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Does Street Social Activity Impact Crime? An Analysis in New York City

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Does Street Social Activity Impact Crime? An Analysis in New York City

Abstract

The current study examines the relationship between the level of social activity and crime in place. We theoretically conceptualized the social activity as a combination of two essential elements of *vitality* and *diversity*. Our results suggest that level of social activity has a crime-enhancing effect on both violent and property crime. We also found that there are positive interaction effects between the measures of vitality and diversity. This study contributes to the field by introducing a theoretically driven concept of social activity and empirically showing how the two dimensions of social activity—vitality and diversity—have independent effects that multiplicatively impact the level of crime at a location.

Keywords: Social activity, Crime, Place

Does Street Social Activity Impact Crime? An Analysis in New York City

Introduction

Given the evidence that crime tends to concentrate spatially at particular locations, studies have focused on possible explanations for why some locations have higher levels of crime. Although numerous explanations have been given, one possibility that has been given less consideration is that the *level of social activity* in a location may impact the level of crime. The level of social activity is the extent to which a place feels alive or lively. Previous studies have emphasized the importance of level of social activity in place when explaining the notion and meaning of place in urban daily life (Montgomery 1998, 2003; Jacobs 1961). Level of social activity is composed of two key elements: *vitality* and *diversity* (Montgomery 1998). Vitality refers to how lively a place feels. This can be conceptualized by how many people visit the area for various reasons or how many local stores are present. However, vitality can only be achieved and maintained if there is sufficient diversity of land uses (Montgomery 1998; Jacobs 1961).

Based on routine activities theory, the expectations of the relationship between the level of social activity and crime are uncertain. On the one hand, we would expect there to be *less* crime in places if there is more social activity given that such areas tend to have more “eyes on the street” and thus higher levels of natural surveillance. In such areas, the chance of being caught is elevated, which reduces the benefit of committing crime. Moreover, business owners might care more about the area where their business is located and may invest resources in surveillance and formal resources of control (i.e., CCTVs, security systems, etc.) to protect their properties. On the other hand, high levels of social activity may provide *more* criminal opportunities due to a higher probability of

the convergence of motivated offenders and potential targets with a lack of capable guardians at the same place and time. Also, high levels of social activity may reduce territoriality of the area due to the increase of strangers, and hinder the formation of informal social control, social trust and networks among residents. We construct several measures capturing social activity and assess whether the level of social activity in a location helps explain crime patterns in place.

The current study examines the importance of the level of social activity for crime in place. Based on theoretical considerations, we conceptualize the level of social activity as a combination of two essential elements of *vitality*: (1-1) the number of business establishments in places, (1-2) the number of employees of businesses; as well as two factors of *diversity*: (2-1) level of land use mix, and (2-2) the proportion of local businesses. We utilized the data from a large sample of Census blocks in New York City in 2014. In the subsequent section, we focus our theoretical motivations on the level of social activity and elaborate theoretical arguments that support the hypothesized relationship between social activity and crime in place. Then, we discuss previous empirical studies focusing on social activity and crime.

Defining Social Activity

In this section, we explain our theoretical conceptualization of the level of social activity in place and its relevance to crime. Over the past few decades, there has been a discussion on what constitutes place (or sense of place) in many ecological studies (Cullen 1961; Jacobs 1993; Jacobs 1961; Montgomery 1998; Appleyard 1981; Montgomery 2003; Buchanan 1988). These studies have argued that people develop routinized activities which interact with physical environmental characteristics to shape

the patterns of daily life. These physical environments include land uses, street layouts, landmarks, building designs, street connectivity, and the like. Jane Jacobs (1961) recognized that the social activity in a place affects and reflects the quality of the built environment. Buchanan (1988) also commented that “urban design is essentially about place-making, where places are not just a specific space, but all the *activities* and *events* which made it possible” (p.33). Thus, we should consider two important components of places: (1) *physical settings of place*, and closely related, (2) *level of social activity in place*.

Level of social activity is defined as the combination of two distinct but closely related concepts: *vitality* and *diversity*. Vitality is the extent to which a place feels alive or lively. According to Montgomery (1998; 2003), vitality can be theoretically conceptualized by two potential indicators: *the number of business establishments* and *the number of business employees*, which may quantify the approximate amount of foot traffic and level of social activity in place.¹ The number of business facilities in places can be one good indicator of vitality because it is an indicator of the existence of businesses in the place. Also, the number of employees is another indicator of vitality because larger business facilities tend to have more customers visiting and thus more employees. While it is not easy to quantify the magnitude of people moving in-and-out of the area, the number of employees can be used as a proxy measure.

Diversity refers to the mix of activities in a place. According to Montgomery, complex diversity of primary land uses and business activities are the necessary

¹ Note that Montgomery (1998) suggests three interrelated elements of urban sense of place: Activity, Form, and Image. In the current study, we focus on Activity part, and test his model partially due to data limitation for testing the other parts of his model.

conditions to have vitality in places. This is because lively places require a mix of activities and a diversity of ingredients to sustain a wide array of activities. In addition to the mix of land uses, the proportion of locally owned and run businesses is another possible indicator of diversity in places. Lively and interesting urban areas tend to be places of complex variety with a large representation of small-scale local businesses that are involved in a dynamic of importing, exporting, and domestic consumption, which can increase social activity at a place. Jacobs (1961) also recognized the importance of diversity for vitality in place. According to her, a sufficiently dense concentration of population is necessary for vitality and diversity in place. Primary land uses are important because they are anchors to bring people into a place for specific purposes. However, she stated that a primary land use is relatively less effective at generating diversity unless it is combined with other primary land uses. If primary land uses are effectively mixed, people will visit the area more often, and there will be more vitality at the place, which also gives a theoretical implication for testing possible interactions between the two dimensions of social activity (one primary focus of the current study). Therefore, diversity is theoretically conceptualized by two potential indicators: *land use mix* and *the proportion of local business* (Jacobs, 1961).

Level of Social Activity and Crime in Place

Protective Effect of Social Activity

Some theories suggest that level of social activity may have a crime-reducing effect. Specifically, Jane Jacobs argued that there would be *less* crime in a place if there is higher level of social activity given that more livable places can have more “eyes on the street,” and therefore more natural surveillance, which would increase the chance of

being caught and thus reduce the benefit of committing crime. Moreover, building on social disorganization theory, the level of social activity in an area may be able to reduce the level of crime. According to social disorganization theory, the absence or breakdown of informal social control in communities limits the capability of crime prevention (Bursik and Grasmick 1993; Kubrin and Weitzer 2003; Kubrin 2009; Sampson and Groves 1989). In a vibrant area with a high level of social activity, residents have more opportunities to get to know each other, and thus have more attachment to the place. People are more likely to feel an affective bond or a link with the specific place (Hidalgo and Hernandez 2001) because vibrant places provide economic conditions (goods and services) as well as social needs and support (social interactions with others). In such areas, we would expect greater levels of cohesion among residents, and hence a greater willingness to provide informal social control, which would result in a lower level of crime.

Another body of research argues that facilities at places potentially contribute to lower crime rates because they enhance the opportunities of social interaction among residents that can lead to higher levels of informal social control. These studies have found that businesses (i.e., restaurants, bars, coffee shops, cafes, ice cream parlors, pizza parlors, etc.) generally provide crime reducing effects in neighborhoods (Papachristos et al. 2011; Wo 2014). For example, Papachristos et al. (2011) showed that the presence of coffee shops is related to lower homicide rates in Chicago neighborhoods. Likewise, Wo (2014) found that neighborhoods with more employees of coffee shops, cafes, bagel and doughnut shops, pizza parlors, ice cream parlors, diners, and snack and beverage shops have lower crime rates.

Adverse Effect of Social Activity

On the other hand, an alternative hypothesis is that when the level of social activity is too high there will be *more* criminal opportunities due to higher probability of the convergence of motivated offenders and potential victims at the same place and time. Theories of criminal opportunities posit that routine activity patterns can affect crime in place by changing the convergence of motivated offenders, suitable targets, and the presence or absence of capable guardians (Cohen and Felson 1979). Specifically, the Brantinghams (1984, 1995) suggest that busier places will have a greater inflow of people which leads to higher probability of potential offenders and targets (Brantingham and Brantingham 1995; Brantingham and Brantingham 1993; Brantingham and Brantingham 1984; Brantingham and Brantingham 1993). Also, high levels of social activity may bring more strangers to the place that can disrupt the social trust and networks among the people, and thus increase crime. Areas with more social activity may have less territoriality, which may reduce territorial protection (Newman 1972; Newman and Franck 1980). In such area, residents might have difficulty recognizing which persons are locals who belong in the area, increasing ambiguity of who is responsible for the surveillance of the area.

Previous empirical studies have examined the relationship between crime and business facilities in a place measured by the number of specific types of businesses such as bars, liquor stores, or restaurants.² For example, Bernasco and Block (2011) tested whether various types of business facilities (bars, restaurants, food stands, liquor stores, grocers, etc.) that are expected to attract criminals increase the amount of crime in street

² See Stucky and Ottensmann (2009) for an informative review on the literature of land use, type facilities, and crime.

blocks. They found that blocks with certain types of businesses have increased numbers of robberies. Additionally, Kubrin et al. (2011) and Kubrin and Hipp (2014) examined the impact of fringe lenders on neighborhood crime rates. Both studies found that the presence of fringe banks is related to higher levels of crime.

Despite the potential importance of social activity for impacting crime, most existing studies simply focus on the count of specific types of businesses, which is conceptually distinct from measuring the overall level of social activity in a place and its relationship with crime. To date, we are aware of only one published study that has defined level of social activity considering multiple indicators of economic activity. Stacy, Ho, and Pendall (2016) examined the effect of neighborhood-level economic activity on crime. They measured level of economic activity as a factor score of business establishments, business births and deaths, sales, and employment, and found that increases in economic activity was associated with lower violent and property crime in the same year, although they found no lag effect one year later.

In sum, building upon previous studies, we propose to define the level of social activity in a place conceptualized as a combination of two essential elements of vitality: (1-1) *the number of business facilities* and (1-2) *the number of employees of businesses*; and two elements of diversity: (2-1) *the land use mix* and (2-2) *the proportion of local businesses*. We use New York City as our study site, given that this is a city particularly well known for its street vibrancy, and thus was the impetus for Jane Jacobs' initial theorizing. In the subsequent sections, we describe the data and method employed to measure social activity and crime in place, and the specific analytic strategy to examine their relationships.

Data and Methods

The unit of analysis of the current study is the census block. We employed census blocks following prior communities and place research using blocks to examine micro-spatial processes (Bernasco & Block, 2011; Kim, 2018). About 30,000 blocks in the New York City area (Boroughs of Brooklyn, Bronx, Manhattan, Queens, and Staten Island) were included. The outcomes are five Part 1 crimes in 2014. The crime data are from official crime reports of the police department of New York City, aggregated to blocks. The number of aggravated assault, robbery, burglary, larceny, and motor vehicle theft crime incidents are used as the outcomes.

To measure social activity in blocks, one source we used was Reference USA business establishment data in 2014. Reference USA data include a wealth of information such as address, type of industry by North American Industry Classification System (NAICS) code, the number of employees, year of establishment, etc. As discussed, the four potential indicators (two for vitality and two for diversity) of the concept of level of social activity are: (1) the number of consumer-facing business establishments, (2) the number of consumer-facing business employees, (3) level of land use mix, and (4) the proportion of local consumer-facing businesses. In order to properly obtain (1) and (2) at the block level, we geocoded addresses of businesses to latitude–longitude point locations using ArcGIS 10.2 and then aggregated the total number of business establishment and employees to blocks based on proximity. For (1), (2), and (4), we chose consumer-facing business types (Delgado, Porter, and Stern 2014; Porter 2000; Kane, Hipp, and Kim 2017) because they tend to attract customers for products and services at the locations. Therefore, they have more direct relevance to foot traffic coming in-and-out of the area.

Also, these businesses engender frequent face-to-face interactions among stakeholders including owners, employees, and customers, and thus potentially increase the level of social cohesion and ties in the area (Kim and Hipp 2021, 2021). Consumer facing business types include *Retail* (Apparel, General Merchandise, Home Products, Personal Products, and Specialty), *Services* (Auto Services, Child Care Services, Gas Stations, Laundry, Hair Care Services, Other Personal Services, and Repair Services), *Restaurants* (Full-Service and Limited-Service), and *Food/Drug Stores* (Convenience Stores, Drug Stores, Groceries, and Specialty Food).

For (3), we constructed a Herfindahl index based on five primary land use categories of residential, office, retail, industrial, and other land use. We utilized the NYC Primary Land Use Tax Lot Output (PLUTO) data from the data portal of the Department of City Planning to measure land use in the area. These measures were initially constructed for parcels, which we aggregated to blocks. To measure (4), we considered three different attributes in the Reference USA data: (a) whether a business facility is a franchise or not; (b) whether a facility is a headquarter, branch, or neither; and (c) if a facility is publicly traded company, branch of publicly traded company, or private company (Kim and Hipp 2021). The third attribute is based on an assumption that most local businesses tend not to be publicly traded. Combining these three criteria together, a business facility is identified as locally owned and run if it is: 1) not categorized as franchise, 2) neither a headquarter nor a branch, and 3) a private company.

To define the level of social activity we combined the abovementioned four potential indicators – (1) the number of business establishments, (2) the number of business employees (logged), (3) level of land use mix, and (4) the proportion of local


businesses, using Principal Component Analysis (PCA) following the lead of Stacy et al. (2016). These four indicators loaded on a single factor with an Eigenvalue above 1, and we computed a factor score, *level of social activity*. We used this index as our main independent variable in the models. All loadings are above 0.5, except for the measure of land use mix (-0.12). The loading value of the number of business establishments was 0.58 and those of the number of business employees (logged) and the proportion of local businesses were relatively higher than other components (0.95 and 0.91, respectively). In subsidiary analyses, we constructed measures of vitality and diversity by combining the z-scores of their measures: the number of consumer-facing business establishments and employees for vitality, and land use mix and proportion of local consumer-facing businesses for diversity.

We control for structural characteristics of blocks with non-zero population using 2010 U.S. Census data. To capture the socio-economic status of the blocks, we included the percent persons at or below 125% of the poverty level. We included the proportion of Black and percent Latino to measure the racial/ethnic composition (percent white, Asian and other race as the reference category). We also capture racial/ethnic heterogeneity measured as a Herfindahl index (based on five categories of Black, Latino, Asian, White and other race). We used the proportion of homeowners to capture residential stability in blocks, and proportion of occupied units to measure opportunities provided by vacant units in the area. We controlled the proportion of aged 15 to 29 to capture the young adult population. Finally, we included percent foreign born residents to capture the immigrant

population.³ The summary statistics for the variables used in the analyses are shown in Table 1.

<<< Table 1 about here >>>

Analytic Strategy

To address the possibility that social activity may be endogenous to crime given the prior evidence that crime can affect business mobility and failure (CITE ) we implement a two-stage estimation with instrumental variables to address the simultaneity. Specifically, we use the level of social activity in 2010 as an instrumental variable to predict social activity in 2014, as we believe that social activity at this earlier time point will impact the level of social activity at the current time point, but have no additional impact on the level of crime (thus being a suitable instrument). The general expression of this model is:

$$A_i = \mu + B_1Z + B_2\mathbf{S} + B_3\mathbf{WS} + B_4\mathbf{C} + e \quad (1)$$

where A is the level of social activity in 2014, Z contains the social activity that existed in 2010 for capturing the endogenous explanatory variable. \mathbf{S} is the matrix of the controls for the structural characteristics, \mathbf{WS} represents the matrix of the spatially lagged measures of the structural characteristics, and \mathbf{C} is a vector of fixed effect terms for boroughs. We obtain the predicted value of A from this equation for use in the second stage equation.

³ For some of these measures, we needed to first impute values from block groups to the blocks. We accomplished this using the synthetic estimation for ecological inference strategy. This approach builds an imputation model at the block group level, and then uses the available block information to provide more informed imputed values in blocks. For more detailed information, please see Boessen and Hipp (2015).

Then, Equation (2) below shows the second stage of the modeling process with the dependent variable of the crime count. For this set of models, we estimate negative binomial regression models including the independent variables with dummy variables for the boroughs to control for unmeasured borough-specific effects. We employ a negative binomial regression approach to address possible over-dispersion in the count outcomes (Osgood, 2000). We included logged population as an exposure term and set the coefficient equal to 1, which effectively transforms the outcomes to crime rates. The general expression of this model is:

$$E(y) = \exp(\mu + \Gamma_1 \hat{A} + \Gamma_2 \mathbf{S} + \Gamma_3 \mathbf{WS} + \Gamma_4 \mathbf{C} + \nu) \quad (2)$$

where y is the number of crime events in 2014, \hat{A} represents the predicted social activity from Equation 2, \mathbf{S} is a matrix of the structural characteristic variables, \mathbf{WS} is a matrix of the spatially lagged measures for \mathbf{S} , \mathbf{C} is a matrix of the dummy variables for boroughs, and ν is the overdispersion term following a gamma distribution.

For another set of models, we replace the social activity index with the measures of vitality and diversity to examine the possibility that specific dimensions of social activity have a greater impact on crime. We applied the same analytic strategy to create the instrumental variables for the measures of vitality and diversity, estimated first stage equations for them to obtain predicted values, and tested their respective effects on the level of crime. We then estimated a set of models including the interaction term (*Vitality*Diversity*), which multiplies these two predicted values together from the first stage equations, to test possible moderating effects between the vitality and diversity measures. Table 1 shows the summary statistics of the variables included in the analyses.

Results

Main Effects

The results are presented in Table 2. First, of particular importance to us, we observe that higher levels of social activity are associated with higher levels of violent and property crime. For example, a one standard deviation increase in the level of social activity leads to a 27 percent increase in robbery risk ($\exp(0.287 * \text{S.D.}) - 1) * 100 = .27$) and an 21 percent increase in aggravated assault. Furthermore, the level of social activity is associated with more property crime. For example, a one standard deviation increase in the social activity index is associated with an 21 and 42 percent increase in the risk of burglary and larceny, respectively while the coefficient estimate for motor vehicle theft is not statistically significant. Given the theoretical discussion above, we tested a possible nonlinear relationship between the level of social activity and levels of crime by including quadratic terms for social activity. We found no evidence of a pronounced curvilinear relationship.

Unpacking the Dimensions of Social Activity

We next explored whether the two dimensions of social activity have different effects on crime patterns (Table 3). Both the vitality measure and diversity measure generally show evidence of crime-producing effects, in general. Specifically, we find that our measure of vitality is positively associated with all crime types (except motor vehicle theft). A block one standard deviation above the mean on vitality has 22% more robberies, 16% more aggravated assaults, 25% more burglaries, and 58% more larcenies, respectively. Likewise, the diversity measure is consistently significantly and positively related to all types of crime (except for burglary and larceny). For example, a block one

standard deviation above the mean on diversity has 17% more aggravated assaults, 18% more robberies, and 13% more motor vehicle thefts. However, the coefficient estimates for burglary and larceny are not statistically significant.

<<< Tables 2 and 3 about here>>>

Moderating Effects: Vitality and Diversity

Given theoretical expectations, we next assessed possible moderating effects between the measures of vitality and diversity by including an interaction term to the models: *Vitality*Diversity*. Interaction coefficients are reported in Table 4. In Figure 1, we plotted the predicted crime rates for given levels of vitality at varying levels of diversity (Low = -1 SD and High = +1 SD). We observe a pronounced moderation effect. A general pattern is that vitality exhibits crime-enhancing effects in blocks with average levels of diversity, and this crime-producing pattern is even stronger in areas with high diversity. In contrast, vitality shows much weaker crime-producing or even crime-reducing effects in blocks with low diversity; and thus, the combination of high vitality with low diversity shows the lowest risk for all types of crime. For instance, for two areas with high vitality, the one with low diversity has about 65 percent fewer robberies than the one with high diversity (Figure 1a). Likewise, Figure 1b demonstrates that blocks with higher vitality combined with high diversity are at highest risk of aggravated assault. For example, for two areas with high vitality, the one with low diversity has about 76 percent fewer aggravated assaults than does one with high diversity. We observed similar patterns for burglary and motor vehicle thefts.

<<< Table 4 about here>>>

<<< Figure 1 about here >>>

We briefly comment on the results of other measures included in the models reported in Table 2. In terms of structural characteristics, the percentage in poverty is associated with more violent and property crime in blocks. We observed that blocks with higher racial/ethnic heterogeneity have less property and violent crimes, and crime risk is reduced in blocks with more occupied housing units. We observe that more homeowners in blocks tend to reduce the risk of robberies, aggravated assaults and larcenies, but has crime-producing effects for burglary and motor vehicle thefts.

Discussion

Although a burgeoning body of literature has examined the social and physical environmental features that have direct relevance for explaining the spatial patterns of crime, there has been less attention paid to the theoretical importance of the *level of social activity* in a location and the impact on crime. We theoretically conceptualized the level of social activity using two closely related concepts: *Vitality* and *Diversity* (Montgomery 2003, 1998; Jacobs 1961). Then we further operationalized vitality as a combination of (1a) the number of business establishments and (1b) the number of business employees in blocks, and diversity as (2a) land use mix and (2b) the proportion of businesses that are local. This approach is driven by theoretical motivations from previous studies as discussed above. For the criminological relevance of the concept of social activity, we utilized various theoretical arguments. Particularly, criminal opportunity theories including the Brantinghams' crime pattern theory (1984, 1995) posit that busier places with more social activity will have more inflow of people and thus more opportunities for crime because of a higher probability of potential offenders and victims being present at the same time and place. In contrast, Jacobs (1961) observed that

areas with diversely mixed land uses would draw more pedestrians, which could provide a foundation for effective natural surveillance due to more “eyes on the street” with increased monitoring as a byproduct, and thus less crime in the area.

Our findings show strong evidence that social activity is positively related to all crime types. A possible explanation is that the “hustle and bustle” from a high volume of foot traffic enhances the probability of the convergence of potential offenders and targets at the same time and place along with compromised guardianship capability from more anonymity and ambiguity on surveillance responsibility. That is, in areas with high social activity, there will be a higher number of potential targets including residents, employees, or visitors, which increases target suitability and disrupts guardianship capabilities, at least to some extent (Reynald 2010).

We also disentangled the separate effects of the two dimensions of social activity on crime. Thus, we estimated another set of models testing the separate effects of vitality and diversity dimensions. This provided another key finding: Although each of the dimensions exhibited crime-producing effects, the effects of these dimensions reveal some meaningful differences with respect to direction and magnitude. Specifically, although the measures of vitality and diversity have crime-enhancing effects for violent and property crime (consistent with the findings of social activity index), the diversity measure shows a crime-reducing effect for larcenies in blocks. This is consistent with an alternative hypothesis that diversity of social activity may enhance the amount of foot traffic and walkability of the area as diverse land use settings can provide different types of goods and services at a given location which may not require further vehicular movements. Such enhanced walkability in the area can engender more eyes on the street

that theoretically can increase the natural surveillance in the area. We also found that our measures of social activity show statistically nonsignificant effects for motor vehicle thefts. This finding may be due to the targets of the crime – automobiles. Our measure of vitality was constructed based on business activities that largely overlaps with the dimensions of neighborhood walkability. This is because business activities are theorized to engender pedestrian activities given that more businesses can provide various goods and services at one location not involving further vehicular travels from one another. Therefore, the observed null effect of the social activity index and vitality measure might be attributable to the fact that our measure, by nature, may capture fewer targets (automobiles) in the structure of criminal opportunity.

Another key finding is the interaction effects we detected between the measures of vitality and diversity. This result suggests that it is important to simultaneously account for the effects of vitality and diversity for understanding the spatial patterns of crime. For example, the crime-enhancing effect of vitality becomes stronger with more diversity whereas vitality exhibits crime-reducing effect when combined with low diversity. Therefore, areas with a high-high combination of vitality and diversity are at the highest risk of crime while a high-low combination shows the lowest risk. These findings imply the need for future research to examine how the two dimensions of social activity (vitality and diversity) can collectively work together in shaping of the structure of criminal opportunities and guardianship. This is contrary to the hypotheses of Jane Jacobs, who posited that greater diversity would be beneficial to blocks. Why this occurred is unclear. One possibility is that Jacobs' hypothesis requires a particular

definition of diversity, and one that differs from ours here. Nonetheless, more work is needed to adjudicate this possibility.

Our findings have important implications for crime policy. Previous studies have suggested that features of the built environment that shape the number of visitors in the area can be an important factor for understanding the spatial patterns of crime. Therefore, a natural policy implication for police and policymakers is to disproportionately assign limited policing resources to areas with higher social activities, business density and land use diversity. Moreover, our results for the moderating effects suggest that areas with high density of social activity combined with high diversity are at the highest risk of crime. This makes sense from a perspective of criminal opportunities in that higher social activity along with more diverse activities would generate greater ambient population, which enhances the spatial and temporal convergence of potential offenders and targets. Given that, police and lawmakers should also consider focusing resource allocation, most notably police patrol, to such areas.

We acknowledge some limitations to the present study. First, although the present study found relationships between crime and social activity in place, identifying the exact mechanisms that bring about such associations is still unclear and beyond the scope of the current study. Consequently, the possible theoretical explanations of the results based on criminal opportunities are still speculative. Second, there could be other ways to measure the level of social activity. For example, other elements of the place such as the street network configuration could operate as a proxy (Frith, Johnson, and Fry 2017; Summers and Johnson 2016; Davies and Johnson 2015; Kim and Hipp 2019). As suggested in previous studies, looking at the connectivity of a place based on the street network can be

another way to capture the potential foot traffic and thus the level of social activity. Studies could simultaneously incorporate business-land use characteristics and the street network configurations to better examine the level of social activity and crime in place. And studies using social media data attempt to proxy for the ambient population in a location at a particular point in time (Hipp et al. 2018; Malleson and Andresen 2015; Malleson and Andresen 2016). Social activity and crime in place may be better captured and examined by looking at short term periods such as one month, or even a week. Indeed, a body of recent studies suggests that the temporal and spatial dimensions of crime can be different across measures of the physical and social environment within relatively shorter time periods (Boessen 2014; Haberman and Ratcliffe 2015; Hipp and Kim 2019; Hipp 2016). Therefore, for generalizability, future research may want to further investigate how social activity may produce varying effects on crime by different time periods and regions.

In sum, we attempted to define and measure social activity in place based on business and land use characteristics using data from all blocks in New York City. We examined the effects between the level of social activity and five UCR Part 1 crime types. Therefore, this study contributes to the field by introducing a theoretically driven concept of social activity and empirically showing how social activity and crime in place are associated with each other. We also demonstrated how the two dimensions of social activity—vitality and diversity—have independent effects that multiplicatively impact the level of crime at a location. Further research assessing these measures in other cities will help us better understand the role of social activity in impacting crime within micro locations.

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Tables

Table 1. Summary Statistics

	Mean	Std. Dev.	Min	Max
<u>Outcomes</u>				
Robbery	0.49	1.17	0	33
Agg. Assault	0.60	1.49	0	39
Burglary	0.52	1.06	0	19
Larceny	1.24	3.23	0	120
MV Theft	0.22	0.57	0	13
<u>Social Activity (instrumental variables)</u>				
Social activity index	0.15	0.83	-0.91	24.13
Vitality	0.17	1.59	-1.31	97.43
Diversity	-0.20	1.16	-1.68	2.80
<u>Structural Characteristics</u>				
% Poverty	24.80	28.57	0	100
Racial/Ethnic heterogeneity	0.42	0.20	0	0.80
% Homeowners	47.33	31.74	0	100
% Black	21.68	30.96	0	100
% Latino	22.71	23.32	0	100
% Occupied units	91.71	11.80	0	100
% Aged 15-29	21.68	9.00	0	100
% Immigrants	39.76	37.41	0	100
<u>Spatially lagged (1/4 mile)</u>				
% Poverty	18.99	10.60	0	100
Racial/Ethnic heterogeneity	0.47	0.17	0	0.79
% Homeowners	44.62	25.51	0	100
% Black	22.02	29.39	0	94.91
% Latino	23.26	20.10	0	100
% Occupied units	92.71	4.47	33.17	100
% Aged 15-29	22.01	5.04	0	76.90
% Immigrants	50.73	16.05	0	99.75

Table 2. Negative binomial regression models: Social activity (instrumental variable) and crime

	Robbery	Agg. Assault	Burglary	Larceny	MV Theft
<u>Social Activity</u>					
Social activity index	0.287 **	0.229 **	0.225 **	0.421 **	0.014
	15.234	12.455	13.513	27.046	0.638
<u>Structural Characteristics</u>					
% Poverty	0.005 **	0.004 **	0.003 **	-0.001	0.003 **
	7.160	5.441	4.984	-1.594 *	3.299
Racial/Ethnic heterogeneity	-1.362 **	-1.101 **	-0.850 **	-2.270 **	-0.747 **
	-12.419	-10.232	-8.416	-27.902	-5.622
% Homeowners	-0.002 *	-0.005 **	0.000	-0.004 **	0.001
	-2.423	-6.116	0.399	-6.944	1.448
% Black	-0.003 *	0.006 **	-0.006 **	0.011 **	-0.002
	-2.389	4.279	-4.445	10.615	-0.917
% Latino	0.000	0.005 **	0.001	0.002 †	-0.003 †
	-0.278	4.354	0.825	1.744	-1.917
% Occupied units	-0.022 **	-0.020 **	-0.015 **	-0.021 **	-0.014 **
	-18.054	-16.907	-12.396	-24.000	-9.316
% Aged 15-29	-0.001	-0.004 *	-0.001	-0.004 **	-0.003
	-0.790	-2.438	-0.818	-3.693	-1.371
% Immigrants	-0.007 **	-0.007 **	-0.006 **	-0.013 **	-0.007 **
	-12.342	-12.822	-11.485	-31.034	-10.465
<u>Spatially lagged (1/4 mile)</u>					
% Poverty	0.006 **	0.006 **	-0.011 **	-0.001	-0.013 **
	2.917	3.296	-6.335	-0.408	-5.382
Racial/Ethnic heterogeneity	2.563 **	1.919 **	1.053 **	2.764 **	1.737 **
	18.758	14.385	8.511	26.558	10.645
% Homeowners	-0.001	-0.003 *	0.000	0.003 **	0.002
	-0.852	-2.228	-0.368	2.936	1.109
% Black	0.023 **	0.016 **	0.013 **	-0.008 **	0.010 **
	15.491	11.187	8.491	-7.459	5.191
% Latino	0.014 **	0.008 **	0.003 *	-0.004 **	0.010 **
	9.299	5.423	2.179	-2.987	5.397
% Occupied units	-0.009 *	-0.012 **	-0.031 **	-0.032 **	-0.018 **
	-2.542	-3.521	-10.178	-12.776	-4.261
% Aged 15-29	0.018 **	0.019 **	0.043 **	0.017 **	0.022 **
	4.962	5.397	13.739	6.622	5.291
% Immigrants	0.012 **	0.008 **	0.002 †	0.007 **	-0.001
	8.969	5.746	1.753	6.065	-0.472
Intercept	-6.105 **	-5.182 **	-2.994 **	-0.848 **	-4.901 **
	-17.279	-15.071	-10.274	-3.454	-12.459
N	30,078	30,078	30,078	30,078	30,078

** $p < .01$ (two-tail test), * $p < .05$ (two-tail test).

T-values are presented below coefficient estimates.

Year and borough fixed effects were included but not shown.

Table 3. Examining the separate effects of vitality and diversity dimensions (instrumental variables)

	Robbery	Agg. Assault	Burglary	Larceny	MV Theft
<u>Social Activity</u>					
Vitality	0.127 **	0.092 **	0.143 **	0.289 **	-0.030 †
	10.293	7.287	13.050	25.444	-1.679
Diversity	0.139 **	0.135 **	0.002	-0.001	0.106 **
	7.873	7.713	0.155	-0.037	4.715
Intercept	-6.358 **	-5.394 **	-3.185 **	-1.246 **	-5.035 **
	-18.073	-15.734	-10.892	-5.149	-12.848
N	30,078	30,078	30,078	30,078	30,078

** $p < .01$ (two-tail test), * $p < .05$ (two-tail test).

T-values are presented below coefficient estimates.

Year and borough fixed effects were included but not shown.

All other controls were included not shown.

Table 4. Interaction effects: Vitality and Diversity (Instrumental variables)

	Robbery	Agg. Assault	Burglary	Larceny	MV Theft
<u>Social Activity</u>					
Vitality	0.070 **	0.012	0.069 **	0.258 **	-0.086 **
	4.467	0.768	4.773	19.946	-4.367
Diversity	0.163 **	0.171 **	0.044 **	0.010	0.139 **
	9.008	9.626	2.623	0.675	6.258
Interaction term	0.069 **	0.099 **	0.082 **	0.052 **	0.068 **
	5.948	8.561	7.927	5.187	4.934
Intercept	-6.367 **	-5.434 **	-3.158 **	-1.276 **	-5.041 **
	-18.137	-15.849	-10.813	-5.284	-12.896
N	30,078	30,078	30,078	30,078	30,078

** $p < .01$ (two-tail test), * $p < .05$ (two-tail test).

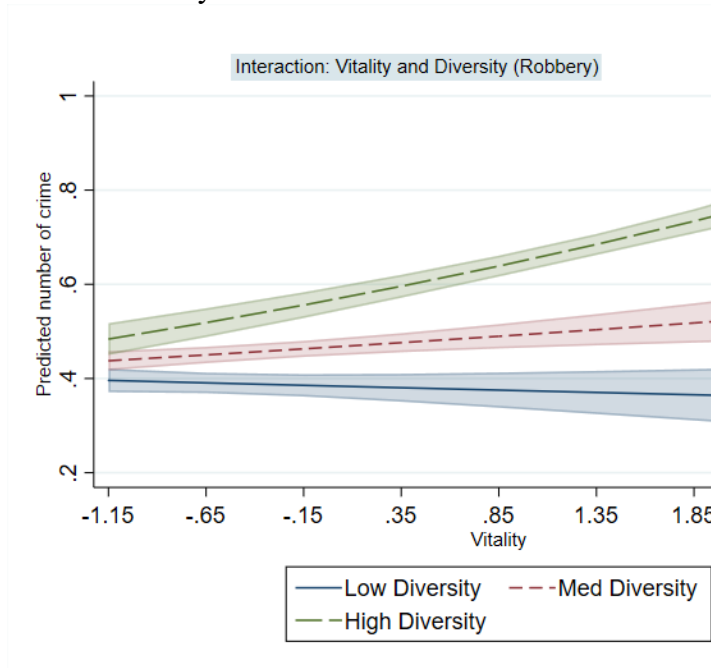
T-values are presented below coefficient estimates.

Borough fixed effects were included but not shown.

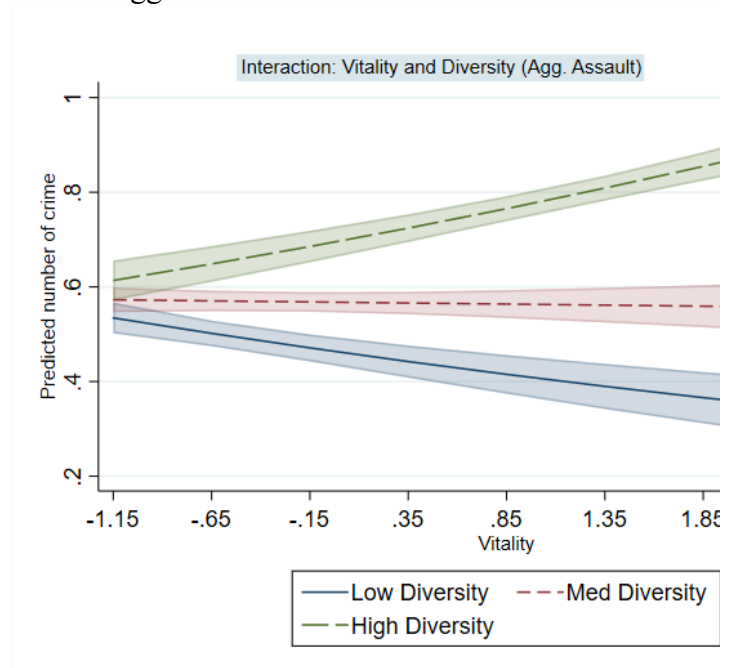
All other controls were included not shown.

Figure 1. Interaction Effects of Vitality and Diversity on Various Crime Types

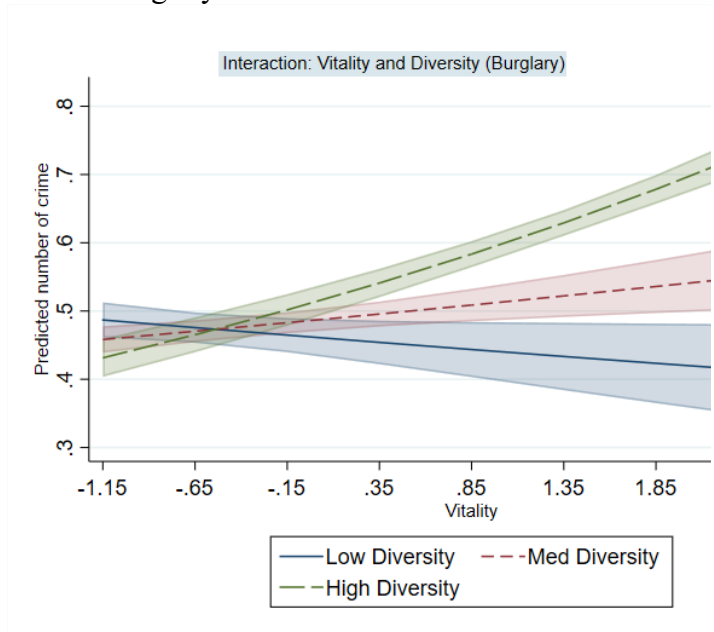
a. Robbery



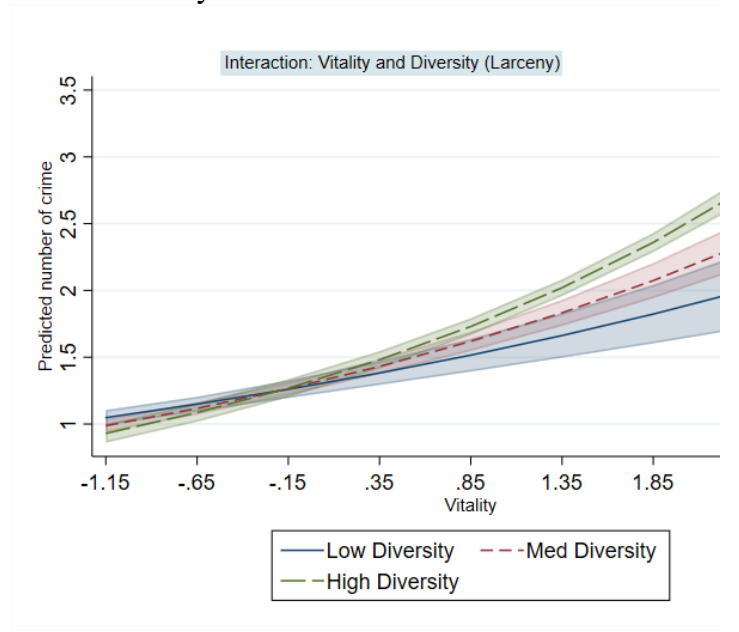
b. Aggravated Assault



c. Burglary



d. Larceny



e. Motor Vehicle Theft

