of closures is not associated with less crime in neighborhoods. Our finding is an important one for St. Louis, given that addressing crime is the argument being made explicitly in the legislation that authorizes more recent installations of barriers. For other municipalities that may be considering defensible space or other techniques to "design out" crime, our findings suggest that street closures are at best ineffective and at worst associated with higher rates of violent crime in neighborhoods. They may also have secondary effects on first responders’ ability to reach the neighborhoods they serve.
Notes

1 The data representing barrier locations can be downloaded and cited via:

https://zenodo.org/record/1432531

2 Barriers that are known to have been removed prior to 2016, those added after 2016, and closures of streets as part of redevelopment projects that fundamentally change the streetscape are not included (n = 45).

3 The analysis data set can be downloaded and cited via: https://osf.io/sxuze/

4 To calculate the extent of spatial autocorrelation for each areal unit, a spatial weighting system takes into account the values of neighboring features. When using the rook spatial weighting system (categorizing neighbors as grid squares that border on a unit’s edges but not those that only touch its corners), 150 had four neighbors, 22 had three neighbors, and 33 had two neighborhoods.
References


# Tables

**TABLE 1 - Descriptive Statistics per Square Kilometer in St. Louis**

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<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
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<td>Barrier Count</td>
<td>1.366</td>
<td>2.769</td>
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<td>14</td>
</tr>
<tr>
<td>African American (2016)(^a)</td>
<td>0.549</td>
<td>0.339</td>
<td>0.017</td>
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<tr>
<td>Below Poverty Line (2016)(^a)</td>
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<td>0.129</td>
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<td>Population Change (1970-2016)(^a)</td>
<td>-0.424</td>
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<td>-0.830</td>
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<tr>
<td>Vacancy (2016)(^a)</td>
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<td>0.105</td>
<td>0.028</td>
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<td>Population Count (2016)</td>
<td>399.590</td>
<td>363.959</td>
<td>0.006</td>
<td>1955.264</td>
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</table>

*Notes:*

\(^a\) - proportion
<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1 (OLS)</th>
<th>Model 2 (GMM)</th>
</tr>
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<tr>
<td>African American (2016)^a</td>
<td>2.227 (1.031)^*</td>
<td>1.672 (0.882)</td>
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<td>Below Poverty Line (2016)^a</td>
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<td>Population Change (1970-2016)^a</td>
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<td>-2.421 (0.989)^*</td>
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<td>Vacancy (2016)^a</td>
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<td>0.0004 (0.00016)**</td>
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<td>Spatial Lag Term</td>
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<td>Constant</td>
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<td>F-statistic</td>
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<td>Adjusted $R^2_b$</td>
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<td>Spatial Pseudo $R^2$</td>
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<tr>
<td>Breusch-Pagan test</td>
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</tr>
<tr>
<td>Diagnostic for Spatial Dependence^c</td>
<td>51.157***</td>
<td>0.202</td>
</tr>
</tbody>
</table>

Notes:
* - $p < .05$; ** - $p < .01$; *** - $p < .001$
^a - proportion
^b - Refers to a pseudo measure of $R^2$ in the case of GMM models
^c - Langrange Multiplier (lag) for OLS models and the Anselin-Kelejian test for GMM models
TABLE 3 - Modeling the Relationship Between Barrier Density and Violent Crime per Square Kilometer, 2016

<table>
<thead>
<tr>
<th>Variables</th>
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<th>Model 4 (OLS)</th>
<th>Model 5 (GMM)</th>
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</tr>
<tr>
<td>African American (2016)(^a)</td>
<td>-</td>
<td>20.083 (7.068)**</td>
<td>13.882 (7.20)</td>
</tr>
<tr>
<td>Vacancy (2016)(^a)</td>
<td>-</td>
<td>101.502 (32.443)**</td>
<td>85.217 (27.656)**</td>
</tr>
<tr>
<td>Population Count (2016)</td>
<td>-</td>
<td>0.020 (0.002)***</td>
<td>0.015 (0.002)***</td>
</tr>
<tr>
<td>Spatial Lag Term</td>
<td>-</td>
<td>-</td>
<td>0.353 (0.142)*</td>
</tr>
<tr>
<td>Constant</td>
<td>22.809 (2.414)***</td>
<td>-38.942 (6.206)***</td>
<td>-30.956 (5.925)***</td>
</tr>
</tbody>
</table>

| F-statistic                           | 23.253***         | 51.075***         | -                 |
| Adjusted \(R^2\)\(^b\)               | 0.098             | 0.596             | 0.689             |
| Spatial Pseudo \(R^2\)                | -                 | -                 | 0.614             |
| Breusch-Pagan test                     | .039              | 119.040***        | -                 |
| Diagnostic for Spatial Dependence\(^c\) | 115.877***        | 40.022***         | 1.401             |

Notes:
* - \(p < .05\); ** - \(p < .01\); *** - \(p < .001\)
\(^a\) - proportion
\(^b\) - Refers to a pseudo measure of \(R^2\) in the case of GMM models
\(^c\) - Langrange Multiplier (lag) for OLS models and the Anselin-Kelejian test for GMM models
Figure Captions

FIGURE 1 - “Schoemehl Pot” style street barriers in the Vandeventer neighborhood of St. Louis. These are concrete “pots” that are typically filled with soil and sometimes plantings.


FIGURE 3 - K-density Map of Street Barriers in St. Louis

FIGURE 4 - Street Barriers and Violent Crimes (2016) per Square Kilometer in St. Louis
Figures

FIGURE 1
FIGURE 2

Vertical line represents first street barrier installation (1977).
FIGURE 3

Breaks classified using the Jenks Natural Breaks method.
FIGURE 4

Barriers per Grid Square

0
1 - 3
4 - 6
7 - 9
10 - 14

Violent Crimes per Grid Square

0
1 - 19
20 - 51
52 - 101
102 - 202

Notes:
Breaks selected using the Jenks Natural Breaks method
NAD 1983 State Plane Missouri
East projected coordinate system
each grid square is one square kilometer