ORIGINAL ARTICLE

Differentiating Between Outlaw Motorcycle Gangs (OMCGs): Estimating the Effect of Membership of the Most Crime-Prone OMCGs on Crime Using Matching Weights

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Introduction

Outlaw motorcycle gangs (OMCGs) are increasingly viewed as societal menace. Prior research corroborates concerns about OMCGs by showing that many outlaw bikers have a criminal record for various—at times serious–types of offenses (Blokland et al., 2019; Klement, 2016; Rostami & Mondani, 2019; Van Deuren et al., 2021). From a theoretical point of view, OMCGs appear to occupy somewhat of a middle-ground between street gangs and organized crime groups (Von Lampe & Blokland, 2020). Like street gangs, OMCGs are durable, street orientated associations, whose members engage in criminal activity, such as violence and damaging offenses (Klein & Maxson, 2006). Unlike street gang members, however, OMCG members tend to be adults (Blokland et al., 2019; Klement, 2016). Some OMCGs have also been found to engage in serious and organized crimes, such as the manufacturing and trafficking of drugs, extortion, and racketeering (Barker, 2015; Quinn & Koch, 2003; Von Lampe & Blokland, 2020), making them resemble organized crime groups rather than juvenile street gangs in this respect (Lauchs et al., 2015).

Despite being labeled as 'outlaw gangs', not all OMCGs and their members are equally involved in crime. While those enmeshed in the outlaw biker subculture appear, on average, more crime-prone than non-outlaw biker males (Van Deuren et al., 2021), both theory and empirical research indicate that there is still ample variation among groups characterized as outlaw biker gangs (Blokland et al., 2017b; Morgan et al., 2020; Wolf, 1991); OMCGs cover a full spectrum from clubs to

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organizations of criminals and criminal gangs (Barker, 2015; Von Lampe, 2016). These differences in OMCGs' level of criminal involvement suggests that, even within those that are part of the outlaw biker subculture, the effects of OMCG membership on crime may be conditional of the type of OMCG one becomes a member of.

By studying both the juvenile and adult criminal careers of Dutch OMCG members, we seek to assess the potential criminogenic effects of OMCG membership, while instead of making the common comparison between gang members and non-gang members, we make use of observed variation in OMCGs' level of criminal involvement (Blokland et al., 2017a, b; Morgan et al., 2020). By using unique and long-term criminal career data on 2090 police-identified members of Dutch OMCGs and their support clubs,[1] we contrast officially registered adult criminal careers of members of the Netherlands' least criminal OMCGs to those members of the Netherlands' most criminal OMCGs, thus estimating the effect of adult membership of different types of 'gangs' for those equally embedded in the outlaw biker subculture. To optimally control for selection bias, we apply the recently developed propensity score-based method of matching weights (Li & Greene, 2013).

Gang Membership and Criminal Behavior

Three causal mechanisms may explain the positive association between gang membership and crime: selection, facilitation, and enhancement (Thornberry et al., 1993). Selection does not entail a criminogenic effect of gang membership per se, but rather assumes those already most crime-prone to be drawn to gang membership, either based on their own preference or because of them being actively recruited into the gang (Densley, 2012). Facilitation, on the other hand, entails that future gang members are not more or less crime-prone than non-gang members prior to gang membership; rather, their criminal behavior is increased only once in the gang. Gang members may want to impress other gang members by committing crime, get involved in violent inter-gang rivalries, or feel the need to uphold the gang's criminal reputation (Klein, 1995; Klein et al., 2006). Gang membership may also increase the opportunity to commit certain types of crime or alter the cost/benefit ratio of offending, for example by making use of the gang's violent reputation to intimidate victims and witnesses in refusing to cooperate with police investigations (Felson, 2006). Finally, enhancement combines the processes of selection and facilitation: while future gang members may be already more crime-prone to begin with, the difference between gang members and non-gang members is further exacerbated once future gang members actually join the gang (Thornberry et al., 1993).

Empirical evidence supports both selection and enhancement effects of gang membership (Pyrooz et al., 2016). Several studies find that future gang members differ from their peers already in the years prior to joining a gang. Prior to gang

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[1] Support clubs are clubs officially affiliated to OMCGs, as is apparent for instance from their web site or using similar color combinations in their club logo. Members of support clubs may be used to carry out (violent and criminal) services for the OMCG to which the members are affiliated (Barker 2017).

membership, future gang members are found to be more aggressive, hyperactive, and oppositional (Haviland et al., 2007) and to report higher levels of substance abuse and delinquent and criminal behavior, compared to non-gang members (Gordon et al., 2004; Lahey et al., 1999). Finding evidence of selection a priori rules out a pure facilitation effect of gang membership in favor of a possible enhancement effect. Selection, however, also complicates isolating a potential causal effect of gang membership, as a simple comparison of the criminal involvement of gang members to that of non-gang members would be exaggerated by pre-existing differences in criminal propensity between the two groups. Many empirical studies into the effect of gang membership on crime have, therefore, controlled for selection either by including variables representing the individuals' prior criminal involvement in OLS regressions or by using fixed effect models to isolate the within-individual effects of gang membership from any a priori time-stable between-individual differences (e.g., Gordon et al., 2004; Krohn et al., 2011). Recently, a number of studies have also used quasi-experimental propensity score-based techniques to construct samples of gang members and non-gang members that are highly comparable with regard to their history of problem behavior (Barnes et al., 2010; DeLisi et al., 2009; Haviland et al., 2007). A recent review of studies into the effects of gang membership concludes that street gang membership indeed tends to increase criminal behavior in juveniles, aggravating pre-existing differences between gang members and non-gang members, hence supporting an enhancement interpretation of the effect of gang membership on crime (Pyrooz et al., 2016).

Prior Empirical Studies on the Effect of OMCG Membership on Crime

Although a number of studies have examined criminal careers of individuals associated with organized crime groups (Brian et al., 2013; Campedelli et al., 2019; Kleemans & Van Koppen, 2014), none has specifically addressed the effect of joining a group known for their involved in organized crime on members' subsequent criminal behavior. To our knowledge, only two studies have begun to examine the effect of OMCG membership on crime. The first, a Danish study by Klement (2016), was able to compare the officially registered criminal histories of 297 OMCG-members identified as such by the police, to that of a sample of 181,931 controls, not affiliated with an OMCG. Comparison of the two groups showed pre-existing differences between the OMCG and control group in terms of the extent of criminal history already prior to being registered as an OMCG member. Exact matching on age, age of onset of the criminal career, and offending frequency prior to registration as an OMCG member was, therefore, used to control for selection bias. Comparisons of OMCG members to matched controls showed that OMCG membership was associated with significant increases in the level of overall crime, and especially property, drugs, and weapon crimes. Klement (2016), however, compared OMCG members to non-OMCG members, reducing gang membership to a dichotomous state and hence ignoring any potential variety between OMCGs in terms of their collective criminal involvement.

The second study was performed by Blokland et al. (2017a) and used conviction data on a sample of police-identified Dutch outlaw bikers and sex- and age-matched control group of registered motorcycle owners who were not known-outlaw bikers. Dutch OMCG members were found to differ from non-outlaw male motorcyclists, both in terms of the adolescent (prior to age 25) conviction history—evidencing selection—and in their adult (age 25 and up) conviction rates, with OMCG members being over three times more likely to have an adult criminal record. Even when juvenile criminal history was controlled for in a multivariate logistic regression model, adult criminal history was still significantly associated with OMCG-membership, suggesting an enhancing effect of OMCG-membership on adult crime. The enhancement effect was particularly strong for drug offenses: compared to non-outlaw motorcyclists, OMCG members have fivefold higher odds of being convicted for a drug offense—which in the Dutch context pertains to the production, trafficking, or (whole) sale of drugs rather than possession for individual use (Van Ooyen-Houben & Kleemans, 2015). As the authors rightly noted, however, caution is needed when drawing causal conclusions from regression models, as results may be biased by uncontrolled confounders influencing both OMCG-membership and adult convictions (Blokland et al., 2017a: 28). Importantly, both the Danish and the Dutch study compared outlaw bikers to non-outlaw biker males and male motorcyclists respectively, thus estimating the effect of being part of the outlaw biker subculture as a whole, rather than estimating the effect of membership of a particular type of OMCG.

Street Gangs, Organized Crime Groups, and OMCGs

While there is mounting evidence showing a positive association between juvenile street gang membership and crime (Pyrooz et al., 2016), empirical research on the effects of OMCG membership on members' crime is still scarce. Prior research indicates that street gang membership and crime are not only linked, because youths displaying the most delinquent behavior tend to join gangs, but that this is also due to crime becoming more likely once youths are in a gang. Findings from studies on juvenile street gangs, however, cannot simply be generalized to membership of adult gangs or organized crime groups. For one, the reasons for joining a juvenile street gang—and, therefore, its effects on crime—may be different for those joining an adult gang or organized crime group. Among the primary motives for juveniles to join street gangs are that they have family and friends who are already in the gang, that being a gang member is associated with friendship and fun, and that gangs are believed to provide protection against victimization (by other gangs) (Descormiers & Corrado, 2016; Peterson et al., 2004; Thornberry et al., 2003). Decker and Curry (2000) add that juveniles join gangs, because it makes them feel important in their neighborhood and to impress girls. Street gangs, in turn, may actively search for gang members who contribute to the gang's notoriety and violent reputation, and who are willing to fight during inter-gang confrontations (Densley, 2012). The reasons for gang joining and recruiting being predominantly social and symbolic may explain why the effect of gang membership on juvenile criminal behavior is especially pronounced for expressive and symbolic crimes, such as violence (Papachristos, 2009).

Adults, on the other hand, tend to get involved in organized crime groups for various other reasons, including primarily economic motives (Savona et al., 2017; Van Koppen, 2013). They typically join organized crime groups because it allows them to engage in the kind of complex, high-profit crimes that generate sufficient funds to pay off debts, enhance their financial position, or defray extravagant lifestyle expenditures (Felson, 2006; Hobbs, 2013; Kleemans & De Poot, 2008). In turn, adult offenders are recruited in organized crime groups not solely—or even primarily—for their ability to use violence, but also for other skillsets and opportunities they offer, which are essential for the completion of the group's illicit endeavors (Kleemans & De Poot, 2008; Van Koppen & De Poot, 2013). Given the predominantly economic reasons to join or be recruited by organized crime groups, the effects of criminal group membership on adult crime may be expected to be especially prevalent for entrepreneurial, profit-oriented crime.

OMCGs are hybrid collectives showing both street gang-like and organized crime group-like features (Von Lampe & Blokland, 2020). Like street gangs, adults report to join OMCGs, because membership provides them a sense of belonging, mutual support, and protection against other criminal groups and law enforcement agencies (Von Lampe, 2016). As in street gangs, violence and inter-gang conflict often serve to strengthen group cohesion and to imbue symbolic meaning to OMCG membership (Decker, 1996; Quinn & Forsyth, 2011). As do organized crime groups, OMCGs may also provide a setting for finding suitable co-offenders for committing more complex crime (Van Deuren et al., 2020) and may be more willing to allow individuals in their ranks who provide for opportunities to engage in high-profit entrepreneurial crime (e.g., Queen, 2005). OMCGs also provide their members the opportunity to profit from the intimidating reputation (also referred to as 'the power of the patch') to commit violent and profit-oriented crime (Van Deuren et al., 2020). Consequently, compared to non-membership, OMCG-membership may be expected to have an enhancing effect on both symbolic and entrepreneurial crime.

The principal difference between street gangs, organized crime groups and OMCGs, however, is that both street gangs and organized crime groups are by definition centered around illegal activity, whereas OMCGs are first and foremost (legal) associational structures originating from a joint attraction to the outlaw biker lifestyle (Von Lampe, 2016). While deviant and nonconformist, prior research shows that OMCGs differ substantially in their members' level and nature of criminal involvement (Blokland et al., 2017b; Morgan et al., 2020) and that not all groups labeled OMCGs are automatically engaged in (serious) crime. Despite being labeled outlaw motorcycle gangs by law enforcement, in reality, OMCGs cover a full spectrum ranging from mere clubs to criminal gangs (Barker, 2015). This apparent variety between OMCGs in terms of their collective criminal involvement suggests that the effects of OMCG membership on adult crime may be conditional on the type of OMCG one becomes a member of.

Judged by the many published first-hand accounts, the outlaw biker subculture as a whole is steeped with violence. In the hyper-masculine outlaw biker milieu, both individual and group conflicts are often resolved through physical force. As various

authors have noted, however, only in some OMCGs criminal motivations appear to have come to eclipse more traditional biker values, rendering membership of these OMCGs more and more a mere resource to be used to obtain some criminal goal (e.g., Barker, 2017; Quinn, 2001). For these OMCGs, the emphasis is on criminal entrepreneurialism and illicit profit. Hence, the differential effects of membership of one of the most criminal OMCGs, compared to membership of one of the least criminal OMCGs, are expected to be most pronounced for entrepreneurial rather than violent crime.

Law enforcement interest is typically focused on those more prone to crime OMCGs rather than on the outlaw biker subculture as a whole. Therefore, rather than treating OMCG membership as an all or nothing variable, comparing the criminal behavior of OMCG members to non-OMCG members—as did previous research (Blokland et al., 2017a; Klement, 2016)—here we focus on comparing the effects of membership of the most criminal OMCGs with that of membership of the least criminal OMCGs, thus focusing on the effects of membership of a particular type of OMCG for those otherwise equally submerged in the outlaw biker subculture.

Current Study

The current study seeks to contribute to our knowledge regarding the effects of joining one of the most criminal OMCGs contrasted to joining one of the least criminal OMCGs on individual members' criminal careers, controlling for the fact that it might be those already more crime-prone that aspire to become, or are recruited as members of the most criminal OMCGs. Besides doing justice to the wide variety of OMCGs observed (Blokland et al., 2017b, 2019; Morgan et al., 2020), this provides the methodological advantage of a-priori reducing the level of selection bias, as our comparison is limited to those individuals attracted to the hyper-masculine outlaw biker subculture in the first place. Membership of different OMCGs was based on police-made identifications. Extant OMCG research, as well as prior research into street gangs and organized crime, leads us to formulate three hypotheses regarding the effect of joining a more criminal OMCG compared to a less criminal OMCG that we aim to test in the current study. We predict that:

(1) prior to joining an OMCG, future members of one of the most criminal OMCGs already show more signs of criminal inclination, as reflected in an earlier start, higher frequency, and larger variety of their juvenile offending, than do future members of one of the least criminal OMCGs, indicating selection into membership of the most criminal OMCGs.
(2) there is an enhancement effect of joining one of the most criminal OMCGs, reflected in a higher overall rate of officially registered crime for members of one of the most criminal OMCGs as opposed to members of one of the least criminal OMCGs, even after statistically controlling for selection bias.
(3) this enhancement effect will be most outspoken for entrepreneurial and organized types of crime rather than crimes that seem to be part of the outlaw biker

subculture as a whole (e.g., inter-gang violence, public order offenses) (Lauchs et al., 2015).

Data and Methods

Sample

Starting point for our analyses was a sample of 2090 OMCG and support club members constructed by the outlaw motorcycle gang intelligence unit of the Central Criminal Investigation Division of the Dutch National Police. Individuals in the sample were registered in the police system as members of a Dutch OMCG or support club at least once at some point between 2010 and 2015.[2] For an individual to be listed as an OMCG member, a police officer had to determine the identity of the individual and had to officially register the individual as belonging to an OMCG. Registered affiliation with an OMCG or support club may result from, for example, the individual being observed by police officers wearing 'official' club colors or regularly attending private club meetings. Such registrations may have resulted from various police actions, such as traffic stops, police reports, or observations of community police officers, and, therefore, are not necessarily resulting from the individual being suspected of a criminal offense (see Blokland et al., 2017b for a detailed description of the sampling procedure).

To what extent the current sample constitutes a representative sample of all Dutch OMCGs is unclear, since the exact size and buildup of Dutch OMCG membership are unknown. Selectivity bias may be present when especially criminally active OMCG members are known to the police. The potential consequences of such selectivity bias depend upon two factors: the proportion of OMCG members who are missing in the sample and the extent to which these OMCG members are involved in crime. See Blokland et al. (2019) for a sensitivity analysis on the potential effects of selectivity bias under different combinations of these two factors.

Criminal Careers

Information on the criminal careers of the OMCG and support club members in the sample was obtained from the Judicial Information System (JDS). Extracts from the JDS contain information on the amount, timing, and nature of all criminal cases registered at the Public Prosecutor's Office. These extracts also contain information about the type and severity of the imposed sanction. To reconstruct members'

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[2] In the years between 2010 and 2015, individuals could enter, leave, and switch between OMCGs. At the time of data collection, the Dutch police was particularly focused on registering members to the appropriate OMCG, and less attention was devoted to members possibly leaving the OMCG, as at the time OMCG membership was regarded as something 'for life.' Nowadays, the police check registered OMCG members every two years to determine if a person is still a member of a Dutch OMCG.

criminal history, only information on criminal cases that resulted in a guilty verdict, a prosecutorial fine, or policy dismissal—for brevity referred to as 'convictions' in the remainder of the text—were used. Cases ending in an acquittal or a technical dismissal were not taken into account. For all individuals in the sample, the data include criminal career information starting at age 12—which is the minimum age of criminal responsibility in the Netherlands—up to the individual's age in December 2015.

The JDS extracts distinguish 52 offense types. Based on the classification scheme of Statistics Netherlands, we merged these offense types into nine offense categories: traffic offenses (e.g., driving under influence), property crimes (e.g., burglary and theft), violence (e.g., assault), public order offenses (e.g., collective violence), damaging (e.g., arson), weapon offenses (violations of the Arms and Ammunition Act), and drug offenses (Opium Act offenses). It is important to note that drug use is not defined as an offense in the Netherlands. Furthermore, the possession of small (consumer) amounts of drugs is not prosecuted and, therefore, does not result in a criminal antecedent (Van Ooyen-Houben & Kleemans, 2015). As a consequence, in our data, drug offenses primarily refer to the (large-scale) production, trade, and trafficking of drugs. Legal possession of a firearm is rare in the Netherlands (124 per 10.000 inhabitants in 2012) and violations of the Arms and Ammunitions Act therefore typically pertain to illegal possession of guns (or explosives). Research distinguishes three groups of offenders carrying illegal fire arms: young offenders committing armed robberies, seasoned criminals operating on a regional or national level, and internationally active criminals involved in drugs, weapons, or human trafficking (Bruinsma & Moors, 2005). Finally, in accordance with prior research on the current data (Blokland et al. 2017b, 2019) and following Quinn and Koch (2003), we also distinguished an offense category we labeled 'ongoing criminal enterprises' (oce), which included convictions for extortion, human trafficking, and money laundering. Together with drugs and weapon offenses, ongoing criminal enterprises comprise the overarching category of 'organized crime.' All remaining offenses were subsumed under a miscellaneous 'other' category.

The Most Criminal OMCGs Versus the Least Criminal OMCGs

To distinguish the most criminal OMCGs from the least criminal OMCGs, we constructed a nine-item scale that, for each OMCG, measured the mean number of felony convictions, convictions for violent, property, and public order crimes, drugs and weapon offenses, convictions for ongoing criminal enterprises, monetary fines, and prison sentences prior to age 25 per OMCG member. It is important to note that, while based on individual criminal career information, the nine-item scale measures crime at the OMCG level, indicating the type of OMCG environment individuals enter into when becoming a member of a particular OMCG. The 2090 members in our initial sample belonged to 51 different OMCGs. To allow for individual variation around the OMCG mean, only OMCGs for which our sample consisted of ten or more members were included in
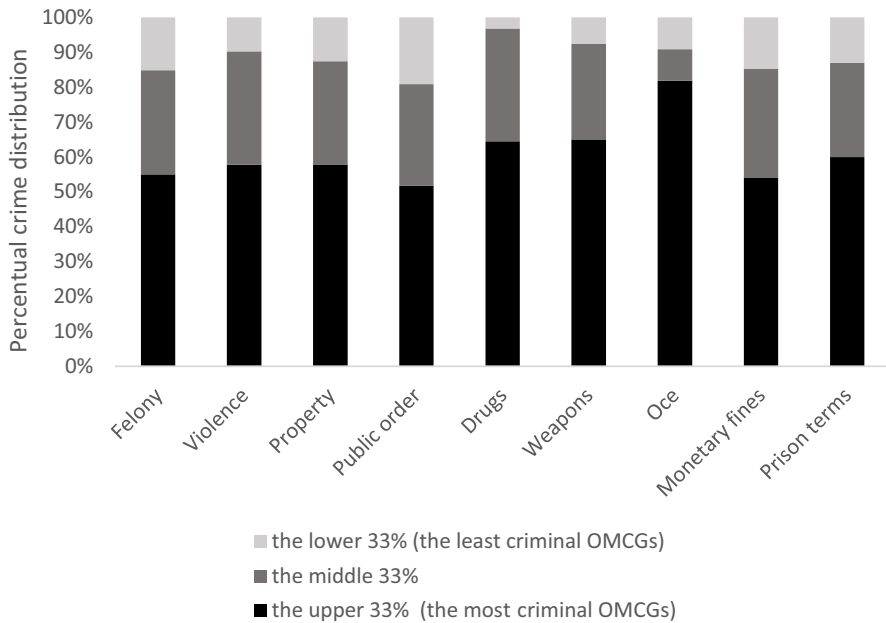
Fig. 1 The percentual juvenile crime distribution among the most, the middle, and the least criminal OMCGs

the analyses, leaving 27 OMCGs in the analyses.[3] Cronbach's alpha for the nine-item scale was 0.84, making it suitable for comparing groups (Bland & Altman, 1997). After standardizing all nine offense items, a continuous variable was constructed by adding the mean values of the nine standardized items.

Subsequently, following Loeber and Farrington (2012), we trichotomized (lower 33.3%, middle 33.3%, and upper 33.3%) the OMCG crime scale, to differentiate between the most criminal (upper 33%) and the least criminal (lower 33%) OMCGs. As a consequence, only members of the nine OMCGs labeled 'the most criminal' and the nine OMCGs labeled 'the least criminal' were included in the subsequent analyses, leaving out members of the nine OMCGs in the middle of the OMCG crime distribution. Figure 1 depicts the percentual crime distribution prior to age 25 for OMCGs in the lower 33.3%, middle 33.3%, and upper 33.3% of the OMCG crime scale. What Fig. 1 shows is that OMCGs not only quantitatively but also qualitatively differ in their criminal involvement: the least criminal OMCGs are, particularly, involved in offenses related to the outlaw biker subculture, such as public order and violent offenses, whereas the criminal behavior of the most criminal OMCGs is aimed at more serious types of crime, such as ongoing criminal enterprises, weapon, and drug offenses.

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[3] Further examination of the data revealed that OMCGs with less than ten known members were predominantly official support clubs of established Dutch OMCGs and clubs whose status as an independent OMCG was uncertain.

Both OMCGs and support clubs differ in size and so does the number of members per OMCG or support club in our sample.[4] As a result, our final sample consisted of 679 OMCG and support club members, of which 140 were members of one of the nine least criminal OMCGs or support clubs and 539 were members of one of the nine OMCGs or support clubs labeled as the most criminal.

Figure 2 illustrates the observed variation in criminal history on both the OMCG and individual level. The black and white dots represent the OMCG-level means for each of the nine variables comprising the OMCG crime scale respectively for the most criminal and the least criminal OMCGs. The gray lines represent the extent of individual variation on the items (i.e., indicating the range between the lowest and highest individual score for members classified as being a member of either the most criminal or the least criminal OMCG). Figure 2 shows that while the most criminal and the least criminal OMCGs differ in gang means—as a result of trichotomizing—there is much variation, and, consequently, much overlap in the individual ranges for the different variables between members of the most criminal versus members of the least criminal OMCGs. It is this variation in members' individual criminal histories within each type of OMCG that allows us to treat the OMCG-level measure as separate from the individual-level measure.

Analytical Strategy: Matching Weights

To control for selection bias in assessing the potential criminogenic effect of membership of the most criminal OMCGs, we applied matching weights, a propensity score-based method recently introduced by Li and Greene (2013). In this study, for each individual the propensity score is defined as the conditional probability of becoming a member of one of the most criminal OMCGs given the individual's criminal history prior to membership, estimated using logistic regression. For the individuals in our sample, the exact age of first OMCG-membership, however, is unknown. Prior research finds that OMCG-members typically are (mid)adults (Klement, 2016). These findings are corroborated by the current sample in which we find that only 5.1% of the total of 2,090 OMCG and support club members are aged under 25, and 15.5% are aged under 30 at the time of sampling. Therefore, for our examination of the effects of membership of the most criminal OMCG on the adult criminal career, we set the time of first membership at age 25,[5] as did previous studies (Blokland et al., 2017a; Klement, 2016). As membership of the most criminal versus the least criminal OMCGs can be considered

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[4] Though selective police attention may have resulted in especially members of the most criminal OMCGs to be officially registered as OMCG members at the cost of members of more rule abiding OMCGs, the differences in registered membership numbers in our sample do mirror differences in the number of chapters these OMCGs themselves report on their official websites and to that extent can be argued to reflect actual differences in club size. In the Netherlands, judged by the number of chapters, it indeed is predominantly the larger OMCGs and their support clubs that are most criminal in the sense as defined here.

[5] As we define age 25 as the age of initial OMCG-membership, we exclude those individuals from the analyses who, given their age in 2015, turned 25 in a year prior to the establishment of the OMCG they were identified as being a member of. Given that most OMCGs in our sample were established prior to 1990, this mostly affects membership of support clubs.
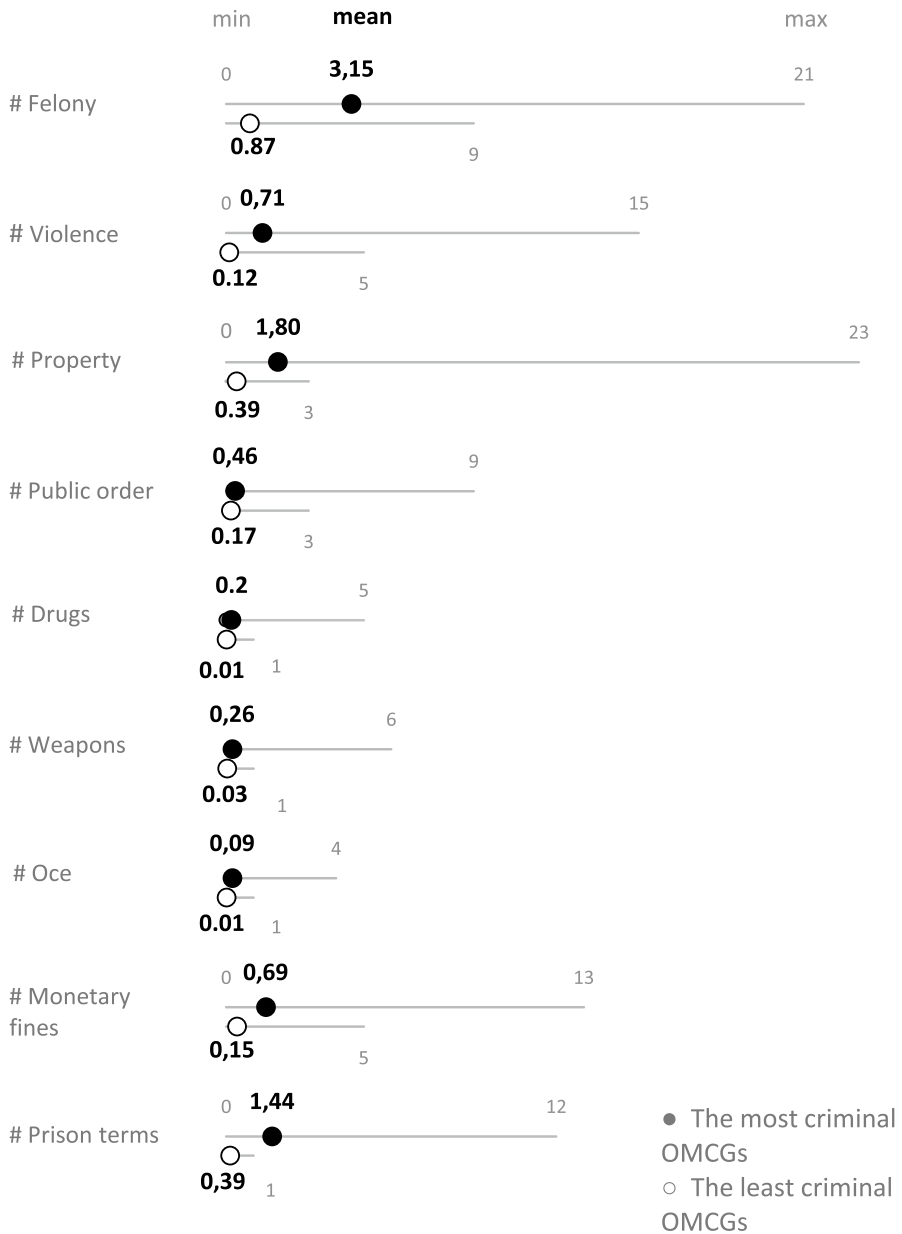
min   **mean**   max

0   **3,15**   21

 # Felony

0.87   9

0 **0,71**   15

 # Violence

0.12   5

0 **1,80**   23

 # Property

0.39   3

0,46   9

 # Public order

0.17   3

0.2   5

 # Drugs

0.01   1

0,26   6

 # Weapons

0.03   1

0,09   4

 # Oce

0.01   1

0 **0,69**   13

 # Monetary fines

0,15   5

0 **1,44**   12

 # Prison terms

0,39   1

● The most criminal OMCGs

○ The least criminal OMCGs

Fig. 2 Variation in criminal history prior to gang membership on both the OMCG and individual level of (members of) the most criminal and the least criminal OMCGs

randomly assigned among individuals with the same propensity score, matching on the propensity score helps eliminate selection bias and isolate the effect of membership of the most criminal OMCGs (Rosenbaum & Rubin, 1983).

One-on-one (caliper) matching on the propensity score is arguably the most popular criminological application of the propensity score (Banks & Gottfredson, 2003; Bingenheimer et al., 2005; Brame et al., 2004; King et al., 2007; Leeb et al., 2007; Mocan & Tekin, 2006; Sweeten & Apel, 2007), although some studies have applied inverse probability weighting in which individuals are weighted by the inverse of their propensity score (Hoffman & Mast, 2019; Mowen & Visher, 2015; Sampson et al., 2006). Here we opt for using matching weights, a method particularly suited when the distribution of the propensity score is skewed. Matching weights are computed as follows (Li & Greene, 2013; Yoshida et al., 2017):

$$\text{Treated weight} = \frac{e_i}{((Z_i * e_i) + ((1 - Z_i) * (1 - e_i)))}$$

$$\text{Untreated weight} = \frac{(1 - e_i)}{((z_i * e_i) + ((1 - z_i) * (1 - e_i)))}$$

e_i is the propensity score for individual i and Z_i is a dichotomous variable denoting the individual's membership of the most criminal OMCG ($Z_i = 1$) or the least criminal OMCG ($Z_i = 0$). Matching weights resemble inverse probability weights, yet the numerator for the matching weights is defined e_i or 1-e_i conditional on the value of Z, instead of 1 as in inverse probability weighting. Compared to matching on the propensity score, weighting has the advantage of retaining in the analysis those individuals who display propensity scores that are either close to 0 or close to 1, resulting in a larger analysis sample, increased balance, and a more robust estimates (Li & Greene, 2013; Yoshida et al., 2017). For individuals in the tails of the propensity score distribution, however, inverse probability weights can become very large, compromising the analysis and estimated effect of the treatment of interest (Austin & Stuart, 2015). Matching weights do not suffer from this problem, as by definition they can only vary between 0 and 1. Matching weights can be thought of as the individual's probability of being selected into the matched sample, placing emphasis on those who, given their background characteristics, are equally likely as not to have joined the most criminal OMCG (Li & Greene, 2013). Prior research has shown that applying matching weights is an effective method to control for selection bias, especially in samples that deal with unequal propensity score distributions (Yoshida et al., 2017).

Results

Selection Into One of the Most Criminal OMCGs

To test our first hypothesis that members of the most criminal OMCGs show evidence of higher criminal propensities compared to members of the least criminal

Table 1 Juvenile pre-treatment covariates of members of the most criminal OMCGs and members of the least criminal OMCGs in unweighted sample

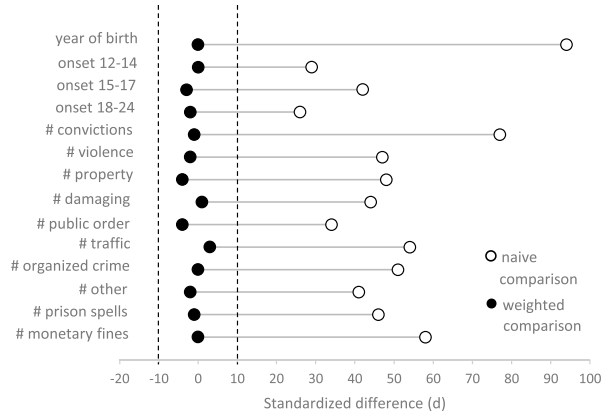| Variables | Members of the most criminal OMCGs | | Members of the least criminal OMCGs | | |
| | (N = 539) | | (N = 140) | | |
	M	SD	M	SD	d
Year of birth[*]	1978	7.44	1971	7.68	94%
Onset age 12–14	0.11	0.32	0.03	0.17	29%
Onset age 15–17	0.34	0.47	0.15	0.36	42%
Onset age 18–24	0.34	0.47	0.22	0.41	26%
Convictions (any)	4.39	4.82	1.02	1.84	77%
Violence	0.86	1.72	0.16	0.58	47%
Property	1.62	3.19	0.24	0.57	48%
Public order	0.73	1.33	0.20	0.53	44%
Damaging	0.29	0.76	0.05	0.22	34%
Traffic	1.60	2.57	0.36	0.92	54%
Organized crimes	0.52	1.10	0.02	0.15	51%
Other	0.49	1.03	0.11	0.33	41%
Prison sentences	0.61	1.41	0.03	0.17	46%
Monetary fines	1.43	2.07	0.34	0.82	58%

Note: Variables are represented as means and standard deviations for number of convictions for each variable per condition. Standardized differences are computed as a percentage of the standard deviation. *M*, means; *SD*, standard deviations; *d*, standardized differences

[*]The minimum and maximum year of birth for those OMCG members included in the unweighted sample are 1959 and 1990 respectively

OMCGs already prior to joining an OMCG, we compare members of both groups on a number of important criminal career characteristics, such as age of onset of offending, the frequency of different types of offenses, and the frequency of both monetary fines and prison sentences in the 12–25 age period. Table 1 provides the group means and standard deviations for each of these variables as well as their standardized difference.[6] Standardized differences exceding 10% indicate systematic differences between groups (Austin & Stuart, 2015). Standardized differences are found to exceed 10% for all variables, indicating that future members of the most criminal OMCGs and future members of the least criminal OMCGs are already highly different prior to joining an OMCG. In line with our first hypothesis, we find that future members of the most criminal OMCGs show an earlier onset of their criminal careers, more frequent and diverse offending, and are more often fined or sentenced to imprisonment between ages 12 and 25 than are future members of the least criminal OMCGs.

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[6] Unlike t-statistics, standardized differences are not influenced by sample size (Austin & Stuart 2015).

Fig. 3 Standardized differences of pretreatment covariates before and after applying matching weights


Balance Diagnostics

The presence of selection effects precludes a simple comparison between the adult criminal careers of members of the most criminal OMCGs and members of the least criminal OMCGs, as pre-existing differences in criminal propensity might inflate observed differences in adult crime between these groups. Hence, we applied matching weights to create a weighted sample in which membership of the most criminal OMCG is independent of observed features of individuals' criminal history in the age 12–25 period; as weighting will only result in unbiased estimates of the effect of membership of the most criminal OMCG if there are no more systematic differences between groups in these pre-membership characteristics. Prior to estimating the effect of becoming a member of one of the most criminal rather than the least criminal OMCGs, we checked for the extent to which applying matching weights results in baseline covariate balance in our sample, by calculating various balance diagnostics (Austin & Stuart, 2015).

First, we calculated standardized differences for all 14 variables in the propensity score model for the weighted sample. Standardized differences of pretreatment covariates in the unweighted sample ranged from low 26% to high 94% (Table 1); the 25th percentile being approximately 41%, median 47%, and the 75th percentile 53%. After applying matching weights, all standardized differences are within the desired ± 10% range (Fig. 3). Standardized differences in the weighted sample ranged from low − 4% (property crimes) to high 3% (damaging); the 25th percentile being approximately − 2%, median − 1%, and the 75th percentile 0%. Applying matching weights thus minimized standardized differences for each of the observed covariates, providing a first indication that the method satisfactiorily reduced selection bias, when comparing members of the most and the least criminal OMCGs.

Second, to check whether applying matching weights balanced not only the means and prevalence scores but also other characteristics of the pre-treatment covariate distribution, following suggestions by Ho et al. (2007), we compared interactions and higher order moments of the pre-membership covariates. Therefore, we

Fig. 4 QQ-plot of the distribution of propensity scores in unweighted and weighted sample
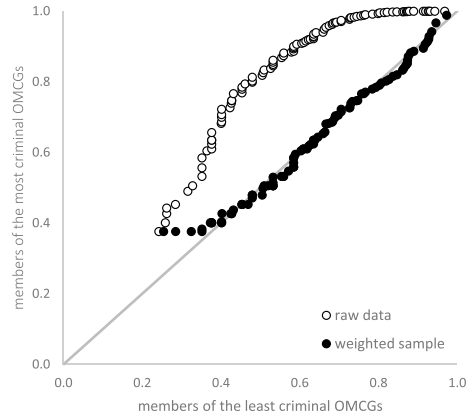
calculated thirteen interactions between year of birth[7] and every single other pre-membership covariate. Interactions of standardized differences of pretreatment covariates in the unweighted sample ranged from low 29% to high 78%; the 25th percentile being 41%, the median 45%, and the 75th percentile 50%. In the weighted sample, we find that standardized differences ranged from low -2% to high 4%; the 25th percentile, median, and 75th percentile being approximately -2%, 0%, and 2% respectively.

We also compared high order moments of the pretreatment covariates. Standardized differences of fourteen high order moments in the unweighted sample ranged from low 25% to high 91%; the 25th percentile being 26%, the median 29%, and the 75th percentile 36%. Standardized differences of the high order moments in the weighted sample ranged from low -8% to high 9%; the 25th percentile, median, and 75th percentile being -2%, 0%, and 6% respectively. In short, the results suggest that applying matching weights successfully reduced initial group differences.

Third, following Austin and Stuart (2015), we graphically examined the distributions of pretreatment covariates in the unweighted and weighted sample. Graphical examination allowed us to analyze particular features of the pre-membership covariate distribution, such as the tails, more extensively (Austin, 2009). A quantile–quantile plot (QQ-plot) for the propensity scores in the unweighted and weighted data is given in Fig. 4. Furthermore, Fig. 5 depicts the empirical cumulative distribution functions for three exemplary covariates—the total number of convictions for any offense, the total number of convictions for violence, and the total number of convictions for organized crime offenses—for members of the most criminal OMCGs and members of the least criminal OMCGs in both the unweighted and weighted sample.

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[7] To prevent balance diagnostics with very large numbers, we computed year of birth as year of birth minus 1900. This has no further implications for balance diagnostics.
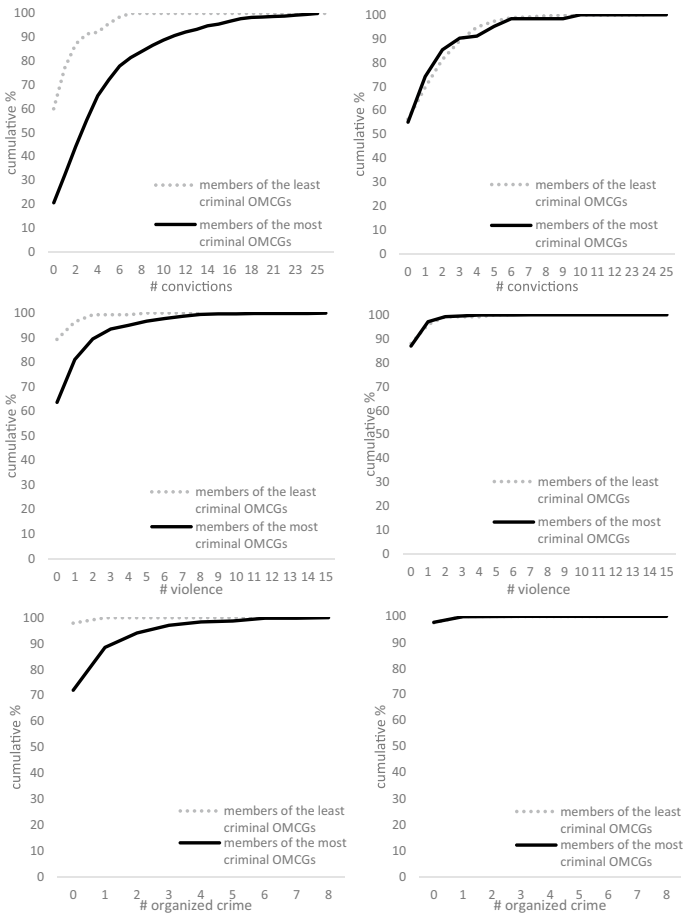
Fig. 5 Cumulative percentages (y-as) of pretreatment covariates of the total number of convictions (x-as) for convictions in general (1) violence offenses (2), and organized crimes (3), in the unweighted (left) and weighted (right) sample based on matching weights

In Fig. 4, the 45-degree reference line indicates perfectly similar distributions of the propensity score for members of the most criminal and the least criminal OMCGs. The QQ-plot of the unweighted sample (white dots) is above the 45-degree line, indicating that prior to OMCG-membership, future members of the most criminal OMCGs differ from future members of the least criminal OMCGs in the distribution of the propensity score. The QQ-plot of the weighted sample (black dots) more closely approximates the 45-degree line, indicating that weighting resulted in a more similar distribution of the propensity score among members of the most criminal and the least criminal OMCGs respectively. Results from graphically comparing the empirical cumulative distributions of baseline covariates in the unweighted and weighted sample (Fig. 5) further strengthen our notion that applying matching weights resulted in a weighted sample in which the distributions of pre-membership

covariates are highly similar between members of the most criminal OMCGs and members of the least criminal OMCGs.

Finally, we used the Kolmogorov–Smirnov test as a numerical method to compare the distributions of pre-membership covariates between members of the most criminal OMCGs and members of the least criminal OMCGs in both the unweighted and the weighted sample. The Kolmogorov–Smirnov test statistic is defined as the maximal vertical distance between two cumulative distribution functions, so smaller values signal better balance (Austin & Stuart, 2015). Outcomes of the Kolmogorov–Smirnov test for the fourteen covariates in the unweighted sample ranged from low 0.892 (onset age 12 to 14) to high 4.729 (year of birth). The Kolmogorov–Smirnov statistic of the fourteen covariates in the weighted sample ranged from low 0.141 (onset age 12 to 14) to high 1.672 (year of birth).

Taken together, these diagnostic findings indicate that applying matching weights succeeded in creating a highly balanced sample of members of the most criminal and the least criminal OMCGs. We can, therefore, be confident that any differences in the adult criminal career between members of the most criminal OMCGs and members of the least criminal OMCGs can be interpreted as resulting from membership of one of the most criminal OMCGs and are unlikely to be the result of pre-existing differences between these two groups.

Effects of Membership of One of the Most Criminal OMCGs on Crime

The main aim of this study was to examine the effect of becoming a member of one of the most criminal OMCGs relative to joining one of the least criminal OMCGs on the adult criminal career. Given that we find evidence of pre-existing differences between these two groups, elevated rates of officially registered crime among members of the most criminal OMCGs would be in line with a selection interpretation of the effect of OMCG membership on adult crime (hypothesis 1). To test for a possible enhancement effect, we regressed the dichotomous indicator of membership of the most criminal versus the least criminal OMCG on the adult offending rate in the weighted sample. Following recommendations by Ho et al. (2007), apart from the 'treatment' indicator, we include all 14 baseline variables as covariates in these models. As the residuals of the various outcome variables we use in our analysis are non-normally distributed, we estimate the effect of membership of one of the most criminal OMCGs by using a bootstrapped weighted multiple regression model. Bootstrapping is a commonly used method to address non-normality violations in numerical data (Pek et al., 2018). Regression coefficients are significant, when the bootstrapped confidence interval does not include zero (Deng et al., 2013). We estimate separate models respectively using the individual's offending rate during the years between 2010 and 2015—the years in which individuals at some point were registered as OMCG members—and for the entire post-age 25 follow-up period. In both instances, differences in exposure due to periods of imprisonment were taken into account by reducing the denominator of the fraction used to calculate the individual's

Table 2 Conditional treatment effects on offending for members of the most criminal OMCGs (*N*=539) relative to members of the least criminal OMCGs (*N*=140)

|	b	SE	95% CIs	b	SE	95% CIs
Variables	*Crime between 2010 and 2015 and age 25+*			*Age 25+*		
Convictions	.077*	.021	[.033, .119]	.093*	.019	[.053, .127]
Violence offenses	.014	.011	[−.008, .036]	.017	.009	[−.003, .032]
Property crimes	.016*	.006	[.005, .027]	.020*	.005	[.010, .031]
Public order offenses	.001	.004	[−.008, .010]	.003	.003	[−.003, .009]
Damaging offenses	.004	.002	[.000, .009]	.001	.002	[−.002, .005]
Traffic offenses	.034*	.012	[.008, .057]	.048*	.012	[.022, .072]
Organized crimes	.035*	.010	[.014, .054]	.031*	.007	[.017, .043]
Other offenses	.008	.008	[−.007, .023]	.008	.005	[−.004, .018]
Prison sentences	.006*	.003	[.001, .013]	.012*	.003	[.006, .017]
Monetary fines	.009	.008	[−.009, .025]	.035*	.010	[.015, .052]

*$p < .05$

average yearly offense rate with the time spent incarcerated during the period under scrutiny.[8]

The coefficients in Table 2 show the conditional treatments effects of membership of the most criminal as opposed to the least criminal OMCGs. We find that, regardless of pre-existing differences in their pre-age 25 offending history, and irrespective of the follow-up period over which the outcome is measured, members of the most criminal OMCGs show significantly higher conviction rates during their adult criminal careers than do members of the least criminal OMCGs. This would be in line with an enhancement interpretation of the effect of gang membership on crime (hypothesis 2). The average yearly conviction rate for members of the least criminal OMCGs is 0.144, while the average yearly conviction rate for members of the most criminal OMCGs is 0.221. These rates are visualized in Fig. 6 by the gray and black bars respectively. The line in Fig. 6 represents the relative difference between the two rates—members of the most criminal OMCGs show an adult conviction rate that is 1.6 times higher than that of members of the least criminal OMCGs.[9]

To answer our third and final hypothesis, we estimated the conviction rates for members of the most criminal and the least criminal OMCGs for different types of crime. We find that members of the most criminal OMCGs have higher rates for a variety of crime types: traffic crimes, property crimes, and organized crimes. Rates in Fig. 6 show that, relative to members of the least criminal OMCGs, the effects of membership of the most criminal OMCG are more outspoken for organized crime and property crime. Members of the most criminal OMCGs show an adult organized

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[8] Using information on imposed sentences from the JDS extract.

[9] All fourteen baseline covariates were mean centered and included in the bootstrapped regression models. The relative difference between the rates of the two groups is calculated by dividing the conviction rate of members of the most criminal (i.e., the sum of the intercept and coefficient) by the conviction rate of members of the least criminal OMCGs (i.e., the intercept—not shown in Table 2).
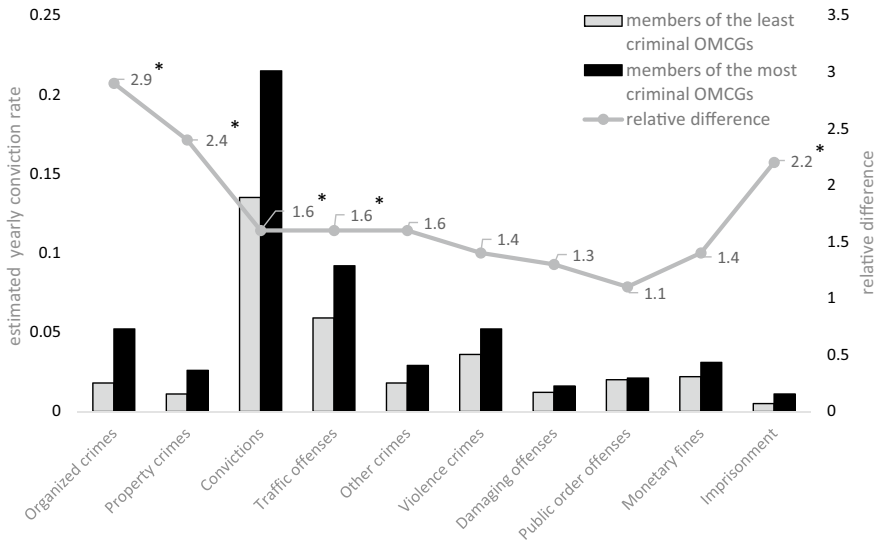
* indicates group difference significant at *p*<.05.

Fig. 6 Effects of membership of the most criminal OMCGs compared to membership of the least criminal OMCGs on different types of criminal behavior

crime rate that is almost 3.0 times higher, and a property crime rate that is 2.4 times higher than that of members of the least criminal OMCGs. Furthermore, members of the most criminal OMCGs are sentenced to prison more than twice as often as members of the least criminal OMCGs. As prison sentences will usually be more prevalent for more severe crimes, this suggests that the adult criminal careers of members of the most criminal OMCGs are characterized by relatively more serious forms of crime. It is, however, important to keep in mind that prison sentences are based not only on the seriousness of the committed crime itself but also on the offender's individual circumstances and criminal history. The effect of membership of the most criminal OMCGs is not statistically significant for violence, damaging, and public order offenses.

Sensitivity Analyses: Age of Onset of OMCG Membership

Studies into the effect of juvenile street gang membership are often based on self-report panel data and hence allow for the moment of entering the gang to be pinpointed between two consecutive waves. Due to lack of self-report data, studies into the effect of OMCG membership are based on officially registered data, the exact age at which individuals enter the gang is usually unknown. As did previous studies (Blokland et al., 2017a; Klement, 2016), in our analyses, we have therefore thus far used age 25 as the proximate age of first OMCG membership. Given the observed age distribution of our and other samples of OMCG members, it seems unlikely that many current members

joined an OMCG prior to that age. However, it could very well be that current members first joined an OMCG only when they were older. Given that in the above analyses, we controlled for pre-existing differences between members of the most and the least criminal OMCGs based on individuals' pre-age 25 criminal career characteristics, when in actuality, current members first joined an OMCG at later ages, our results could favor enhancement over selection. That is, part of the period over which elevated convictions rates for members the most criminal OMCGs were found would than refer to years prior to instead of post membership. If, however, current members first joined an OMCG at an age younger than the particular cut-off age used, analysis would tend to underestimate the effect of OMCG membership—favoring selection over enhancement—as part of the enhancement effect would be captured by the information going into the propensity score model.

By way of sensitivity analysis, we have repeated the above analysis each time defining a different age of first OMCG membership—i.e. 28, 30, 32, 34, 36, 38, and 40—and subsequently controlling for selection bias by employing matching weights. Again, using bootstrapped weighted multiple regression, we then estimated the effect of membership of one of the most criminal OMCGs versus membership of one of the least criminal OMCGs under these different assumed ages of first OMCG membership for convictions between the years 2010 and 2015. Results of these analyses for convictions in general and organized crime are graphically depicted in Fig. 7.

As expected, the results of the sensitivity analysis show a declining enhancement effect of membership of the most criminal OMCGs with an increasing assumed age of first OMCG membership. This could be explained by unduly controlling for criminal career characteristics during years when sampled individuals in actuality were already OMCG members. For convictions for any type of crime (top pane of Fig. 7) and organized crime (low pane Fig. 7), the differences in post-membership conviction rate between members of the most criminal and members of the least criminal OMCGs remain significant, regardless of which age is defined as that of first OMCG membership. Given that analyses using an older age of first OMCG membership are likely to overcontrol for selection at the cost of any enhancement effect, these results strongly suggest that membership of one of the most criminal OMCGs increases members' conviction rates for crime in general and organized crime, compared to members of one of the least criminal OMCGs.

Discussion

OMCGs are increasingly seen as a societal problem due to OMCG members' being disproportionately involved in crime, such as (inter-gang) violence and organized crime (Blokland et al., 2017b, 2019; Lauchs et al., 2015). Prior OMCG research suggests that OMCG membership is positively related to crime. While especially crime-prone individuals are typically found to join OMCGs, once they do this, OMCG membership seems to elevate their criminal involvement even further, compared to those individuals who do not join OMCGs (Blokland et al., 2017a; Klement, 2016). Prior research, however, also showed that OMCGs differ in the level of criminal
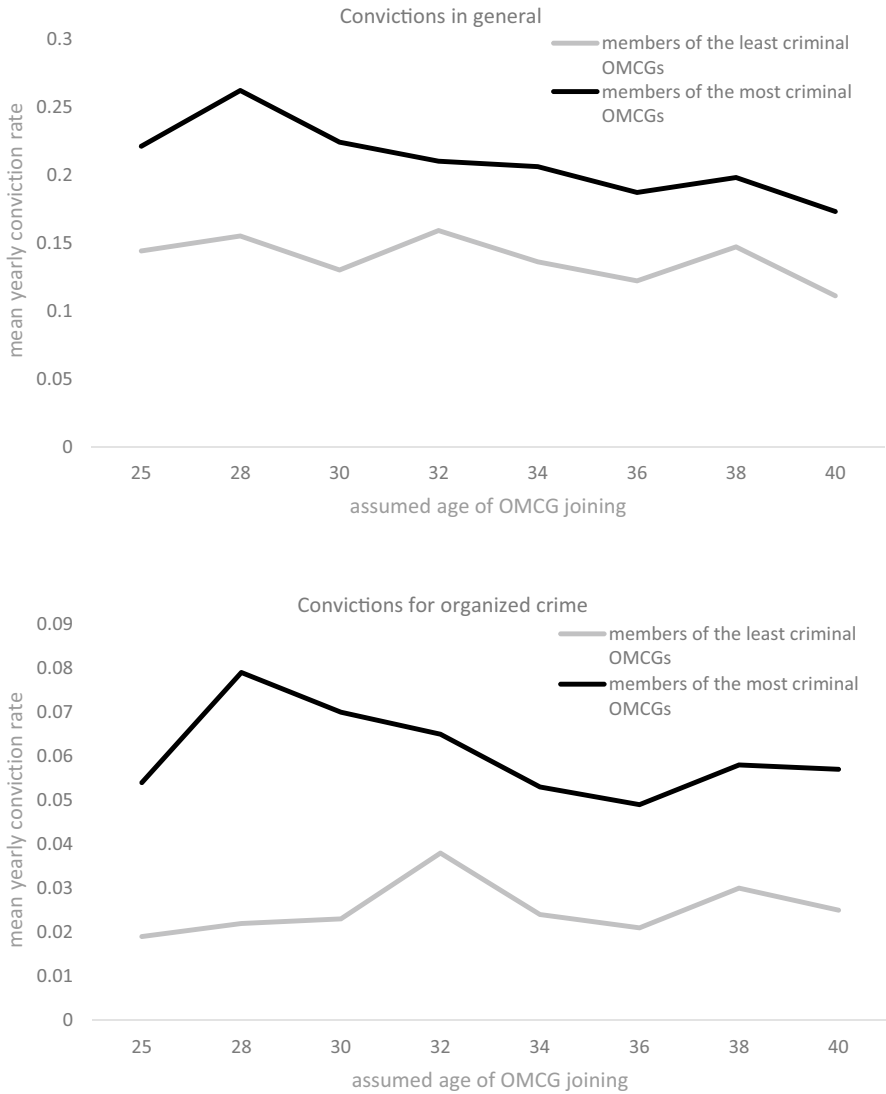
Convictions in general

Convictions for organized crime

Fig. 7 Estimated post-membership average yearly conviction rates for members of the most criminal OMCGs and least criminal OMCGs for convictions in general (top) and convictions for organized crime (bottom) between the years 2010 and 2015 for different onset ages of OMCG membership (adjusted for exposure time)

involvement, suggesting that the effects of OMCG membership may be dependent on the type of OMCG an individual becomes member of. To increase our knowledge on the effects of OMCG membership on adult crime, here we estimated the effects of membership of one of the most criminal OMCGs as opposed to one of the least criminal OMCGs on officially registered crime. As a first step to limit potential selection effects, we focus on a sample of men that, at some point during their adult

lives, were all part of the outlaw biker subculture. We further control for baseline differences between groups, by employing propensity score-based matching weights.

The results of our analysis corroborate our first hypothesis that, even within the bounds of the hyper-masculine outlaw biker subculture, future members of the most criminal OMCGs differ from future members of the least criminal OMCGs already in the years prior to their OMCG membership. On average, future members of the most criminal OMCGs showed an earlier onset, higher frequency, and greater diversity of offending during their adolescent and early adult years than did future members of the least criminal OMCGs. This indicates that, on average, the most crime-prone individuals end up as members of the most crime-prone OMCGs.[10]

We also find that when selection is taken into account, members of the most criminal OMCGs show higher conviction rates during their adult years, the period during which—at some point—they joined and were a member of the OMCG. This fits our second hypothesis and suggests that joining one of the most criminal OMCGs has an enhancing effect on the individual's criminal behavior.

Finally, we find that this enhancing effect is most outspoken for organized crime and property crime. Results show that the conviction rate for organized crime of members of the most criminal OMCGs is almost three times as high as that of members of the least criminal OMCGs. The conviction rate for property crimes of members of the most criminal OMCGs is almost two and a half times higher than that of members of the least criminal OMCGs. The effect of gang membership on property crime is in line with the study by Klement (2016); contrasting members and non-members that study found the effect of OMCG-membership to be large for property crimes. We find no effects of membership of one of the most criminal OMCGs on expressive crimes, such as violence, public order, and damaging. This finding corroborates the argument that these crimes are intrinsically linked to the outlaw biker subculture as a whole, and thus do not differentiate members from the most criminal from members of the least criminal OMCGs.

While the nature of the data available for the current study allows for a sophisticated quantitative examination of possible selection and enhancing effects of membership of one of the most criminal OMCGs, the substantive mechanisms behind these effects remain a topic for further study. Selection of crime-prone individuals into the most criminal OMCGs could result from future members' personal choice, but also from the admission policy of the most criminal OMCGs, or a combination of the two. While juveniles have been extensively questioned on their motivations for joining street gangs, the reasons for adults to join gangs and organized crime groups are less well researched. While a sense of belonging and protection could explain much of the attraction of the outlaw biker subculture as

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[10] Importantly, this is not just an artefact of the way we defined the distinction between the most criminal and the least criminal OMCGs, as given variation in pre-membership criminal careers among members of the same OMCG, and differences in the number of known members per OMCG, averaging over the mean criminal career characteristics of particular OMCGs, and averaging over the total number of members affiliated with all OMCGs of a particular type do not necessarily yield the same results.

a whole, a priori these would seem to equally apply to both the most criminal and the least criminal OMCGs, disqualifying them as convincing explanations for selection into especially the most criminal OMCGs. Crime-prone individuals may seek to become members of the most criminal OMCGs hoping to profit from the contacts, criminal opportunities, and collective reputation these OMCGs provide. The most criminal OMCGs, on the other hand, might be especially keen on selecting members that have earned their criminal standing, providing tangible or symbolic benefits for the club or, at the minimum, a trusted partner in future illegal activities. Future qualitative research among (ex-)members may help uncover the precise mechanisms through which individual criminal history and membership of the most criminal OMCG are interrelated.

Likewise, while we find that membership of one of the most criminal OMCGs is associated with increased criminal involvement in the adult years, precisely why this would be the case remains a question to be answered by future research. Our use of officially registered data, known to suffer from dark figure problems and reflecting both individual and system behavior, further complicates substantive interpretation of this finding. To the extent that members of the most criminal OMCGs—knowingly or unknowingly—subject themselves to increased police attention, more tenacious prosecution, or harsher penal judgement, this could result in an increased number and diversity of convictions, followed by more frequent and serious punishment. Our finding that members of the most criminal OMCGs show significantly more traffic violations might attest to this scenario. To the extent that especially members of the most criminal OMCGs gain access to opportunities for entrepreneurial types of crime—by for example having access to suitable co-offenders, opportunities to successfully shield their criminal activities, and facilitating criminal behavior of members—membership of one of the most criminal OMCGs could result in an actual change in either the frequency or the nature of the crimes committed. This scenario is in accordance with the increase in organized crime found in the members of the most criminal OMCGs in our data. Like in explaining selection effects, combinations of these processes may occur, as for example prosecutorial efforts might be especially focused on particular types of crime.

Finally, though we employed the quasi-experimental propensity score method of matching weights to estimate the effects of OMCG membership on crime, caution is still needed when making 'causal' inferences from the current analyses. While we were able to control for the possible selection effects of many relevant variables such as age, age of criminal onset, and the nature and severity of the individual's criminal behavior prior to OMCG membership, our results might still suffer from unobserved variable bias, if selection into the most criminal OMCGs is partly based on individual's demographic or other characteristics not available in the present data set. Future research may therefore seek to include additional variables into the propensity model that, on theoretical grounds, can be expected to influence the selection, such as the presence of kinship ties, and residential and socio-economic propinquity.

The current study enriches theoretical knowledge regarding the effects of adult OMCG membership on crime, by showing that even when we control for pre-existing differences between the groups, criminal behavior increases when adults join the

most criminal OMCGs. The results of the study show both selection and enhancement effects that, at least to the extent that the latter represents a behavioral change, results in increased criminal behavior. The enhancement effects particularly apply for those crimes that are not part and parcel of the outlaw biker subculture. The findings, furthermore, indicate that within the OMCG subculture, OMCGs vary in terms of members' criminal behavior, and consequently in the effects OMCG membership has on crime. Theoretically, these findings underscore the need to include individuals' direct social context in explaining their criminal career, not only during adolescence but also during their adult years and raise questions on the exact mechanisms by which these effects materialize in adults, providing powerful incentives to increase our understanding of the most criminal OMCGs. Our results also have important implications for policy regarding OMCGs and are of great relevance to the public debate about OMCGs, since countries have taken far reaching measures to combat crimes of OMCGs. The current research on the one hand shows that there may be valid grounds to take certain measures. The most criminal OMCGs seem to add to the (organized) crime problem, over and above the criminal inclination of their individual members. By using the variation of Dutch OMCGs' level of criminal involvement, the results, however, also stress the importance of distinguishing the most criminal from the least criminal OMCGs in this respect. It is the nature and culture of predominantly the most criminal OMCGs that seems to stimulate members' criminal behavior.

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