

NEARBY NEIGHBOURHOOD INFLUENCES ON ADOLESCENT OFFENDING

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This study extends recent research on the spatial dynamics of neighbourhood disadvantage and youth offending. Data include self-reported offences from 794 Dutch adolescents and the socio-economic status in their residential neighbourhood and the surrounding community. The findings reveal that youth engage in the highest levels of offending when they reside in disadvantaged neighbourhoods surrounded by neighbourhoods characterized by relative affluence. This spatial pattern is attributable to greater temptations to offend, reduced parental monitoring, and more frequent involvement in unstructured activities among youths who live in close proximity to neighbourhoods more affluent than their own. This study highlights the importance of criminogenic opportunities and parental monitoring for understanding the spatial dynamics of neighbourhood disadvantage on offending.

Key Words: neighbourhood effects, spatial processes, adolescent offending

A substantial body of literature highlights the importance of neighbourhood context for adolescent development and well-being. Adolescents who grow up in impoverished neighbourhoods fare worse on a variety of psychosocial domains compared to adolescents from affluent communities, including more frequent involvement in offending (Leventhal and Brooks-Gunn 2000; Sampson *et al.* 2002). Research on aggregate crime rates suggests that neighbourhood processes are spatially dependent such that crime and socio-economic disadvantage in one neighbourhood spill over and influence levels of crime in surrounding neighbourhoods (Heitgerd and Bursik 1987; Mears and Bhati 2006; Krivo *et al.* 2013). Scholars have recently started to explore whether similar spatial patterns also characterize the relationship between neighbourhood disadvantage and individual variation in offending. This small body of research demonstrates that disadvantage in neighbourhoods that are geographically proximate to residential neighbourhoods (i.e. nearby or 'extralocal' neighbourhoods) affects individual offending differently than what is often observed in aggregate studies of neighbourhood crime. Extralocal disadvantage appears to *reduce* rather than *increase* offending (Graif 2015; Vogel and South 2016).

There are two general limitations in this line of research. For one, the few studies to date have relied on samples of US adolescents. It remains to be seen whether these findings will translate to other contexts. European neighbourhoods are substantially different than their American counterparts. For instance, they are relatively heterogeneous

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in regards to socio-economic and ethnic composition, translating into less extreme differences across neighbourhoods than are typically observed in US cities (Musterd 2005; Tammaru *et al.* 2016). There is also less neighbourhood-level variation in delinquency in Western-European samples compared to US samples (Pauwels *et al.* 2018). Given these differences, conclusions from US research might not apply to the European context. Therefore, the current study examines whether the associations among local (residential) and extralocal neighbourhood disadvantage found in US samples similarly characterizes patterns of offending among European youth.

The second limitation is that theoretical explanations for the described spatial patterns are in short supply. It is unclear why levels of disadvantage in spatially proximate neighbourhoods would exert countervailing influences on individual behaviour. We attend to this gap in the literature by examining three complementary explanations that may help account for this association. We propose that nearby affluence may: (1) provide greater opportunities to engage in acquisitive forms of offending; (2) translate into lower levels of parental monitoring, which, in turn, increases involvement in unstructured socializing and (3) instigate unfavourable comparison processes, increasing feelings of disrespect and injustice. We replicate and extend prior research by examining the relationships between residential and nearby levels of neighbourhood disadvantage on self-reported offending among a sample of Dutch youth.

Nearby Neighbourhood Influences on Adolescent Offending

Adolescents' activities are rarely confined to their immediate neighbourhood environments. The typical adolescent spends upwards of 50 per cent of their waking hours engaged in activities outside of this residential area (Wikström *et al.* 2010) and travels an average of 8.5 km (5.25 miles) each day (Basta *et al.* 2010). As such, characteristics of residential neighbourhoods may only partially capture environmental influences that affect youth behaviour (Wikström *et al.* 2012; Browning and Soller 2014). Nearby neighbourhoods are an important component of youth activity spaces, as adolescents regularly traverse these areas as they commute to and from school, their friends' homes and various extracurricular activities. The structural characteristics of nearby areas expose youth to factors that either encourage or inhibit criminal conduct. They also serve as important frames of reference as youth come to view their place within their broader social environments (Shedd 2015).

Thus far, few studies have explored how features of such nearby neighbourhoods affect individual-level offending (Wikström *et al.* 2010; Graif 2015; Vogel 2016; Vogel and South 2016). Generally, these studies find that *relative affluence* in the broader community, rather than concentrated disadvantage, has more profound consequences for problematic youth behaviour. For instance, Graif (2015) investigated how levels of poverty in 'extended neighbourhoods' influenced delinquency among the predominantly low-income youth participating in the Moving to Opportunity experiment. The results demonstrate that boys who lived in high poverty areas surrounded by low poverty areas participated in delinquent behaviour at much higher rates than boys who lived in neighbourhoods surrounded by similar levels of poverty. Vogel and South (2016) examined the separate effects of levels of disadvantage in local and nearby neighbourhoods on offending among a representative sample of American youth (National Longitudinal

Survey of Youth, 1997 Cohort). They report that local disadvantage exerts a strong, *positive* effect on offending, while levels of disadvantage in nearby neighbourhoods has a strong, *negative* effect.

To our knowledge, no studies have examined whether this spatial pattern is confirmed in locations outside of the United States. Due to their historical development, European cities are characterized by infrastructure and concentrations of residential and commercial activity that are distinctive from their American counterparts (Pauwels *et al.* 2018). The zonal model of Park and Burgess (2019) often does not apply. Relevant to the current study, research demonstrates that neighbourhood-level variance in individual delinquency in Western-European samples is often smaller than in US samples (Pauwels *et al.* 2015), that social disorganization theory might be less applicable in a European context (Bruinsma *et al.* 2013; Sutherland *et al.* 2013 but see Favarin 2018; Gerell and Kronkvist 2017) and that European neighbourhoods tend to be less segregated than American neighbourhoods (Musterd 2005). Thus, the spatial distribution of socio-economic disadvantage is not as pronounced in the European context as it is in the United States. Therefore, replicating the work by Graif (2015) and Vogel and South (2016) provides an important and conservative test of the generalizability of previous findings established primarily among American samples while also responding to more general calls from criminologists for replication research (Pridemore *et al.* 2018; Savolainen and Van Eseltine 2018).

Although we do not know of studies that have examined local and extralocal neighbourhood effects in non-US cities, there are indications that European youth are also more strongly influenced by economic inequality than by concentrated disadvantage. In a study among 1,630 children (aged 5 to 12) in the United Kingdom, Odgers *et al.* (2015) found that low-income boys (but not girls) who grew up surrounded by more affluent neighbours engaged in *more* antisocial behaviour than their peers who resided in areas of concentrated disadvantage. This study focussed on variability in local disadvantage, operationalized as the socio-economic status in the 0.5-mile radius around the respondents' homes. Nieuwenhuis *et al.* (2017) examined the role of neighbourhood wealth on internalizing and externalizing problem behaviour among 926 adolescents (aged 12–20) from the Netherlands. Local neighbourhood wealth was operationalized as the average property value in postcode areas, containing on average 17 households. They found that, after controlling for parental income, adolescents who had moved to a more affluent postcode showed increased levels of aggression than those who moved to a less affluent postcode.

Individual-Level Explanations

Beyond questions of generalizability, there have been relatively limited attempts to theoretically explicate and empirically assess the proximate processes underlying the spatial patterning of local and nearby neighbourhood characteristics on offending. Building upon prior research, we propose three complementary explanations for why levels of affluence in nearby neighbourhoods may condition the effect of local disadvantage on individual-level offending. We refer to these as the *opportunity*, *parenting* and *relative deprivation* explanations. Each of these explanations is theorized to operate at the individual level. In other words, we focus on how neighbourhood context contributes

to how adolescents perceive opportunities, parenting practises and relative deprivation and whether these perceptions translate into individual involvement in offending.

Opportunity

The first explanation concerns temptations or opportunities for offending available in geographically proximate neighbourhoods. Drawing from routine activities theory (Cohen and Felson 1979), criminal behaviour can be seen as the confluence of a motivated offender and a suitable target in the absence of a capable guardian. In line with this theory, studies have shown that individuals with the highest risk of offending are those most often exposed to areas where temptations are high and deterrence is low (Wikström *et al.* 2012). Criminal opportunities arise where targets convene and social control wanes. Not only is the attractiveness of an area (i.e. many targets and low deterrence) relevant for predicting crime but also the accessibility of the area. Criminal conduct is much more likely when motivated offenders live in close proximity to 'attractive' areas (Andresen *et al.* 2014; Bernasco and Block 2009). Studies of offender decision-making suggest that, while offenders would prefer to target highly affluent homes, most are comfortable selecting homes near their neighbourhoods that are just one socio-economic class above the homes in their residential neighbourhoods. In fact, burglars from poor neighbourhoods usually choose middle-income houses near their own homes (Rengert and Groff 2011).

Together, these findings suggest that a motivated offender would choose to target a given neighbourhood based on the relative affluence in that neighbourhood and the proximity of that neighbourhood to their own. Thus, while local neighbourhood disadvantage may generate a plethora of motivated offenders, *concentrated disadvantage* in the surrounding community should diminish the availability of suitable targets. Conversely, *affluence* in the surrounding community should increase the availability and visibility of targets, thereby increasing temptations for individuals to engage in offending. Adolescents who reside in disadvantaged neighbourhoods surrounded by neighbourhoods with comparably higher levels of affluence are expected to encounter criminogenic opportunities more frequently than adolescents from areas characterized by concentrated disadvantage.¹

Parenting

Parents who live in disadvantaged neighbourhoods may be more active in monitoring their children's whereabouts and may take a proactive role in supervising their children's behaviour if they perceive other adults in the community as unable or unwilling to do so (Furstenberg *et al.* 1999; Tolan *et al.* 2003; Zuberi 2016).² The protective influences of parental monitoring are well documented in the criminological literature (for a meta-analysis, see Hoeve *et al.* 2009) and research suggests that parental

¹To be clear, opportunities to offend can arise at an areal level. Ultimately, however, offending occurs when *individuals* observe and decide to respond to the presence of such opportunities (Wikström *et al.* 2012).

²These studies show that there is a tendency for parents living in disadvantaged neighbourhoods to exercise a higher level of parental monitoring, but they do not take into account characteristics of nearby ('extralocal') neighbourhoods. We do not know of research that examines the role of nearby affluence on parenting behaviour.

supervision reduces the deleterious impact of socio-economic disadvantage on delinquent behaviour (Rankin and Quane 2002; Burrington 2015). In this sense, nearby *disadvantage* may serve a protective function as parents will be especially vigilant in monitoring their children's behaviour or they may work harder to shield their children from potentially negative influences when they perceive the surrounding community as dangerous (Vogel *et al.* 2017). On the other hand, we might expect parents residing in economically deprived communities to be more lenient when their neighbourhood is surrounded by relatively affluent neighbourhoods, as they place a greater deal of trust in adults in the nearby community to intervene if their children misbehave. Thus, we theorize that parents from disadvantaged neighbourhoods will take greater care in monitoring their own children's behaviour when the surrounding areas are disadvantaged. We also theorize that parents from disadvantaged neighbourhoods will be more lenient when the surrounding areas are relatively affluent. The processes proposed here diverge somewhat from studies of community-level crime rates (e.g. Sampson 1987; Osgood and Anderson 2004), as we are most concerned with how perceptions of parental monitoring affect *individual-level* involvement in offending (Hoeve *et al.* 2009) and whether differences in perceptions of parental permissiveness accounts for the effects of local and extralocal disadvantage on adolescent offending.

Active parenting may also affect adolescents' offending *indirectly* by structuring their leisure activities. Several studies report that strong parental monitoring and limit-setting decrease the amount of time that adolescents spend unsupervised with peers in unstructured activities—a phenomenon commonly referred to as 'unstructured socializing' (Osgood and Anderson 2004; Janssen *et al.* 2014). Indeed, one of the strongest situational correlates of offending involves spending unsupervised time with peers in public settings (Osgood *et al.* 1996; Bernasco 2013; Hoeven and Weerman 2014). Building from these observations, we might expect some of the effects of nearby neighbourhood affluence to operate through decreased parental monitoring and increased involvement in unstructured socializing. Thus, it is not the temptations provided in affluent communities that *increase* delinquency; rather, it is the *decreased* parental monitoring associated with nearby affluence that *increases* opportunities for youth to get in trouble.

Relative deprivation

High levels of affluence in the surrounding community may lead youth from disadvantaged neighbourhoods to negatively evaluate their own circumstances in relation to those around them. Consistent with theories of relative deprivation, perceived inequality may be accompanied by feelings of injustice or anger (Jarjoura and Triplett 1997; Smith *et al.* 2012), which may give rise to externalizing forms of offending as youth attempt to either equalize the perceived injustice (through theft) or to act out their frustrations (through violence or vandalism).

Aside from evoking frustration among youth living in disadvantaged neighbourhoods, inequality may also influence the behaviour of the residents of nearby neighbourhoods. Group threat theories portend that residents of affluent neighbourhoods located near pockets of concentrated disadvantage may be especially sensitive to outsiders encroaching on their turf. Such residents may also be more vigilant to defend

their community from the perceived threat posed by those who look and behave differently (Green *et al.* 1998; Lyons 2008). These defence mechanisms may manifest in verbal or physical confrontations or through the reliance on police officers to ensure that outsiders are discouraged from lingering too long. Adolescents who live near—and travel through—relatively affluent communities may be viewed as ‘outsiders’ and met with hostility. They may need to work harder to navigate physical and social spaces to avoid conflicts with residents who are already ‘on guard’. Indeed, urban youth seem especially cognizant of the places through which they can safely travel and of the places where they need to avoid conflict (Sharkey 2006; Shedd 2015). In this sense, relative affluence in the nearby community may give rise to higher levels of offending as youth experience greater conflict in comparison to their peers who live in areas of either concentrated disadvantage or concentrated affluence. Thus, we expect the effect of local disadvantage on offending to be stronger when youths’ residential neighbourhoods are surrounded by more affluent communities and, conversely, for this effect to diminish as levels of disadvantage in nearby neighbourhoods increase.

Current Study

The current study examines the role of local and extralocal neighbourhood socio-economic disadvantage on self-reported offending among a sample of Dutch adolescents. We contribute to prior research in two ways. First, we examine whether the spatial patterning of neighbourhood effects on individual behaviour that have been observed among samples of American youth also characterize self-reported offending among a sample of Dutch youth. Second, we directly assess three explanations hypothesized to underlie the spatial patterning of neighbourhood disadvantage on adolescent offending. This is the first study to attempt to explain how and why features of nearby neighbourhoods exert countervailing influences on adolescent offending.

Methods

Data

Data for this study come from the Study of Peers, Activities, and Neighbourhoods (SPAN), a two-wave, dual cohort, longitudinal study of high-school students in the Dutch city of the Hague and its surrounding suburbs. The Hague is the third largest city in the Netherlands and the seat of the Dutch government. It is one of the four cities that comprise the Randstad, the largest metropolitan area in northern Europe. The SPAN project was designed to test various criminological theories and contains a number of theoretically relevant concepts at the individual, family, peer, school and neighbourhood levels. The first wave of data collection took place during the school year 2008–09 and the second wave two years later in 2010–11. In total, 843 adolescents participated in the first wave and 616 respondents participated in the second wave. The study consists of two cohorts. At the first wave of the data collection, the younger cohort attended Grade 1 (age 12–13) and the older cohort attended Grade 4 (age 15–16). The current study uses data from the W1 survey. The average age of respondents is 14.67 years; the majority of respondents is male (55 per cent), are native Dutch (54 per cent) and live with both parents (60 per cent).

*Measures**Dependent variable*

The core dependent variable in each of the regression equations is an index of *general offending*, measured as the frequency in which respondents reported they had engaged in 20 different acts of delinquency in the 12 months preceding the interview ($\alpha = 0.81$). Items in this index include measures of minor delinquency, such as shoplifting and vandalism, as well as more serious acts, including arson, robbery and assault. [Table A1](#) documents all items included in the offending scale. Additional analyses examine the effects of neighbourhood disadvantage on acquisitive offending and violence. Acquisitive offending was measured as the frequency in which respondents reported to have engaged in seven acts of theft or burglary ($\alpha = 0.88$). Violence was measured with three items, asking the respondents whether they had hit or kicked someone; injured someone by hitting or kicking or whether they had threatened someone in the past 12 months ($\alpha = 0.80$). [Table 1](#) presents the descriptive statistics for all variables included in the analyses

Local neighbourhood disadvantage

In an effort to examine the influence of local and nearby neighbourhood conditions on offending, we append official measures of neighbourhood socio-economic disadvantage to the individual records of 794 respondents who participated in the first wave of data collection. These measures were culled from Statistics Netherlands ([Centraal Bureau voor de Statistiek 2008](#)). Consistent with many studies conducted on Dutch

TABLE 1 *Descriptive statistics (N = 794)*

| | Mean | SD | Min | Max |
|-------------------------------------|-------|-------|--------|-------|
| Dependent variables | | | | |
| Self-reported offending | 3.74 | 6.19 | 0.00 | 55.00 |
| Self-reported acquisitive offending | 0.89 | 3.19 | 0.00 | 35.00 |
| Self-reported violence | 2.48 | 4.33 | 0.00 | 25.00 |
| Demographics | | | | |
| Age | 14.67 | 1.67 | 11.30 | 18.8 |
| Ethnic minority | 0.46 | 0.50 | 0.00 | 0.46 |
| Female | 0.45 | 0.50 | 0.00 | 1.00 |
| Two-parent household | 0.60 | 0.48 | 0.00 | 1.00 |
| Parental unemployment | 0.07 | 0.26 | 0.00 | 1.00 |
| Individual variables | | | | |
| Self-control | 29.40 | 6.32 | 10.00 | 45.00 |
| Peer delinquency | 9.04 | 3.43 | 5.92 | 23.00 |
| School attachment | 11.66 | 2.07 | 3.00 | 15.00 |
| Perceived temptations | 9.20 | 2.97 | 5.00 | 20.00 |
| Parental monitoring | 16.69 | 4.24 | 5.00 | 25.00 |
| Unstructured socializing | 5.56 | 2.02 | 3.00 | 12.00 |
| Perceived provocations | 9.22 | 2.98 | 5.00 | 20.00 |
| Neighbourhood variables | | | | |
| Neighbourhood disadvantage | 0.75 | 2.79 | -12.38 | 6.26 |
| Non-western immigrants | 31.94 | 26.61 | 1.00 | 91.00 |

Source: Study of Peers Activities and Neighbourhoods. CBS census data.
SD, standard deviation.

samples, we employ *buurten* (Dutch for neighbourhoods) as our geographic aggregation. On average, neighbourhoods in Dutch metropolitan areas are approximately half the size of the US census tract. Our index of neighbourhood disadvantage combines five indicators: the average income per inhabitant, the proportion of the population with an income in the lowest forty per cent in the Netherlands, the proportion of the population aged 15–65 that is unemployed, the proportion of the population receiving sick or disability benefits and the proportion of the population receiving unemployment benefits. These items are highly intercorrelated and load on a single factor ($\alpha = 0.83$). Our index of neighbourhood disadvantage combines these into a standardized index such that higher scores indicate greater levels of neighbourhood *disadvantage*.

Nearby neighbourhood disadvantage

Following Vogel and South (2016), we construct a spatially lagged, distance-weighted index capturing the average level of socio-economic disadvantage in all neighbourhoods within 5 km (3.11 miles) of each respondent's tract of residence.³ This variable is based on the application of spatial weights to the level of disadvantage in these nearby areas. The strategy used here assumes that the influence of surrounding neighbourhoods on the behaviour of individuals in a focal neighbourhood is inverse to the distance of the surrounding neighbourhood from the individual's residential neighbourhood. Specifically, we construct a row-standardized matrix of spatial weights defined as

$$w_{ij} = \frac{1}{d_{ij}}$$

where d_{ij} is the geographic distance between the centroid of the neighbourhood of residence (i) and the centroid of the nearby neighbourhood (j). Row standardization assures that the nearby neighbourhood disadvantage effect is independent of the actual number of nearby neighbourhoods.

While many studies employ spatial lag models that either (1) combine local and nearby neighbourhood characteristics (Graif 2015) or (2) consider only the influence of adjacent neighbourhood characteristics (Mears and Bhati 2006), a key advantage of our measure is that we are able to specify separate effects of local and more distal neighbourhood socio-economic conditions. The use of the distance decay function allows us to consider the declining influence of nearby yet non-contiguous neighbourhoods on youth offending—areas that form a considerable portion of youth activity spaces. This measurement strategy treats the spatially lagged index as a separate contextual characteristic with possible additive and interactive effects. We refer to the levels of disadvantage in respondents' residential neighbourhoods as 'local' disadvantage and to the spatially weighted measure of disadvantage in the surrounding community as 'extralocal' disadvantage. It is important to note that, although the correlation

³The distance of five kilometres was chosen arbitrarily. In creating our spatial weights matrix, we had to select a distance band that would be large enough to incorporate all neighbourhoods in the Netherlands without generating isolates—a condition necessary for the estimation of the weights matrix. As a sensitivity analysis, we re-estimated the spatial lags using buffers of 3.5, four and ten kilometres (2.17, 2.49 and 6.21 miles, respectively). These models revealed stronger spatial effects of neighbourhood disadvantage on offending with the smaller buffers, but the general findings comport with those reported herein. These models are available from the first author.

between local and extralocal disadvantage is positive and strong ($r = 0.64$), it is not so high as to prohibit estimating separately the effects of local and nearby disadvantage on offending.

Explanatory factors

The empirical models include several measures intended to explain the spatial patterning of neighbourhood disadvantage on self-reported offending. The first explanation, regarding exposure to perceived opportunities, is represented by the variable *perceived temptations* ($\alpha = 0.65$), which measures the most recent time respondents felt tempted to commit four types of delinquent acts (i.e. destroying property, hitting someone, stealing something from a store or breaking in to a car). Answer categories were 'last week', 'last month', 'last year', 'over a year ago' and 'never been tempted'. A higher score indicates a more recent temptation. This construct originated from the PADS+ study (Wikström *et al.* 2012).

The second explanation regards parental monitoring and unstructured socializing. *Parental monitoring* (Kerr and Stattin 2003) is a five-item scale that captures the extent to which respondents inform their parents of where they are and with whom they will be with when they go out ($\alpha = 0.77$). *Unstructured socializing* (Osgood *et al.* 1996) is a three-item scale that captures the frequency with which respondents report spending time with their friends in public places, including on the streets, malls and the city centre ($\alpha = 0.63$).

The third explanation, regarding feelings associated with relative deprivation, was represented by the variable *perceived provocations*, a five-item scale measuring how often respondents feel that other people disrespect or provoke them ($\alpha = 0.79$). Answer categories were 'never', 'sometimes', 'regularly (every month)' and 'often (every week or every day)'. A higher score indicated more frequently perceived provocations. This construct was developed for SPAN (McNeeley and Hoeben 2017).

Control variables

At the neighbourhood level, the models control for the percentage of non-western immigrants, obtained from the census data from Statistics Netherlands.⁴ At the individual level, socio-demographic control variables include respondents' *gender* (female = 1), *age* and *ethnicity*. *Ethnicity* demarcates native Dutch respondents from all other ethnic groups, primarily Surinamese, Antillean, Moroccan and Turkish (ethnic minority = 1).

The models also control for several individual-level risk factors presumably associated with neighbourhood disadvantage and self-reported offending: *Self-control* (Grasmick *et al.* 1993) is a ten-item scale encompassing items intended to capture risk seeking behaviour, lack of premeditation, temper, inability to delay gratification and a preference for simple tasks ($\alpha = 0.75$). A measure of *peer delinquency* was generated by summing

⁴The census data used here include information on all neighbourhoods in the Netherlands but contain a relatively limited number of neighbourhood variables relevant to our study. An alternative registry, the Buurtmonitor, is available for the municipality of The Hague (Den Haag in Cijfers 2008). In an effort to include a more comprehensive set of neighbourhood-level controls, we estimated a series of supplemental models on a subset of 650 respondents who lived within the boundaries of the municipality of The Hague. We incorporated neighbourhood-level controls for ethnic heterogeneity and residential mobility. Neither ethnic heterogeneity nor mobility emerge as significant predictors of any of our outcome variables. The remainder of the key findings were consistent with those reported here.

six items on which respondents reported how often their friends' skipped school, got drunk, used drugs, stole, destroyed property and got into fights ($\alpha = 0.82$). *Two-parent household* delineates respondents living in two-parent homes from other family arrangements. *Parental unemployment* differentiates youth who live with at least one employed parent from those who live in households in which neither parent is employed. *School attachment* is a three-item scale capturing the extent to which respondents report that they enjoy going to school, get along with their teachers and get along with their classmates ($\alpha = 0.65$).

Analytic strategy

The empirical analyses unfold through a series of negative binomial regression models. The first model establishes the main effect of local neighbourhood disadvantage on self-reported offending, net of the neighbourhood-level and individual-level controls. The second model incorporates the measure of extralocal disadvantage to ascertain the extent to which conditions in nearby neighbourhoods influence youth behaviour. The third model introduces an interaction between local and extralocal disadvantage to assess whether economic disadvantage in nearby neighbourhoods conditions the effect of local disadvantage on offending. The final set of models (models 4–8) incorporates the proposed explanatory factors individually and simultaneously to determine whether and how perceived temptations, parental monitoring, unstructured socializing and perceived provocations account for local and extralocal neighbourhood influences on self-reported offending. The coefficients presented in the tables are incidence rate ratios (IRR), the exponential transformation of the log counts. The IRR minus one is interpreted as the expected change in the rate of self-reported offending given a one-unit increase in the predictor variable. Values less than one signify a negative relationship between the independent variable and offending, while values greater than one indicate a positive association.

We present the results from regression models using robust (sandwich, Huber-White) standard errors that are adjusted (i.e. inflated) to account for the non-random distribution of respondents across neighbourhoods. The sample used here consists of 794 respondents nested within 143 neighbourhoods or approximately 5.6 respondents per neighbourhood. Approximately 25 per cent of all neighbourhoods contain only a single respondent and over 60 per cent contain five or fewer respondents. The maximum number of respondents in a single neighbourhood was 26.

Results

Local and extralocal neighbourhood effects

[Table 2](#) presents the results of the negative binomial models of self-reported offending regressed on the measures of local and extralocal neighbourhood disadvantage. Model 1 includes the measure of local neighbourhood disadvantage alongside the controls and Model 2 introduces the distance-weighted, spatially lagged measure of extralocal neighbourhood disadvantage. Departing from prior research ([Vogel and South 2016](#)), we detect no evidence of a direct effect of either local or extralocal disadvantage on self-reported offending.

Model 3 in Table 2 introduces the product term for local \times extralocal disadvantage. The coefficient is statistically significant and negative, suggesting that levels of disadvantage in nearby neighbourhoods moderate the effect of local disadvantage on offending. While a likelihood ratio test suggests that the inclusion of the product term does not provide a statistically significant improvement to model fit ($\chi^2 = 2.86$; $P = 0.09$), the findings provide some indication that high levels of affluence in the surrounding community amplify the criminogenic influence of local neighbourhood disadvantage on offending. This finding is consistent with the work of Graif (2015), who reports that the strongest neighbourhood effects on youth behaviour occur when impoverished neighbourhoods are surrounded by high levels of affluence.

Explaining countervailing influence of nearby neighbourhood disadvantage

Table 3 presents the results of the regression models incorporating the explanatory factors. The first model in this table, Model 4, introduces the measure of perceived temptations. The coefficient is positive, indicating that a one-unit increase in the perceived temptation scale is associated with a 23 per cent increase in the expected rate of self-reported offending. The inclusion of this measure attenuates the product term between local and extralocal neighbourhood disadvantage, reducing the magnitude

TABLE 2 Negative binomial regression model of self-reported offending on neighbourhood disadvantage and control variables ($N = 794$)

| | Model 1 | | Model 2 | | Model 3 | |
|--------------------------------|-----------|------|---------|-----------|---------|-----|
| | IRR | SE | IRR | SE | IRR | SE |
| Individual controls | | | | | | |
| Age | 0.95 | 0.03 | ** | 0.94 | 0.03 | ** |
| Ethnic minority | 1.03 | 0.10 | | 1.03 | 0.10 | |
| Female | 0.57 | 0.06 | *** | 0.57 | 0.06 | *** |
| Two-parent household | 0.93 | 0.09 | | 0.92 | 0.09 | |
| Parental unemployment | 0.85 | 0.18 | | 0.86 | 0.18 | |
| Self-control | 0.93 | 0.01 | *** | 0.93 | 0.01 | *** |
| Peer delinquency | 1.17 | 0.02 | *** | 1.17 | 0.02 | *** |
| School attachment | 0.91 | 0.02 | *** | 0.91 | 0.02 | *** |
| Non-western immigrants | 1.00 | 0.00 | | 1.00 | 0.00 | |
| Neighbourhood disadvantage | | | | | | |
| Local dis. | 1.02 | 0.03 | | 1.03 | 0.03 | |
| Extralocal dis. | – | – | | 1.10 | 0.13 | |
| Local \times extralocal dis. | – | – | | – | – | * |
| Log likelihood | –1,666.20 | | | –1,665.90 | | |
| AIC | 3,356.39 | | | 3,357.80 | | |
| BIC | 3,412.52 | | | 3,418.61 | | |

SEs adjusted for clustering within 146 neighbourhoods; SEs correspond to log counts generated from negative binomial regression model.

Source: Study of Peers Activities and Neighbourhoods; CBS census data.

AIC, Akaike's information criterion; BIC, Bayesian information criterion; dis., disadvantage; IRR, incidence rate ratio; SE, standard error.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

of the coefficient by 52.5 per cent and rendering it non-significant.⁵ These results provide partial confirmation that the spatial patterning of neighbourhood disadvantage on self-reported offending can be explained through the greater temptations to offend when youth from disadvantaged neighbourhoods live nearby relatively affluent neighbours.

The second model, Model 5, introduces the measure of parental monitoring. This measure is negatively associated with self-reported offending—a one-unit increase in parental monitoring is associated with a 5 per cent decrease in the expected rate of offending. The inclusion of parental monitoring partially attenuates the moderating effect of extralocal disadvantage on the association between local disadvantage and offending, reducing the coefficient by approximately 16.4 per cent.⁶ These results are consistent with explanations derived from social control theory and support the notion that parents who live in areas of concentrated disadvantage place a greater premium on monitoring their children's behaviour, leading to lower levels of offending.

The third model in Table 3, Model 6, reveals a positive relationship between unstructured socializing and self-reported offending—a one-unit increase in this scale is associated with an 18 per cent increase in the rate of offending behaviour. Consistent with expectation, the inclusion of this measure mitigates the product term of local \times extralocal disadvantage, leading to a 60.7 per cent reduction in the coefficient and rendering the product term non-significant.⁷

The fourth model, Model 7, introduces the measure of perceived provocations. Departing from the prior models, we find no evidence that perceived provocations are associated with self-reported offending. Also, the inclusion of this measure in the model does little to explain the moderating role of extralocal neighbourhood disadvantage on the association between local neighbourhood deprivation and offending.

The final model in Table A4, Model 8, introduces all four explanatory factors simultaneously. Consistent with the previous models, perceived temptations and unstructured socialization remain significant correlates of self-reported offending. However, the parameter estimate for parental monitoring shrinks by 64 per cent and loses statistical significance. Subsequent analyses (available from the first author) revealed that much of this effect was explained through unstructured socialization. Consistent with recent research (Janssen *et al.* 2016), this reaffirms that parental monitoring influences youth offending indirectly by shaping opportunities to engage in unstructured activities with peers. With the inclusion of all explanatory factors simultaneously, the coefficient for the product term local \times extralocal disadvantage is reduced by 85.2 per cent.⁸ This suggests that much of the countervailing influence of nearby disadvantage on youth offending can be explained through the greater temptations to engage in criminal conduct and the greater involvement in unsupervised activities with peers afforded to youth who live in disadvantaged neighbourhoods surrounded by relatively high levels of affluence.

⁵We refer to the percentage change in the log odds between Models 3 and 4. In this case, the log odds on the product term in Model 3 is -0.061 . The coefficient reduces to -0.029 with the inclusion of perceived temptations. This translates to a percentage reduction of 52.5 per cent ($(0.061 - 0.029)/0.061 = 0.524$).

⁶ $(0.061 - 0.051)/0.061 = 0.164$.

⁷ $(0.061 - 0.024)/0.061 = 0.607$.

⁸ $(0.061 - 0.009)/0.061 = 0.852$.

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TABLE 3 Negative binomial regression model of self-reported offending on neighbourhood disadvantage, control variables and explanatory factors (N = 794)

| | Model 4 | | Model 5 | | Model 6 | | Model 7 | | Model 8 | |
|----------------------------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|
| | IRR | SE | IRR | SE | IRR | SE | IRR | SE | IRR | SE |
| Individual controls | | | | | | | | | | |
| Age | 0.97 | 0.03 | 0.93 | 0.03 | 0.95 | 0.03 | 0.94 | 0.03 | 0.97 | 0.03 |
| Ethnic minority | 0.98 | 0.08 | 1.01 | 0.09 | 0.96 | 0.09 | 1.02 | 0.10 | 0.94 | 0.08 |
| Female | 0.65 | 0.06 | *** | 0.06 | 0.56 | 0.05 | *** | 0.06 | 0.66 | 0.06 |
| Two-parent household | 0.89 | 0.08 | 0.99 | 0.10 | 0.97 | 0.10 | 0.92 | 0.09 | 0.96 | 0.08 |
| Parental unemployment | 0.99 | 0.17 | 0.86 | 0.18 | 0.86 | 0.18 | 0.86 | 0.18 | 0.97 | 0.16 |
| Self-control | 0.96 | 0.01 | *** | 0.01 | 0.94 | 0.01 | *** | 0.01 | 0.97 | 0.01 |
| Peer delinquency | 1.07 | 0.02 | *** | 0.02 | 1.13 | 0.01 | *** | 0.02 | 1.06 | 0.02 |
| School attachment | 0.95 | 0.02 | * | 0.02 | 0.91 | 0.02 | *** | 0.02 | 0.95 | 0.02 |
| Non-western immigrants | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 0.01 | 1.00 | 0.01 |
| Neighbourhood disadvantage | | | | | | | | | | |
| Local dis. | 1.06 | 0.04 | 1.06 | 0.04 | 1.03 | 0.04 | 1.08 | 0.05 | 1.03 | 0.04 |
| Extralocal dis. | 1.00 | 0.11 | 1.05 | 0.12 | 1.04 | 0.11 | 1.08 | 0.13 | 0.98 | 0.10 |
| Local × extralocal dis. | 0.97 | 0.03 | 0.95 | 0.04 | 0.98 | 0.03 | 0.94 | 0.03 | 0.99 | 0.03 |
| Explanatory factors | | | | | | | | | | |
| Perceived temptations | 1.23 | 0.02 | *** | - | - | - | - | - | 1.20 | 0.02 |
| Parental monitoring | - | - | 0.95 | 0.01 | *** | - | - | - | 0.98 | 0.01 |
| Unstructured socializing | - | - | - | - | 1.18 | 0.03 | *** | - | 1.10 | 0.03 |
| Perceived provocations | - | - | - | - | - | - | 1.00 | 0.02 | 1.00 | 0.01 |
| Log likelihood | -1,585.24 | | -1,654.19 | | -1,644.93 | | -1,664.66 | | -1,574.97 | |
| AIC | 3,200.49 | | 3,338.38 | | 3,319.85 | | 3,359.33 | | 3,185.95 | |
| BIC | 3,270.64 | | 3,408.54 | | 3,390.01 | | 3,429.48 | | 3,270.13 | |

SEs adjusted for clustering within 146 neighbourhoods; SEs correspond to log counts generated from negative binomial regression model.

Source: Study of Peers Activities and Neighbourhoods; CBS census data.

AIC, Akaike's information criterion; BIC, Bayesian information criterion; dis., disadvantage; IRR, incidence rate ratio; SE, standard error.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Offence-type specific analyses

While the preceding analyses focus on a heterogeneous index of general offending, the hypothesized explanations derived from theories of routine activities and relative deprivation suggest that the spatial patterning of the effect of neighbourhood disadvantage might be *offence specific*. Specifically, if levels of affluence in the surrounding community presents youths from disadvantaged neighbourhoods with more suitable targets (i.e. opportunities), we should expect to observe a stronger effect of nearby neighbourhood affluence on acquisitive forms of offending (e.g. those committed for monetary gain). Conversely, assuming that processes of relative deprivation are at play, we might expect nearby neighbourhood affluence to be most strongly associated with violent forms of offending. Guided by these assumptions, we estimated a series of regression models with acquisitive offending (theft and burglary) and violence as dependent variables. The results of these analyses are presented in [Table A2–A4](#).

We find no evidence that local or extralocal neighbourhood affluence affects *acquisitive forms of offending* ([Table A2](#)). This suggests that the spatial patterning of neighbourhood disadvantage on general offending is driven by other forms of delinquent behaviour. In contrast, we find that local disadvantage is positively associated with *violence* such that a one standard deviation in this index is associated with an eight per cent increase in the expected rate of violence ([Table A3](#)). Moreover, the product term is statistically significant and negative, suggesting that levels of disadvantage in geographically proximate neighbourhoods diminish the positive effect of local disadvantage on violence.

The findings for the explanatory processes for the spatial patterning of neighbourhood disadvantage on violence are presented in [Table A4](#). To briefly summarize, each of these factors emerges as statistically significant predictors of violence when entered into the equation individually. Perceived temptations, unstructured socialization and perceived provocations are positively associated with violence, and parental monitoring is negatively associated with violence. Consistent with the general offending models, perceived temptations, parental monitoring and unstructured socialization each attenuate the moderating effect of extralocal disadvantage on the relationship between local disadvantage and violence. The inclusion of perceived provocations fails to diminish the product term.

When considered simultaneously (Model 8 in [Table A4](#)), parental monitoring, perceived provocations and perceived temptations remain robust correlates of violence. However, the parameter estimate for unstructured socialization is attenuated and no longer significant in this model. Subsequent analyses reveal that most of this effect is absorbed by the measure of temptations (leading to a 53.4 per cent reduction in effect size), perhaps indicating that time spent engaged in unstructured socializing increases temptations for acts of violence ([Hoeben and Weerman 2016](#)). The inclusion of all four explanatory factors reduces the moderating effect of extralocal neighbourhood disadvantage by 48.9 per cent, almost fully attenuating the coefficient.

Discussion

This study replicates and extends recent research examining the spatial patterning of neighbourhood influences on adolescent offending. Drawn primarily from samples of

American youth, this small body of research has found that levels of socio-economic disadvantage in residential neighbourhoods *increases* youth self-reports of criminal conduct, while levels of disadvantage in the surrounding community *suppress* offending. Guided by the recognition that European neighbourhoods differ substantially from their American counterparts, we attempted to replicate the countervailing influences of local and extralocal neighbourhood disadvantage on youth offending observed in US samples among a sample of Dutch youth. Moving beyond current research, we next evaluated whether three complementary processes account for these spatial dynamics. Specifically, we proposed that relative affluence in nearby neighbourhoods may contribute to adolescent offending by (1) increasing temptations to offend, (2) decreasing parental monitoring, leading to increased involvement in unstructured socializing, and (3) initiating social comparison processes that provoke youth into criminal behaviour.

Departing from prior research in the United States (Vogel and South 2016), our empirical models provided no evidence of a direct association between local or extralocal socio-economic disadvantage on offending. However, the product term between local and extralocal disadvantage revealed that the effect of local neighbourhood disadvantage on offending *increases* as nearby disadvantage *decreases*. While the exact nature of these spatial dynamics departs slightly from prior research, this finding is consistent with the main conclusions from those studies: The strongest effects of neighbourhood disadvantage on youth offending occur not when youth live in disadvantaged neighbourhoods surrounded by other disadvantaged neighbourhoods but when youth live in disadvantaged neighbourhoods surrounded by neighbourhoods more affluent than their own (Graif 2015; Vogel and South 2016).

The second set of analyses assessed the extent to which key constructs derived from the three theoretical perspectives explain the spatial patterning of neighbourhood disadvantage on self-reported offending. The results indicate that the effect of local socio-economic disadvantage on criminal conduct is most pronounced when residential neighbourhoods are surrounded by more affluent neighbourhoods because (1) nearby areas increase temptations to engage in offending and (2) parents are less vigilant in monitoring their children's behaviour, thus increasing adolescents' time spent unstructured socializing when the nearby community is more affluent than their own neighbourhood. Parents may take a more active role in monitoring their own children's behaviour when they perceive the surrounding community as dangerous (Furstenberg *et al.* 1999; Rankin and Quane 2002; Zuberi 2016), whereas they may be more lenient when they perceive residents of nearby neighbourhoods as willing and able to intervene. Increased monitoring may limit the ability for youth to spend time in unsupervised activities with their peers, thus translating to lower levels of self-reported offending. Indeed, the models provide some evidence that parental monitoring decreases unstructured socialization, which further mitigates the moderating influence of extralocal socio-economic disadvantage on self-reported offending.

Limitations

Our assessment of the potential explanations underlying the spatial patterning of neighbourhood disadvantage on offending resulted in two unexpected findings that might signal limitations of the current study. First, we find no evidence that affluence

in the surrounding community translates to a greater sense of perceived provocations among youth living in low-income neighbourhoods, as anticipated by theories of relative deprivation. This is contrary to the explanations often evoked in prior research (Graif 2015; Odgers *et al.* 2015; Vogel and South 2016). It is possible that our inability to detect an effect is due to our measurement of the key construct representing relative deprivation. While our index of perceived provocations captures confrontations and hostility to which youth from disadvantaged neighbourhoods are potentially exposed while traversing through comparatively affluent nearby areas, a more rigorous test of this perspective requires a measurement strategy that directly taps into feelings of injustice arising from youth's comparisons with nearby neighbours. Although the models provide little evidence for the role of perceived provocations, the supplemental analyses were consistent with theories of relative deprivation, showing that adolescents who resided in disadvantaged neighbourhood were more likely to engage in violence when their neighbourhoods are surrounded by relative affluence.

Second, while the results regarding the opportunity explanation provide some evidence that the spatial patterning of neighbourhood disadvantage can be attributed to increased temptations provided in nearby, affluent neighbourhoods, the supplemental models paint a more complex picture. If the countervailing influence of extralocal affluence would be mainly driven by providing motivated offenders with nearby targets, we would expect the spatial patterning of disadvantage to be especially salient for acquisitive forms of offending. However, the results provide limited support for this supposition. This suggests that, while nearby affluence may increase temptations and thereby increase risks for offending, these temptations do not necessarily translate into a greater desire to steal or burgle. Notably, our measure of neighbourhood disadvantage focusses on *residents'* financial well-being (e.g. average income and receipt of social benefits), which assumes that opportunities for acquisitive offending would mainly concern theft and burglary from residences. Future work might account for the role of commercial activity since neighbourhoods with concentrated commercial activity will provide greater opportunities for theft irrespective of the income levels of the people residing in these areas (Wikström *et al.* 2010; 2012; Tillyer and Walter 2019).

A final limitation is that we do not directly assess where offending occurs, even though some of the theoretical arguments linking extralocal neighbourhood characteristics to offending assume that individuals engage in criminal conduct in the areas closest to their homes. As such, the models of acquisitive offending may be better specified were we to focus exclusively on theft and burglaries occurring in nearby neighbourhoods. To this end, we strongly advocate the use of spatially referenced measures of offending in future research, such as space-time budgets (Wikström *et al.* 2012; Hoeben *et al.* 2014), to better determine the situational aspects and structural characteristics of the places in which adolescents engage in delinquent behaviour.

Conclusion

The findings documented here provide an important step toward unravelling the spatial dynamics of neighbourhood influences on individual offending. Departing from much research on aggregate levels of crime and delinquency, our results underscore the countervailing influence of broader community features—when considered along residential

neighbourhood characteristics—on adolescent self-reports of offending. Consistent with a growing body of literature, these findings indicate that the strongest effects of neighbourhood disadvantage on youth offending occur when residential neighbourhoods are located nearby relatively affluent neighbourhoods rather than in areas of concentrated disadvantage (Graif 2015; Odgers *et al.* 2015; Vogel and South 2016). Given the less rigid differences in socio-economic disadvantage and residential segregation across Dutch neighbourhoods, these findings present a conservative replication of previous research from primarily US samples. At the same time, the findings underscore a more general process concerning the spatial dynamics of neighbourhood effect on youth offending that extends beyond the United States. Notably, this is the first study to directly examine the explanatory processes underlying the spatial patterning of neighbourhood disadvantage on offending. Parental monitoring and criminogenic opportunities emerge as important mechanisms in this regard. We encourage researchers to carefully consider the role of broader community factors, alongside local neighbourhood characteristics, when examining theoretical models of neighbourhood effects on adolescent behaviour.

ACKNOWLEDGEMENTS

The authors would like to thank Per-Olof Wikström for sharing the questionnaire developed for the Peterborough Adolescent and Young Adult Development Study (PADS+) and Kirsten Grandia and Lieneke Spel for their role in coordinating the data collection and managing the SPAN fieldwork.

APPENDICES

TABLE A1 *Frequency of offending per item (N = 794)*

| | Mean | SD | Min | Max |
|---|------|------|-----|-----|
| Plastered objects with paint, pen or spray paint | 0.92 | 1.45 | 0 | 5 |
| Damaged or destroyed something | 0.71 | 1.23 | 0 | 5 |
| Set a fire | 0.26 | 0.87 | 0 | 5 |
| Stolen something from a store worth less than €5 | 0.71 | 1.32 | 0 | 5 |
| Stolen something from a store worth more than €5 ^a | 0.19 | 0.67 | 0 | 5 |
| Bought something you knew was stolen | 0.34 | 0.90 | 0 | 5 |
| Stolen a bicycle ^a | 0.25 | 0.77 | 0 | 5 |
| Stolen a scooter or moped ^a | 0.13 | 0.65 | 0 | 5 |
| Broken into a house to steal ^a | 0.07 | 0.47 | 0 | 5 |
| Broken into a car to steal ^a | 0.06 | 0.46 | 0 | 5 |
| Broken into somewhere else to steal ^a | 0.08 | 0.48 | 0 | 5 |
| Robbed someone | 0.06 | 0.42 | 0 | 5 |
| Stolen anything covertly ^a | 0.15 | 0.59 | 0 | 5 |
| Threatened someone ^b | 0.33 | 0.87 | 0 | 5 |
| Kicked or hit someone ^b | 0.84 | 1.46 | 0 | 5 |
| Injured someone by kicking or hitting ^b | 0.55 | 1.18 | 0 | 5 |
| Sold drugs like weed or hash | 0.24 | 0.93 | 0 | 5 |
| Sold drugs like XTC, cocaine or speed | 0.12 | 0.62 | 0 | 5 |
| Carried a knife or other weapon | 0.60 | 1.39 | 0 | 5 |
| Used a knife or other weapon | 0.16 | 0.69 | 0 | 5 |

^aItems included in the measure of acquisitive offending.

^bItems included in the measure of violence.

TABLE A2 *Negative binomial regression model of self-reported acquisitive offending on neighbourhood disadvantage and control variables (N = 794)*

| | Model 1 | | Model 2 | | Model 3 | | | | |
|----------------------------|----------|------|----------|------|----------|------|------|------|-----|
| | IRR | SE | IRR | SE | IRR | SE | | | |
| Individual controls | | | | | | | | | |
| Age | 1.05 | 0.06 | 1.06 | 0.07 | 1.06 | 0.07 | | | |
| Ethnic minority | 1.46 | 0.26 | * | 1.47 | 0.27 | * | 1.49 | 0.27 | * |
| Female | 0.46 | 0.08 | *** | 0.46 | 0.08 | *** | 0.46 | 0.08 | *** |
| Two-parent household | 0.73 | 0.12 | | 0.70 | 0.12 | * | 0.69 | 0.12 | |
| Parental unemployment | 1.04 | 0.46 | | 1.04 | 0.49 | | 1.04 | 0.43 | |
| Self-control | 0.91 | 0.02 | *** | 0.91 | 0.01 | *** | 0.91 | 0.01 | *** |
| Peer delinquency | 1.25 | 0.04 | *** | 1.26 | 0.04 | *** | 1.26 | 0.04 | *** |
| School attachment | 0.94 | 0.04 | | 0.96 | 0.04 | | 0.96 | 0.04 | |
| Non-western immigrants | 1.00 | 0.01 | | 0.99 | 0.01 | | 1.00 | 0.01 | |
| Neighbourhood disadvantage | | | | | | | | | |
| Local dis. | 0.94 | 0.05 | | 0.94 | 0.03 | | 1.06 | 0.08 | |
| Extralocal dis. | - | - | | 1.55 | 0.37 | | 1.45 | 0.37 | |
| Local × extralocal dis. | - | - | | - | - | | 0.87 | 0.06 | |
| Log likelihood | -639.48 | | -637.85 | | -636.01 | | | | |
| AIC | 1,302.96 | | 1,301.15 | | 1,300.02 | | | | |
| BIC | 1,358.96 | | 1,361.82 | | 1,365.36 | | | | |

SEs adjusted for clustering within 146 neighbourhoods; SEs correspond to log counts generated from logistic regression model.

Source: Study of Peers Activities and Neighbourhoods; CBS census data.

AIC, Akaike's information criterion; BIC, Bayesian information criterion; dis., disadvantage; IRR, incidence rate ratio; SE, standard error.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE A3 *Negative binomial regression model of self-reported violence on neighbourhood disadvantage and control variables (N = 794)*

| | Model 1 | | Model 2 | | Model 3 | | | | |
|----------------------------|-----------|------|-----------|------|-----------|------|------|------|-----|
| | IRR | SE | IRR | SE | IRR | SE | | | |
| Individual controls | | | | | | | | | |
| Age | 0.99 | 0.04 | 0.99 | 0.04 | 0.98 | 0.04 | | | |
| Ethnic minority | 1.15 | 0.13 | | 1.16 | 0.13 | | 1.15 | 0.13 | |
| Female | 0.45 | 0.05 | *** | 0.45 | 0.05 | *** | 0.45 | 0.05 | *** |
| Two-parent household | 0.92 | 0.11 | | 0.92 | 0.12 | | 0.90 | 0.12 | |
| Parental unemployment | 1.09 | 0.25 | | 1.12 | 0.26 | | 1.12 | 0.25 | |
| Self-control | 0.93 | 0.01 | *** | 0.93 | 0.01 | *** | 0.93 | 0.01 | *** |
| Peer delinquency | 1.16 | 0.02 | *** | 1.16 | 0.02 | *** | 1.16 | 0.02 | *** |
| School attachment | 0.92 | 0.03 | ** | 0.92 | 0.03 | *** | 0.93 | 0.03 | * |
| Non-western immigrants | 1.00 | 0.00 | | 1.00 | 0.01 | | 1.00 | 0.01 | |
| Neighbourhood disadvantage | | | | | | | | | |
| Local dis. | 1.08 | 0.05 | * | 1.09 | 0.05 | * | 1.18 | 0.07 | ** |
| Extralocal dis. | - | - | | 1.21 | 0.17 | | 1.18 | 0.17 | |
| Local × extralocal dis. | - | - | | - | - | | 0.91 | 0.04 | * |
| Log likelihood | -1,380.78 | | -1,380.04 | | -1,378.10 | | | | |
| AIC | 2,785.78 | | 2,786.09 | | 2,783.83 | | | | |
| BIC | 2,841.69 | | 2,846.89 | | 2,844.63 | | | | |

SEs adjusted for clustering within 146 neighbourhoods.

Source: Study of Peers Activities and Neighbourhoods; CBS census data.

AIC, Akaike's information criterion; BIC, Bayesian information criterion; dis., disadvantage; IRR, incidence rate ratio; SE, standard error.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

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TABLE A4 Negative binomial regression model of self-reported violence on neighbourhood disadvantage, control variables and explanatory factors (N = 794)

| | Model 4 | | Model 5 | | Model 6 | | Model 7 | | Model 8 | |
|----------------------------|-----------|------|-----------|------|-----------|------|-----------|------|----------|----------|
| | IRR | SE | IRR | SE | IRR | SE | IRR | SE | IRR | SE |
| Individual controls | | | | | | | | | | |
| Age | 1.00 | 0.04 | 0.97 | 0.04 | 0.98 | 0.04 | 1.00 | 0.04 | 1.00 | 0.04 |
| Ethnic minority | 1.13 | 0.11 | 1.17 | 0.13 | 1.13 | 0.12 | 1.17 | 0.13 | 1.14 | 0.12 |
| Female | 0.50 | 0.05 | *** | 0.06 | *** | 0.05 | *** | 0.05 | *** | 0.06 |
| Two-parent household | 0.88 | 0.11 | 0.97 | 0.12 | 0.95 | 0.12 | 0.89 | 0.11 | 0.92 | 0.11 |
| Parental unemployment | 1.18 | 0.23 | 1.11 | 0.25 | 1.13 | 0.26 | 1.14 | 0.26 | 1.19 | 0.24 |
| Self-control | 0.95 | 0.01 | *** | 0.01 | *** | 0.01 | *** | 0.01 | *** | 0.01 |
| Peer delinquency | 1.09 | 0.02 | *** | 0.01 | *** | 0.02 | *** | 0.02 | *** | 0.02 |
| School attachment | 0.96 | 0.03 | *** | 0.03 | * | 0.03 | * | 0.03 | * | 0.03 |
| Non-western immigrants | 1.01 | 0.01 | 1.01 | 0.01 | 1.01 | 0.01 | 1.01 | 0.01 | 1.01 | 0.01 |
| Neighbourhood disadvantage | | | | | | | | | | |
| Local dis. | 1.14 | 0.07 | * | 0.07 | ** | 0.07 | * | 0.07 | ** | 0.07 |
| Extralocal dis. | 1.10 | 0.14 | 1.14 | 0.16 | 1.13 | 0.15 | 1.18 | 0.17 | 1.06 | 0.14 |
| Local × extralocal dis. | 0.94 | 0.04 | 0.92 | 0.04 | * | 0.04 | 0.91 | 0.03 | ** | 0.04 |
| Explanatory factors | | | | | | | | | | |
| Perceived temptations | 1.18 | 0.02 | *** | - | - | - | - | - | 1.16 | 0.02 |
| Parental monitoring | - | - | 0.95 | 0.01 | *** | - | - | - | 0.97 | 0.01 |
| Unstructured socializing | - | - | - | - | 1.11 | 0.04 | *** | - | 1.05 | 0.04 |
| Perceived provocations | - | - | - | - | - | - | 1.03 | 0.02 | * | 1.040.02 |
| Log likelihood | -1,348.43 | | -1,372.09 | | -1,373.32 | | -1,376.73 | | 1,343.97 | |
| AIC | 2,726.86 | | 2,774.17 | | 2,776.65 | | 2,783.47 | | 2,723.94 | |
| BIC | 2,797.02 | | 2,844.33 | | 2,846.80 | | 2,853.62 | | 2,808.12 | |

SEs adjusted for clustering within 146 neighbourhoods.

Source: Study of Peers Activities and Neighbourhoods; CBS census data.

AIC, Akaike's information criterion; BIC, Bayesian information criterion; dis., disadvantage; IRR, incidence rate ratio; SE, standard error.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

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