Spatial Regression of Juvenile Delinquency: Revisiting Shaw and McKay

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Abstract
This paper re-examines the seminal work of Shaw and McKay (1942, 1969) on the spatial analysis of crime using modern statistical regression techniques as a test of Social Disorganization Theory. Data from the hand-drawn maps in the book Juvenile Delinquency in Urban Areas were transcribed and analyzed using four spatial lag and four spatial error regression models. The spatial regression analysis shows families on relief, median monthly rent, homeownership rates, and rates of foreign-born and minority heads of households each have a statistically significant impact on male juvenile crime and delinquency. Distance from the central business district is not significant in any of the models presented. This analysis validates Shaw and McKay's core findings demonstrating why Social Disorganization Theory has become and still is, an important theoretical perspective explaining neighbourhood crime.

Keywords: Social Disorganization Theory, Spatial regression analysis, Shaw and McKay, Juvenile delinquency.

Introduction
In Juvenile Delinquency and Urban Areas Shaw and McKay (1942, 1969) introduce the central concepts of Social Disorganization Theory (SDT). When originally introduced their work challenged the positivist's views which emphasized crime as caused by individual factors (Williams & McShane, 2004). Over time this approach has grown and now represents a dominant theoretical perspective which helps to explain the root causes of crime in communities (Williams & McShane, 2004).

Andre Guerry (1833) and Adolphe Quetelet (1842) began the ‘Cartographic School’ (Kindynis, 2014) which was prevalent in the mid and late 1800s. Their research demonstrated that crime in France varied by season (Ceccato, 2015) and geography (Shaw & McKay, 1942, 1969). They did this by creating maps to show the relationships between crime, poverty and education (Bernasco &Ellfers, 2010; Ratcliffe, 2010).

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In 1925, borrowing from Cartographic School techniques, Ernest Burgess developed the ‘concentric zone’ model (Kindynis, 2014) which proposed that cities had a central business district (CBD) found at a city’s core, surrounded by a series of concentric circles of varying land-uses. In the CBD’s, crime and social problems were at the highest rate. Burgess hypothesized that by moving away from the CBD, from one circle to the next, social problems within a city declined. According to Burgess, people reacted to these social problems by constantly trying to improve their living conditions by moving further from the city core.

Park et al. (1925) built upon Burgess ideas in *The City*. They identified five specific zones in cities, each 2 miles wide: the central business district, the ‘zone in transition’, (which consisted primarily of run-down housing), the working-class zone, the middle-class housing zone and the affluent suburbs. With the publication of *The City* Park is credited with starting the Ecological School of Crime, also known as the Chicago School (McLaughlin & Muncie, 2012).

The Ecological approach focuses on explaining why crime is concentrated in some neighbourhoods but not in others (Stark, 1987). The emphasis, within the ecological school, on crime by area distinguished the approach from Biological Positivists operating in the early 1900’s. The Biological Positivists approach to explaining crime focused upon heredity and other biological factors arguing that individuals were born with a propensity to commit a crime (White, Haines, & Eisl er, 2013; Williams & McShane, 2004). In contrast, Ecological approaches focused on the impact of the conditions at geographic locations on crime.

In the *Juvenile Delinquency in Urban Areas* and the revised second edition, Shaw and McKay (1942, 1969) took an Ecological approach to explain crime. Though this study does not expressly use the phrase “social disorganization theory”, it is widely regarded as a seminal work on the subject (Andresen, 2006; McLaughlin & Muncie, 2012; Sampson & Wilson, 1995). The book demonstrates the theory by examining juvenile delinquency in a number of American cities. In early chapters of the revised edition Shaw and McKay discuss the city of Chicago over three time periods, 1900 to 1906, 1917 to 1923, and 1927 to 1933. The middle chapters explore juvenile crime in the cities of Philadelphia, Boston, Cleveland, Cincinnati, and Richmond. Finally, the book concludes by returning to Chicago and the surrounding suburbs reviewing delinquency issues from 1934 to 1966. The revised edition cuts sections found in the original edition on Columbus, Birmingham, Denver, Little Rock, Seattle, Portland, Oregon, Spokane, Tacoma, Evansville, Peoria, Omaha, Baltimore, Minneapolis and St. Paul, and Vancouver, British Columbia.

In their examination of Chicago from 1900 to 1933 Shaw and McKay focus on male juvenile delinquents. Building on the work of Park, Burgess, and McKenzie they find that delinquency tends to be concentrated near the central business district in the city centre or near outlying industrial areas. Shaw and McKay expand on these observations and note a number of other factors in Chicago which on a square mile basis correlate with juvenile delinquency. Positively correlating variables included infant mortality rates, tuberculosis rates, trunancy rates, rates of mental health issues, percentage of families on relief, percentage of immigrant and minority heads of families, juvenile recidivism rates, juvenile court appearances, and juvenile commitments. Median rental cost negatively correlated with juvenile delinquency. In addition, Shaw and McKay found that delinquent areas are stable over time. They note specifically that the 12 square mile areas with the highest rates
of delinquency from 1900 to 1906 are the same from 1927 to 1933. In explaining this stability Shaw and McKay make a major theoretical contribution to the literature. Shaw and McKay (1969) introduce, what is currently called, Cultural Transmission Theory (Williams & McShane, 2004) to explain the stability in delinquency rates over time.

[C]ontact [between youth delinquents and adult offenders] means that the traditions of delinquency can be and are transmitted down through successive generations of boys, in much the same way that language and other social forms are transmitted. (p. 174)

Shaw and McKay (1969) demonstrate that in areas with “low economic status” (p. 171) moral values take hold “in direct opposition to conventionality as symbolized by the family, the church, and other institutions common to our general society”. Enough successful gangs and other adult criminals possessed these contrary values that they compete with the “conventional” moral values of society. Parents, the church and other institutions are still able to instil conventional values in some individuals, but many youths also learn “unconventional behavior” (p. 175) which leads to the proliferation of crime in the neighbourhood.

A series of case studies of youth demonstrates the transmission of deviant values. In these cases, one generation of delinquent youths encourages the next to adopt delinquent values. This next generation then introduces delinquency to the subsequent generation, creating a vicious cycle. For example, one interviewee describes his induction into a gang.

One day when I was about nine, we were caught by the gang that beat me up my first day home from the orphanage. They wanted us to join their gang I saw we would get the worst of it, so I made a bargain with them. I told them to let James (my brother) alone, and if they did, I would join their gang. They wanted us both and I pleaded and begged. Finally, the leaders, the fellow that gave me the beating, agreed…The gang was about thirty strong. They would steal milk off porches, bread from bread boxes, steal from peddlers and take kids’ lunch money from them. At first I just watched them. (Shaw and McKay, 1969, p. 178)

The interviewee then describes his first crime. “When my turn came, I wanted to back down. I was shaking like a leaf. They threatened to jump me so I took the hammer and busted a machine with gum balls” (p. 178) [Italics in original]. Once initiated the boy becomes further involved in the gang and he begins to make a lot of money. This makes his younger brother want to join as well. Eventually, the interviewee becomes the leader of the gang. He adds his brother to the gang and teaches him how to steal purses. Thus, despite the interviewee's initial efforts to protect his brother from becoming a member of the gang he ultimately becomes directly responsible for his joining. This completes a full cycle of the transmission of deviant values with the interviewee accepting the values himself and then transmitting them to his brother.

Shaw and McKay, in a section titled “differential social organization” (p. 183), elaborate on a number of methods for the transmission of deviant values in lower status economic areas. First, family’s attempts to instill conventional values are neutralized because one family member is often making money from illegal activities (as was
demonstrated in the previous case study). Second, youth typically identify more with their peers than their parents. Third, Shaw and McKay describe this as a new problem which does not yet have a solution. The issue is a result of the increase in leisure time youth have in cities. This was not typically a problem in the ‘Old World’ or in rural farming communities where children are busy with chores. The solution to harsh punishment, which some parents have tried, often only reinforces peer connections, thus further undermining conventional values. Finally, Shaw and McKay noted that the solution of outside agencies trying to ‘fix’ the problem is also failing.

If the school or playground adapts its program in any way to local needs and interests, with support of the local sentiment, it becomes a functioning part of the community; but instead, it is often relatively isolated from the people of the area, if not in conflict with them. (Shaw & McKay, 1969, p. 186).

Since these programs designed to support the local community tend not to be adapted to local needs, they are ineffective at combating the spread of deviant values from one generation to the next.

Shaw and McKay do not use the words ‘social disorganization’ in their original edition of *Juvenile Delinquency and Urban Areas* and in the revised edition the only mention it once.

It is likely that the forces which lead to a segregation of the groups with lowest economic status in deteriorated areas are related to the forces which make for social disorganization and a breakdown of community controls within these areas (Shaw & McKay, 1969, p. 290).

The only other references to SDT worth noting, as was previously mentioned, occurs when Shaw and McKay use “differential social organization” as a section title in both the first and revised editions and in the introduction to the revised edition where Short uses the words “social disorganization”. Despite not initially naming their theoretical approach, their work had a widespread impact (White et al., 2013; Williams & McShane, 2004). SDT helped to inspire future criminological theories such as Social Control Theory and Differential Association Theories (Williams & McShane, 2004). In addition, many scholars have used SDT as the framework for their own studies.

The breadth of research influenced by Shaw and McKay is widespread and has lasted decades (White et al., 2013). In the past five years, researchers using the SDT have tested the theories ability to explain a wide variety of youth and adult crimes. For example, Law and Quick (2013) show SDT has applicability for explaining the location of young offenders in Toronto. Grubesic (2010) demonstrates SDT can help explain the location of sex offender clusters. LaRue and Andresen (2015) use SDT as a framework for examining rates of burglary, robbery and motor vehicle theft. Benson et al (2003) find SDT can even be used as the basis for explaining intimate partner violence occurring primarily within the home environment despite the theory’s emphasis on the neighbourhood.

Much of this recent interest in SDT can be traced to the Project on Human Development on Chicago Neighbourhood (PHDCN). The PHDCN examined the impact neighbourhoods have on childhood development. The research focused on juvenile delinquency, adult crime, substance abuse and violence. The approach responded
directly to criticisms of the lack of research directly measuring social disorganization (Bursik, 1988). The PHDCN overcame the issues surrounding the direct measurement of social disorganization through a study design which included in-person survey interviews with over 8,700 residents, 2,822 expert interviews and 27,000 block by block observations of disorder (Earls & Visher, 1997). The research subsequently resulted in numerous publications that expanded SDT and the understanding of crime and victimization at the neighbourhood level. For example, Sampson and Raudenbush (2001) confirm elements of SDT finding it is “neighbourhood cohesion and informal social control...that most affect crime” (p. 4). The most notable contribution to SDT as a result of the PHDCN was the addition of the concept of Collective Efficacy to the theory.

Sampson, Raudenbush & Earls (1997) present Collective Efficacy as a central concept of SDT. Expanding on the work of Shaw and McKay they show that concentrated disadvantage alone does not cause crime but it does influence community norms. The mechanism by which they do this is through Collective Efficacy. They explain Collective Efficacy as “the differential ability of neighbourhoods to realize the common values of residents and maintain effective social controls” (Sampson et al., 1997, p. 918). Later they expand on this definition explaining:

Collective Efficacy refers to mutual trust among neighbors combined with willingness to intervene on behalf of the common good, specifically to supervise children and maintain public order (Sampson, Raudenbush, & Earls, 1998, p. 1).

This concept of Collective Efficacy is indeed a logical additional component of Shaw and McKay’s original work as it provides the missing link between neighbourhood economics and the transmission of values. The work of Shaw and McKay (1969) foreshadows the addition of collective efficacy with their research in Richmond where they find “variations in the amount of control exercised by the community, and variations in extent of possible contact with criminals or criminal traditions.” (Shaw & McKay, 1969, p. 312) leads to variations in delinquency rates.

Shaw and McKay (1969) explicitly focus on the community context in explaining crime. “Our attention has been focused too much upon the individual delinquent and not enough upon the setting in which delinquency arises.” (p. 326). They also recognize the importance of a community instilling ‘conventional’ values in youth. When communities fail to do this Shaw and McKay argue “delinquency has developed in the form of a social tradition, inseparable from the life of the local community” (1969, p. 316). Collective Efficacy provides the key link between communities with ‘low-economic status’ and crime, as discussed by Shaw and McKay. Collective Efficacy is correlated with socio-economic status, residential stability and homeownership levels (Sampson & Raudenbush, 2001) hence why these factors help to explain crime. However, areas with high Collective Efficacy and other economic challenges tend to have lower crime rates (Sampson et al., 1998, 1997) as social bonds and individuals willingness to intervene to protect their community reduce crime.

With the revival of interest in SDT, scholars have begun to use a variety of spatial statistical techniques to test elements of the theory. Their approaches rely on the computational power of modern computers and thus were not available to Shaw and McKay. Law and Quick (2013), for example, use Bayesian techniques to demonstrate that
young offenders in York Region Ontario relate to socio-economic variables consistent with SDT. They find young offenders’ locations positively related to residential mobility, government transfers and ethnic heterogeneity. Each of these variables is consistent with Shaw and McKay’s (1969) discussions of ‘low-economic status’ and each of these variables relates directly to the concept of Collective Efficacy. Interestingly, also consistent with the concept of Collective Efficacy, Law and Quick (2013) find that immigrant status was not related to the location of young offenders. Instead, ethnic heterogeneity was the causal factor. This is also consistent with the work of Sampson et al (1997) who found that immigrant concentration was not associated with homicide, but it was negatively associated with Collective Efficacy. These findings are consistent with SDT and suggest that Collective Efficacy is caused by the breaking down of social bonds in a community. Immigration’s influence on social bonds typically results in more close-knit communities. However, if immigrants from different backgrounds settle in the same community this results in ethnically diverse neighbourhoods where there are weak associations between individuals due to their different backgrounds. This results in lower Collective Efficacy. Shaw and McKay (1969) gathered evidence in support of these findings.

In communities occupied by Orientals, even those communities located in the most deteriorated sections of our large cities, the solidarity of Old World cultures and institutions has been preserved to such a marked extent that control of the child is still sufficiently effective to keep at a minimum delinquency and other forms of deviant behavior. (p. 320)

The work of Ouimet (2000) adds nuance to these results using regression analysis (a standard technique today but one not available to Shaw and McKay) to demonstrate that immigration patterns impacted delinquency rates, with areas with immigrants from Asia and India having fewer delinquents and areas with immigrant from Haiti, Jamaica, and French Africa having higher rates of immigrants (it is worth repeating that Ouimet notes that these findings are ecological and cannot be translated to the individual). These patterns are again consistent with the concept of SDT as presented by Shaw and McKay but they complicate the picture for Collective Efficacy, suggesting further research is needed.

Shaw and McKay were limited to correlation analysis in their original work. Fortunately, their book Juvenile Delinquency and Urban Areas contain maps with their detailed raw data for rates of male juvenile delinquency, male juvenile commitments, male court offenders, male school truancies, families on relief, median rentals, home ownership, and minority and immigrant heads of households. By inputting this data into a computer spreadsheet, it is possible to re-test the original findings of Shaw and McKay (inputting this data also creates an appreciation for the amount of work Shaw and McKay completed to conduct their original study). This study aims to re-evaluate the work of Shaw and McKay using modern statistical techniques. It will specifically test if their original conclusions on the connections between male juvenile delinquency and “low economic status” in Chicago hold when accounting for spatial dependency and examining multiple variables at once. Through this analysis, clarity will be provided on the importance of the different variables tested by Shaw and McKay and the strength of the relationships between variables when controlling for the impact of multiple variables and spatial influences.
Methodology

Shaw and McKay (1942, 1969) demonstrated the connection between the neighbourhood and juvenile crime using case studies and correlation analysis. Using data from Shaw and McKay’s 1969 book this study revisits these findings using modern spatial regression analysis, which became widely used after the 1979 publishing of Spatial Econometrics by Jean Paelinck and Leo Klaassen (Anselin, 2010). This research focuses on the period from 1927 to 1933. Shaw and McKay (1969) examine three time periods in their study from 1900 to 1906, 1917 to 1923, and 1927 to 1933. The book provides a number of hand-drawn maps with data provided on a square mile block throughout Chicago. Unfortunately, these maps are not consistently provided for all time periods. The period from 1927 to 1933 contains the most maps and provides these maps with consistent geographies.

Data for analysis is pulled from eight maps of Chicago which divide the city into 140 square mile blocks. The maps list rates for the square mile block written out by hand. Male juvenile delinquent rates, for example, are 0.5 in Block 1, 0.5 in Block 2 and continue on in this manner to Block 140 which has a rate of 1.8. The data from these hand-drawn maps were typed into a spreadsheet file for analysis using the statistical program R.

Shaw and McKay (1969) have four questions which are appropriate to use as dependent variables for analysis. The first dependent variable explored is male juvenile delinquent rates from 1927 to 1933. From 1927 to 1933 there were 8,411 male juvenile delinquents. The mean rate is 4.2 for the City of Chicago as a whole and when examining the 140 square mile blocks in Chicago the median rate is 2.5.

Shaw and McKay (1969) share a map of male juvenile commitment rates from 1927 to 1933. From 1927 to 1933 there were 2,593 male juvenile commitments to prison. The mean rate is 1.8 for the City of Chicago as a whole and when examining the 140 square mile blocks in Chicago the median rate is 1.2. Male truant rates from 1927 to 1933 are also shared by Shaw and McKay (1969). A total of 3,653 male truants are reported in this time period for a mean rate of 1.8 and a median of 1.1. Finally, Shaw and McKay also include data from 1938 on the number of boy court offenders. There were 4,060 court offenders this year for a mean rate of 3.6 and a median of 2.5.

### Table 1. Dependent Variables

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Cases (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Juvenile Delinquent Rates 1927 to 1933</td>
<td>4.2</td>
<td>2.5 (2.7*)</td>
<td>8411</td>
</tr>
<tr>
<td>Male Juvenile Commitment Rates 1927 to 1933</td>
<td>1.8</td>
<td>1.2 (0.7*)</td>
<td>2593</td>
</tr>
<tr>
<td>Male Truants Rates 1927 to 1933</td>
<td>1.8</td>
<td>1.1</td>
<td>3653</td>
</tr>
<tr>
<td>Boy Court Offenders Rates 1938</td>
<td>3.6</td>
<td>2.5</td>
<td>4060</td>
</tr>
</tbody>
</table>

*My replication of the study found slightly different median values as listed.

Shaw and McKay (1969) have four maps which provide useful independent variables for analysis. The first variable is the percentage of families on relief in 1934. According to Shaw and McKay (1969), the mean for the City of Chicago is 13.7% and the median is 10.6%. The second variable is median monthly rent in dollars. Shaw and McKay (1969) did not provide the mean or median of this value. The median was
calculated at $58.14. The third independent variable explored was the percentage of families owning homes in 1930. Once again Shaw and McKay (1969) did not provide the mean or median values. The median value was calculated as 33.6%. The final independent variable taken from Shaw and McKay (1969)’s maps was the percentage of immigrant and minority headed households in 1930. Shaw and McKay (1969) did not provide the mean or median values. The median value was calculated as 49.5.

Table 2. Independent Variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families on Relief 1934 (%)</td>
<td>13.7</td>
<td>10.6</td>
</tr>
<tr>
<td>Median Monthly Rent 1930 ($)</td>
<td>-</td>
<td>58.14</td>
</tr>
<tr>
<td>Families Owning Homes 1930 (%)</td>
<td>-</td>
<td>33.6</td>
</tr>
<tr>
<td>Immigrant &amp; Minority Heads of Families 1930 (%)</td>
<td>-</td>
<td>49.5</td>
</tr>
</tbody>
</table>

In addition, a variable was created that counts the number of square mile blocks each block is from the central business district. The distance from the central business district score was calculated using a queen matrix approach. Under this approach, any block that is touching, even corner to corner, from the central business district is scored as a one. Any block that then touches any of the blocks scored as a one, once again even corner to corner, is scored as a two. This approach continues until all blocks are given a score. The smallest distance score is, therefore, a one. The largest distance score was a twelve.

Each of the dependent variables was tested using a series of regression models containing all of the independent variables. First, an Ordinary Least Squares regression analysis was conducted using these variables and the results of that regression were then tested for autocorrelation. This is necessary to determine if a regression model requires a spatial correction.

Moran’s I is the most commonly used test for spatial autocorrelation (Anselin, 2001). The global Moran’s I equation is as follows: 
\[ I = \frac{1}{N} \sum_{i=1}^{N} \sum_{j=1}^{N} W_{ij} Z_i Z_j \] 
\[ (\sum_{i=1}^{N} Z_i)^2 \] 
where \( I \) is obtained with 1 representing perfect autocorrelation and -1 representing negative autocorrelation. Interpreting these values typically requires converting them to a Z-score. Z-score values above 1.96 indicate spatial autocorrelation significant at the 5% level. The detection of spatial autocorrelation in a regression model requires the use of a spatial regression model. Each of the four models tested in this study had a positive statistically significant Moran’s I value (values ranged from 0.1 to 0.3, see Table 3), thus requiring the use of spatial regression techniques.

Table 3. Moran’s I Values

<table>
<thead>
<tr>
<th>Models</th>
<th>Moran’s I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Juvenile Delinquent Rates 1927 to 1933</td>
<td>0.295***</td>
</tr>
<tr>
<td>Male Juvenile Commitment Rates 1927 to 1933</td>
<td>0.137***</td>
</tr>
<tr>
<td>Male Truant Rates 1927 to 1933</td>
<td>0.317***</td>
</tr>
<tr>
<td>Boy Court Offender Rates 1938</td>
<td>0.336***</td>
</tr>
</tbody>
</table>

* p < .05; ** p < .01; *** p < .001
Spatial lag and spatial error models are the two most common spatial regression techniques. Spatial error models are appropriate in circumstances where autocorrelation is an issue to be addressed but not the main research focus, spatial lag models assess if the variable of interest is impacted by variables in neighbouring areas (Bernalso & Elfers, 2010). When dealing with crime rate data, the spatial error model examines how the clustering of crime rates can be explained by the error terms of independent variables to capture the impact of unmeasured independent variables (Kubrin & Weitzer, 2003). The spatial lag model uses crime rate data from neighbouring areas to assess if “crime in one place may increase the likelihood of crime in nearby locales.” (Kubrin & Weitzer, 2003, p. 394).

The spatial error model and spatial lag models both start with the standard regression model: \( y = X\beta + \varepsilon \). The spatial lag model adds \( Wy \) as a spatially lagged dependent variable, and “\( \rho \) is a spatial autoregressive coefficient, \( \varepsilon \) is a vector of error terms” (Anselin, 2001) to create a new equation as: \( y = \rho Wy + X\beta + \varepsilon \).

In the spatial error model, a “non-spherical error variance-covariance matrix (Anselin & Arribas-Bel, 2011, p. 9)” is added to the general model creating a spatial error model as: \( y = X\beta + \rho W\varepsilon + u \) In this model, the crime rate is \( y \), the matrix of independent variables is \( X\beta \), the spatial weights matrix is \( W \), the measures of the strength of spatial association is \( \rho \), \( \varepsilon \) represents \( y - X\beta \), and the error term is represented by \( u \) (LaRue & Andresen, 2015).

The introduction of the lag or error term thus accounts for the spatial autocorrelation in each model. For example, LaRue and Andresen (2015) use a Spatial Error Model in Ottawa to evaluate SDT and its ability to explain burglary, robbery, and motor vehicle theft, in relation to the two local universities. They implement the spatial error model in their study after finding spatial autocorrelation in their data using Moran’s I. In their regression they test a number of variables consistent with SDT such as unemployment rate, household income, education and distance to downtown. Based on their analysis they conclude “the results of this study were somewhat consistent with the theoretical expectations” (LaRue & Andresen, 2015, p. 207) of SDT.

Since the purpose of this study is to re-evaluate the work of Shaw and McKay, both a spatial error model and a spatial lag model are examined using each of the dependent variables. The spatial error model gives a sense of the spatial influence that is unmeasured by the dependent variables that were available for this study (Kubrin & Weitzer, 2003). While the spatial lag model accounts for the impact of crime rates in neighbouring square mile blocks (Kubrin & Weitzer, 2003), thus recognizing that juvenile delinquency often also impacts adjacent areas. Unfortunately, in both editions of Shaw and McKay’s book (1942 and 1969), they only share maps with the rate data. The results, therefore, could potentially change using a method specifically designed for count data, such as Poisson regression.

Results
The spatial lag regression models were tested first (Table 4 summarizes these results). The first spatial lag regression examined male juvenile delinquency as the dependent variable. The overall model is statistically significant with a Wald value of 39.9. Families on relief, median monthly rent and foreign-born, and minority headed families are each statistically significant in the model. Families owning homes and the distance from the central business district were not statistically significant.
The second model uses male juvenile commitment rates as the dependent variable. This overall model is statistically significant with a Wald value of 12.8. Families on relief, median monthly rent, foreign-born and minority headed families, and families owning homes are each statistically significant in the model. Once again, the distance from the central business district was not statistically significant.

The third model uses male truant rates as the dependent variable. The model is statistically significant with a Wald value of 47.3. Only families on relief and foreign-born and minority headed families are statistically significant. The remaining variables, median monthly rent, families owning homes and distance from the central business, were not statistically significant in model three.

The fourth model uses boy court offender rates as the dependent variable. This model is statistically significant with a Wald value of 31.5. Families on relief, median monthly rent, families owning homes, and foreign-born and minority headed families are each statistically significant in the model. Distance from the central business is the only variable that was not statistically significant in model four.

The fifth model begins the spatial error regressions. Table 5 summarizes the results of the spatial error models. The fifth model conducts a spatial error regression with male juvenile delinquency as the dependent variable. The overall model is statistically significant with a Wald value of 33.7. Families on relief, median monthly rent, families owning homes, and foreign-born and minority headed families are all statistically significant in the model. Only the distance from the central business district is not statistically significant in model five.

Model six uses a spatial error regression with male juvenile commitment rates as the dependent variable. This overall model is statistically significant with a Wald value of 11.3. Families on relief, median monthly rent, families owning homes, and foreign-born and minority headed families are each statistically significant in the model. Once again only the distance from the central business district was not statistically significant.

The seventh model uses male truant rates as the dependent variable. The model is statistically significant with a Wald value of 82.6. Families on relief, families owning homes, and foreign-born and minority headed families are each statistically significant in the model. Both median monthly rent and distance from the central business district are not statistically significant in this model.

The eighth, and final model, uses boy court offender rates as the dependent variable. This model is statistically significant with a Wald value of 31.5. Families on relief, median monthly rent, families owning homes, and foreign-born and minority headed families are each statistically significant in the model. Distance from the central business district is yet again the only variable that was not statistically significant in model eight.
### Table 4. Spatial Lag Model

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Male Juvenile Delinquent Rates 1927 to 1933 (Model 1)</th>
<th>Male Juvenile Commitment Rates 1927 to 1933 (Model 2)</th>
<th>Male Truant Rates 1927 to 1933 (Model 3)</th>
<th>Boy Court Offender Rates 1938 (Model 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-4.223***</td>
<td>-1.988**</td>
<td>-0.779</td>
<td>-6.330***</td>
</tr>
<tr>
<td>Families on Relief 1934 (%)</td>
<td>0.195***</td>
<td>0.080***</td>
<td>0.067***</td>
<td>0.163***</td>
</tr>
<tr>
<td>Median Monthly Rent 1930 ($)</td>
<td>0.032**</td>
<td>0.0167*</td>
<td>-0.002</td>
<td>0.061***</td>
</tr>
<tr>
<td>Families Owning Homes 1930 (%)</td>
<td>-0.017</td>
<td>-0.014**</td>
<td>-0.011</td>
<td>-0.030**</td>
</tr>
<tr>
<td>Foreign Born &amp; Minority Headed Families 1930 (%)</td>
<td>0.051***</td>
<td>0.024***</td>
<td>0.019*</td>
<td>0.071***</td>
</tr>
<tr>
<td>Distance from Central Business District (Blocks)</td>
<td>0.026</td>
<td>0.017</td>
<td>0.045</td>
<td>0.052</td>
</tr>
<tr>
<td>Rho</td>
<td>0.417</td>
<td>0.311</td>
<td>0.513</td>
<td>0.414</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>33.675***</td>
<td>12.594***</td>
<td>38.018***</td>
<td>31.429***</td>
</tr>
<tr>
<td>Wald Statistic</td>
<td>39.895***</td>
<td>12.755***</td>
<td>47.324***</td>
<td>31.484***</td>
</tr>
</tbody>
</table>

* p < .05; ** p < .01; *** p < .001
### Table 5. Spatial Error Model

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Male Juvenile Delinquent Rates 1927 to 1933 (Model 5)</th>
<th>Male Juvenile Commitment Rates 1927 to 1933 (Model 6)</th>
<th>Male Truant Rates 1927 to 1933 (Model 7)</th>
<th>Boy Court Offender Rates 1938 (Model 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.630</td>
<td>-1.092</td>
<td>1.196</td>
<td>-3.267*</td>
</tr>
<tr>
<td>Families on Relief 1934 (%)</td>
<td>0.228***</td>
<td>0.090***</td>
<td>0.082***</td>
<td>0.194***</td>
</tr>
<tr>
<td>Median Monthly Rent 1930 ($)</td>
<td>0.032*</td>
<td>0.017*</td>
<td>0.001</td>
<td>0.060***</td>
</tr>
<tr>
<td>Families Owning Homes 1930 (%)</td>
<td>-0.032*</td>
<td>-0.020**</td>
<td>-0.021*</td>
<td>-0.043**</td>
</tr>
<tr>
<td>Foreign Born &amp; Minority Headed Families 1930 (%)</td>
<td>0.041***</td>
<td>0.022**</td>
<td>0.019**</td>
<td>0.063***</td>
</tr>
<tr>
<td>Distance from Central Business District (Blocks)</td>
<td>-0.181</td>
<td>-0.041</td>
<td>-0.133</td>
<td>-0.133</td>
</tr>
<tr>
<td>Lambda</td>
<td>33.659***</td>
<td>8.006**</td>
<td>39.645***</td>
<td>34.832***</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>0.662</td>
<td>0.391</td>
<td>0.698</td>
<td>0.617</td>
</tr>
<tr>
<td>Wald Statistic</td>
<td>64.671***</td>
<td>11.260***</td>
<td>82.646***</td>
<td>47.91***</td>
</tr>
</tbody>
</table>

* p < .05; ** p < .01; *** p < .001
Discussion

The spatial lag regression models and the spatial error regression models provide strong evidence to validate Shaw and McKay (1942, 1969)’s interpretation of their data. Shaw and McKay found correlations between juvenile delinquency and percentage of families on relief, median monthly rent, the percentage of families owning homes, and percentage of the population which was foreign-born or minority headed. Each of these findings has been validated as a predictor in the spatial regression models.

The strongest predictor in each of the regression models is the percentage of families on relief. This variable was statistically significant in all eight regression models at the p = 0.001 level. Percentage of families on relief provides the strongest measure of poverty available to Shaw and McKay and the results of this analysis show it is a strong predictor of juvenile crime. However, more recent SDT research has demonstrated that the impact of poverty is highly correlated with collective efficacy, which is a much stronger predictor of violent victimizations (Sampson & Raudenbush, 1999).

The percentage of foreign-born and minority headed families was also statistically significant in all eight regression models and it was significant at the p = 0.001 level in five of the eight models. Again, this validates the work of Shaw and McKay, while also pointing to the possibility of Collective Efficacy as a missing variable. Immigrant concentrations have also been negatively associated with Collective Efficacy (Sampson et al., 1997). It is also likely that this variable is also serving as a proxy for poverty. The percentage of foreign-born and minority headed families and percentage of families on relief are correlated at the p = 0.001 level with a Pearson Correlation value of 0.68, providing strong evidence that poverty is a large part of the explanation for why the percentage of foreign-born and minority headed families are a predictor of male juvenile crime and delinquency.

Median monthly rents were statistically significant in six of the eight models. Median monthly rents were not significant in either of the male truant models. Median monthly rents were significant at the p = 0.001 level in both of the boy court offender models. What is curious about the impact of median monthly rents is the positive correlation indicating that as rent rates rose so did the number of male juveniles involved in crime and delinquency. Indeed, as would be expected, a Pearson correlation analysis shows median monthly rents are statistically significantly negatively correlated with the Juvenile Delinquent Rates (r = -0.61), Male Juvenile Commitment Rates (r = -0.53), Male Truant Rates (r = -0.67), and Boy Court Offender Rates (r = -0.48). It is therefore likely that median monthly rent is accounting for some unseen factor.

Percentage of families owning homes is statistically significant in all of the spatial error models, in the spatial lag juvenile commitment rates model, the spatial lag boy court offenders’ model. It is not statistically significant in the spatial lag male juvenile delinquent rates model or the male truant rate model. In each of these models, the percentage of families owning homes is negatively related to the dependent variable, as expected. This indicates that as homeownership rates raise the amount of juvenile crime and delinquency declines. This is consistent with the relationship between poverty and homeownership. It also provides further support to the importance of Collective Efficacy as homeownership is associated with higher level of Collective Efficacy (Sampson et al., 1997).

The distance from the central business district was not statistically significant in any of the eight models tested. However, a Pearson correlation analysis finds that the distance
from the central business district on its own was statistically significantly related to each of the dependent variables: juvenile delinquent rates ($r = -0.61$), male juvenile commitment rates ($r = -0.53$), male truant rates ($r = -0.67$), and boy court offender rates ($r = -0.48$). The lack of significance in the spatial regression model can be explained by the distance from the central business districts' correlation with the other dependent variables. Distance from the central business district was statistically significantly related to percentage of families on relief ($r = -0.46$), median monthly rents ($r = 0.53$), percentage of families owning homes ($r = 0.62$), and percentage of foreign born and minority headed families ($r = -0.41$). The direction of the relationship in each case also aligns with expectations with families on relief and percentage of foreign-born and minority headed households falling the further a square mile block is from the city core. Similarly, as expected rents and homeownership rates rise further away from the city core. This indicates that though the distance from the central business district relates to juvenile crime and delinquency, the impact of this distance is a product of the relationship to other variables and not a result of the distance itself.

Conclusion

What is particularly remarkable about the work of Shaw and McKay (1942, 1969) in *Juvenile Delinquency and Urban Areas* is the volume of data collected and analyzed by hand. In the original edition of the book records of juvenile delinquency and rates of commitments were gathered in Chicago from 1900 to 1906, 1917 to 1923, and 1927 to 1933. In addition, court records were gathered for 1938 and school truancy rates from 1927 to 1933. They then supplement this data by gathering delinquency data for Philadelphia, Boston, Cincinnati, Cleveland and Richmond. The revised edition adds data about male juvenile offenders for Chicago from 1934 to 1940, 1945 to 1951, and 1954 to 1965 and for female offenders brought before the court from 1945 to 1951, 1958 to 1966. In addition, they include data about Cook county delinquents from 1945 to 1951, 1954 to 1957, and 1958 to 1966. Without the use of modern computers, Shaw and McKay (1969) made detailed calculations to determine the correlations between the various delinquency series and socio-economic variables. They also they created detail maps to share their findings in *Juvenile Delinquency and Urban Areas*.

These maps are useful in re-evaluating the work of Shaw and McKay using modern methods. They allow for the manual imputation of Shaw and McKay’s painstakingly gathered data into modern computer spreadsheets which allows for the re-examination of Shaw and McKay’s findings with modern spatial regression analysis. Spatial regression analysis validates Shaw and McKay’s core findings. Families on relief, median monthly rent, homeownership rates, and rates of foreign-born and minority heads of households each has a statistically significant impact on crime associated with male juveniles in most of the models presented. Percentage of families on relief is the strongest predictor in each of the models, indicating the poverty is a strong predictor of male juvenile crime and delinquency. Distance from the central business is not significant in any of the models. Distance from the central business district is likely a product of other factors and not a direct cause of juvenile crime and delinquency.

In *Juvenile Delinquency and Urban Areas* Shaw and McKay (1969) took a step forward in explaining the spatial distribution of juvenile delinquency. Since the books original publication their work has become the framework for SDT which has aided in explaining the spatial distribution of crime generally. They have also provided a basis for
interventions into crime within neighbourhoods which has allowed practitioners to effectively prevent crime by treating the individual alongside the community. These theoretical advances make *Juvenile Delinquency and Urban Areas* a seminal work and the practical implications make Shaw and McKay worthy of a “thank you” from countless communities.

**References**


