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TESTING AND EXPLAINING CRIME CONCENTRATIONS
OUTSIDE THE U.S.: THE CITY OF MILAN

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"Inutilmente, magnanimo Kublai,
tenterò di descriverti la città di Zaira dagli alti bastioni.
Potrei dirti di quanti gradini sono le vie fatte a scale,
di che sesto gli archi dei porticati,
di quali lamine di zinco sono ricoperti i tetti;
ma so già che sarebbe come non dirti nulla.
Non di questo è fatta la città,
ma di relazioni tra le misure del suo spazio
e gli avvenimenti del suo passato [...].
Di quest'onda che rifluisce dai ricordi la città s'imbeve come una spugna e si dilata.
Una descrizione di Zaira quale è oggi dovrebbe contenere tutto il passato di Zaira.
Ma la città non dice il suo passato, lo contiene come le linee d'una mano,
scritto negli spigoli delle vie, nelle griglie delle finestre, negli scorrimano delle scale,
nelle antenne dei parafulmini, nelle aste delle bandiere,
ogni segmento rigato a sua volta di graffi, seghettature, intagli, svirgole."

Le città Invisibili, Italo Calvino

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Abstract

There is a strong evidence that crime is tightly concentrated in a small number of micro places in urban areas. Indeed, studies conducted in different U.S. cities show how 50% of crime events are concentrated in about 3% to 6% of street segments. Moving from these findings, Weisburd, Groff and Yang raise the issue as to whether there is a law of crime concentrations, applicable across different cities and stable over time. Indeed, despite the general decrease of crime trends in Seattle, the authors find that almost an equal number of street segments in the city produce the same proportion of crime in the 16-year period under study. These results were confirmed in Tel Aviv-Jaffa (Israel), suggesting the presence of a sort of "normal level of crime" among cities at micro level.

This study aims at testing the presence of crime concentrations outside the U.S., in a different context, where this hypothesis has not yet been tested and quantitative studies at street segment level have not yet been developed. In particular, a street segment analysis was conducted in Milan (Italy) and the presence of crime concentrations was confirmed. In addition, in order to understand the main determinants of crime concentrations in Milan, a set of negative binomial regressions models were run. Findings show how social disorganisation factors seem to have stronger influence on crime at street segment level, compared to opportunity factors.

Introduction

Crimes which take place in urban areas always arise the interest of the citizens, public opinion and policy makers. Indeed, these incidents closely affect people's daily life and increase their level of insecurity and fears of crime. These topics often provoke a great media effect and administrators are always very interested in solving the crime problem in the cities. Unfortunately, this willingness is not always combined with a deep understanding of crime dynamics nor is there the proper use of all available resources. In line with these considerations, the present study wants to better understand these dynamics in order to represent a starting point for further possible policy implications.

In the past few decades, geographical criminology, a branch of the criminological research, has started to focus on the analysis of micro patterns of crime in urban centres. This focus has been used to discover if there are any commonly occurring regularities in the distribution of offences across the street segment network. The importance of studying crime at very small units of geography develops from the necessity of exploring the degree of spatial heterogeneity of crime present in large areas. Indeed, it has been fully proved that bad neighbourhoods are not always all bad, because there is a very high street to street variability in the distribution of crime incidents. The use of smaller units of geography such as addresses, street segments or groups of these elements permits to better understand crime distribution inside the neighbourhoods and better target crime prevention measures. Several studies have validated how crime clusters at very small units of geography and a number of pieces have demonstrated how 50% of crime events in urban areas are concentrated in about 3% to 6% of the street segments suggesting the presence of a sort of "law of crime concentrations". Nevertheless, the development of this micro geographical approach to gain a better understanding of crime has mainly involved the United States. In order to understand whether there is a normal level of crime among cities at micro level this perspective should be enlarged taking into account other cities around the world. If this hypothesis is demonstrated, Durkheim's original proposition claiming that the level of crime is stable in societies could be applied at concentrations of crime at micro places.

Moving from these considerations, this study aims at testing the presence of crime concentrations outside of the United States. In particular, a street segment analysis was

conducted in Milan (Italy) and a set of negative binomial regression models were run in order to understand the main determinants of crime concentrations in the city. Supporting a theoretical integration of the criminological theories, both opportunity and social disorganization factors were included in the analysis as possible explanations of crime distributions. Since traditionally the micro studies of crime at place have developed from the opportunity theory framework, they tend to take into account only situational variables as determinants of the criminal behaviour. This unilateral approach has been criticised for being short-sighted, too reliant on the micro dynamics and commonly viewed as a method that fails to understand the bigger picture along with the complexities of criminal behaviour. In addition, these critiques have pointed out how a situational approach may resolve problems in the short-term, but it does not impact the advantages and disadvantages structure of the society producing real changes in a long-term period. For all these reasons, a theoretical integration approach has been preferred over a more traditional situational approach to the crime problem at micro level.

To achieve its objectives, this study is organised as follows. Chapter I describes the development of the geographical criminology from the nineteenth century until today, the birth of the opportunity theories and the environmental approach. In addition, it reviews a large amount of studies that have been conducted inside the opportunity theory framework. Chapter II focuses on the introduction of the street segment as unit of analysis and it presents the Seattle study which tests the presence of crime concentrations and its stability in the United States. The development, the methodological choices and the results of this study are discussed in this chapter, as well as other similar attempts to test crime concentrations in other cities. Chapter III describes the data and the method used by this study to conduct the analysis in the city of Milan (Italy), whereas Chapter IV presents the results. In conclusion, Chapter V proposes a discussion of the main findings, advantages and limitations of the study.

CHAPTER I. Micro units of geography and the criminology of place

Theories of offenders have been predominant in the development of criminology. Traditionally, the primary focus of criminological research has been based on the individual's motivation behind criminal behaviour. Nevertheless, criminologists have also demonstrated interest in analysing the "macro" units of criminal activity. While the study of the individual and the "macro" units of particular locations have long been a primary focus of criminological research and theory, recently in the last few decades have criminologists begun to explore crime at very small micro units of geography (Weisburd, Groff, and Yang 2012).

I.1 The geographical approach in the criminological tradition: from the nineteenth century until today

Despite the predominant role these theories have traditionally played on profiling offenders in the development of criminology, the relationship between crime and space has been studied since the 1800s (Lersch and Hart 2011). The birth of geographical criminology can be addressed to the publication of crime statistics on French population by the French Home Office in the 1820s. Many scholars and statisticians inspired by the publication of this new data started to explore criminality. In 1829, André Guerry and Adriano Balbi published the first three maps on the distribution of crime in France between the years of 1825 and 1827. A few years later, Guerry (1833) and Quételet (1831) both went on to analyse the national statistics of criminality in France, identifying the first spatial patterns of crime. The Belgian Edouard Ducpètiaux (1827) published a table linking crime and suicide figures at a regional level. Guerry (1833) realized that crime and suicide rates remained remarkably invariant over time, yet varied systematically by region, sex of accused and type of crime.

The French and the Belgian scholars were the first to analyse crime at place originally focusing on large administrative areas such as nations, regions, counties and provinces. They started to link places and their socio-economic conditions to the crime problem giving the birth to the *statistique morale* and to a positivist empirical approach to the crime problem (Beirne 1987). Members of the Statistical Society of London expressed also their interest in the crime topic starting from the beginning of the nineteenth century. In 1839 Rawson published an article on the critical role played by the units of analysis in the understanding of crime events and the distribution of crime at place (Rawson 1839). Later on, his colleague

Fletcher (1850), mapping the level of illiteracy of England and Wales, investigated the relationship between education and delinquency; whereas Glyde (1856) questioned the validity of the research based on administrative large unit of analysis underlining how large units could hide variations in crime and supporting a disaggregation in smaller units (Glyde 1856). This intuition was concretely developed by Henry Mayhew who studied alcoholism, poverty, housing conditions interviewing offenders and prostitutes in London using a micro analysis at streets, buildings and squares level (Mayhew 1850). For this reason, he is considered the precursor of the contemporary criminology of place (Weisburd, Bruinsma, and Bernasco 2009, 10; Weisburd, Groff, and Yang 2012, 23).

Since the beginning of the twentieth century the focus on the geographical approach in criminology moved from Europe to the United States where the Chicago School of Sociology was developing its first steps. The School included a group of American sociologists, among them, Robert Park, William Thomas, Louis Wirth, Ernest Burgess, Clifford Shaw, and Henry McKay that wanted to distance themselves from the statisticians, psychiatrists or lawyers that were conducting criminological research in Europe. The School, established in 1892, is well-known for its ecological explanation of the human conduct which was applied also to the study of crime and delinquency. "The ecological idea suggests that distinctive patterns of human conduct are shaped by the organization or design of space in which that conduct occurs" (Watts, Bessant, and Hil 2008, 57). The link between behaviour and space is very strong as it is the relationship between individuals and the city in which they live their daily lives. In this way, the city environment shapes the human behaviour and "the social and spatial characteristics of life in a city provided a space, or an ecology, in which particular activities like crime became possible" (Watts, Bessant, and Hil 2008, 57). The work of the scholars belonging to the Chicago School was deeply linked with the study of the city itself. According to Matza (1969), they considered the community as the principal element influencing individuals' behaviours. In 1966, William Thomas was the first to introduce the important concept of *social disorganization* (Thomas 1966).[1] Later, Robert Park, who was a key member of the school and initiator of the urban social research on crime places, shifted the unit of analysis from countries and large administrative areas to neighbourhoods in order to focus on the elementary forms of cohesion in urban life. In adopting this focus of urban

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[1] For an in depth-analysis of social disorganization theory see II.3.2 Social Disorganization Theory.

life, the subject must be studied in terms of "its physical organization, its occupations, and its culture" (Park 1925). During this same period of time, one of Park's students, Ernest Burgess, elaborated on the *Concentric Zone Model* of Chicago by dividing the city in five concentric areas in order to present different social problems and level of crime (Figure 1). The business centre of the city represents the central zone called "the loop" and all the other zones include various neighbourhoods which result from the expansion of the city centre to peripheral areas. According to Burgess, the level of crime in the city would vary depending on the distance from the loop zone (Burgess 1925).

Figure 1. Concentric Zone Model of Chicago
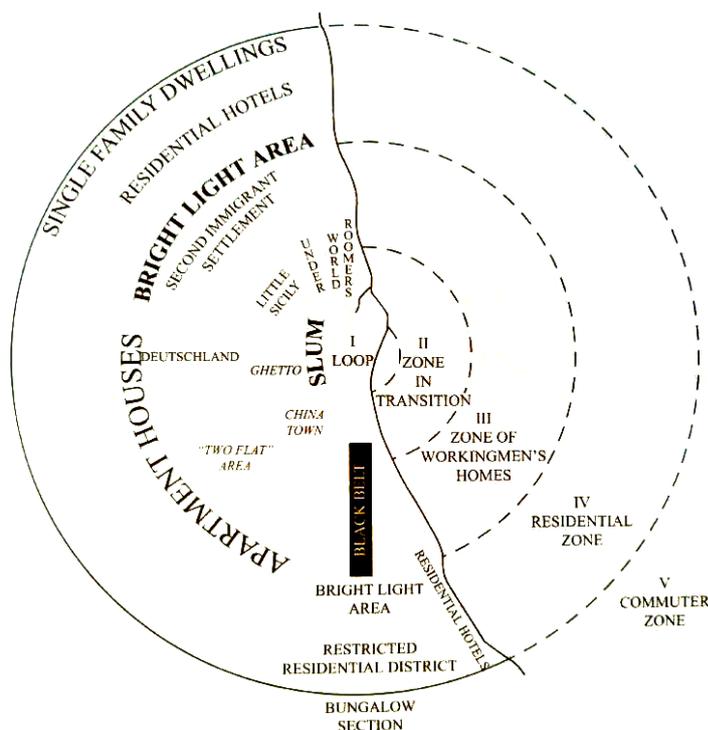
Source: Burgess (1925)

Taking from the work of Ernest Burgess, Clifford Shaw empirically tested the concentric zones theorised by Burgess studying the distribution of truancy of young people, juvenile delinquents and adult offenders (Shaw 1929). Using a large collection of data and new statistical tools to produce his analysis, Shaw was able to produce a study that represented "a landmark in the history of geographic studies of crime" (Weisburd, Groff, and Yang 2012, 34). In this study, Shaw defined communities as unit of analysis and, with the help from his assistant Henry McKay, manually plotted in a map the home addresses of thousands of

juvenile offenders creating the first spot map, which today is considered the precursor to the production of crime maps (Weisburd, Bruinsma, and Bernasco 2009; Ratcliffe 2010). Shaw and McKay also connected addresses with census data in order to create delinquency rate maps and zones of Chicago. In 1942, both Shaw and McKay published *Juvenile Delinquency and Urban Areas* where they expanded on the details of their elaborated analysis of Chicago, and how they also found similar patterns in the distribution of crime in several other U.S. cities. These studies represent a great comparative effort and the first attempt to generalize the results regarding the crime clustering.

In the 1980s emerged a new interest in the topics of the Chicago School. The crime problem connected with communities were brought again in the centre of the criminological agenda. This mainly happened through the willingness of Albert J. Reiss Jr., who received his Ph.D. from the University of Chicago. Reiss started to rise new questions on crime at place that were previously neglected. The main idea theorised by Reiss was that also communities, like individuals, have crime careers (Reiss 1986), a concept that was recently brought back by Weisburd, Lum, and Yang (2004) in their *Criminal career of places*. Among the scholars following the work of Reiss there were Wes Skogan, Robert Sampson, Douglas Smith, Robert Bursik, Ralph Taylor, Stephen Gottfredson, and Lawrence Sherman. The work of Skogan was oriented on communities, fear of crime and policing (Skogan 1986), but also on how disorder can influence crime occurrence (Skogan 1990). According to Skogan, disorder can influence the informal social control, the community perception of crime, the real estate industry and the investments leading neighbourhoods in a condition of insecurity and decline. The idea that physical and social disorder could create opportunities for crime in urban areas goes back to the well-developed Broken Windows Theory, first elaborated by the psychologist Zimbardo (1969) and then better explored by Kelling and Wilson (1982).[2]

Kelling and Wilson stated that maintaining and monitoring urban environments in a well-ordered condition may stop further vandalism and escalation into more serious crime (Kelling and Wilson 1982). In accordance with this point of view, disorder is described as a violation of the social rules in the use of public spaces that can lead to the development of a condition of decay of the public areas helping the proliferation of crime and antisocial behaviour caused

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[2] References to the broken windows theory can be found also in Wagers, Sousa, and Kelling (2008).

by the lack of formal and informal control. The convergence of formal and informal social control is the necessary starting point for maintaining quiet and safe neighbourhoods, streets and, more specifically, common spaces. Formal social control, implemented by authorized agents as police officers, should be complementary to other forms of informal social control performed by informal agents. The local community should take care of its territory avoiding physical and social decline of the neighbourhoods that can lead to more serious crime related problems. These points developed by Kelly and Wilson provided a starting point for Samson, Raudebush, Earl and Moreoff's analysis of the collective efficacy and disorder among different neighbourhoods (Morenoff and Sampson 1997; Sampson, Raudenbush, and Earls 1997; Sampson and Raudenbush 1999; Morenoff, Sampson, and Raudenbush 2001).

In a study concerning neighbourhoods and violent crime, Sampson, Raudenbush and Earl defined collective efficacy "[…] as the social cohesion among neighbours combined with the willingness to intervene on behalf of the common good" (Sampson, Raudenbush, and Earls 1997, 918). They tested collected efficacy through a survey interviewing 8,782 residents in 343 neighbourhoods in Chicago finding that is negatively associated with variations in violence, when individual-level characteristics, measurement error, and prior violence are controlled. In addition, their analysis showed that "the associations of disadvantage and residential instability with violence are mediated by collective efficacy" (Sampson, Raudenbush, and Earls 1997, 918).

Despite the Chicago School called for the use of non-administrative type of data to conduct the analysis of crime at place, the scholars that approach the geography of crime in the 1980s mainly used the census block group as unit of analysis. This unit represents a cluster of census blocks which is a subdivision of a census track. Only few scholars combined the use of administrative data such as census units and non-administrative information creating ideal boundaries in the cities that match with the presence of specific social communities rather than with census units. This is again the case of Sampson, Raudenbush and Earls in their study of collective efficacy and violence conducted in 1997. The use of census tracks or groups of census blocks led the scholars to focus on even smaller unit of analysis compared to the ones analysed by the Chicago School. In this way, the criminological research was making the first step towards a micro analysis of the crime problem.

In recent years, the focus on the relationship between crime and space switched from the large administrative areas studied by the European scholars in the nineteenth century and the middle areas took into account by the Chicago School to the analysis of micro units of place such as addresses, street segments or clusters of these micro units of geography (Weisburd, Bruinsma, and Bernasco 2009, 4; Ratcliffe 2010, 6). This, in essence, resulted in the birth of the *criminology of place* which "represents a radical departure from traditional interests in place in criminology" (Weisburd, Groff, and Yang 2012, 39).[3] A large number of studies demonstrated how crime concentrations would significantly cluster in specific places, irrespective of the specific unit of analysis defined (Crow and Bull 1975; Pierce, Spaar, and Briggs 1988; Sherman, Gartin, and Buerger 1989; P. L. Brantingham and Brantingham 1999; Weisburd and Green 1994; Roncek 2000; W. R. Smith, Frazee, and Davison 2000; Weisburd et al. 2004). A smaller unit of analysis permits to better analyse crime patterns and present more precise targeting, making it possible to establish preventive measures.

The geographical approach to the crime problem has always being focused on a higher level of geographical units mainly due to the data availability did not permit any lower disaggregation and, in any case, statistical tools were not as sophisticated as this type of analysis. In addition, one of the biggest issues was the lack of the theoretical interest in micro places as contrasted with research on individual criminality or crime across macro geographical units (Weisburd, Bruinsma, and Bernasco 2009, 17). This theoretical interest emerged in the 1970s and 1980s while the new environmental approach was growing and new computerized techniques and statistical tools were discovered (Weisburd and McEwen 1997). The next paragraphs will explore the birth of the environmental criminology in contrast with the offender-based approach and the development of new tools able to conduct analysis at small units of geography.

I.2 The shift from an offender-based to a place-based approach

Despite crime and place having always been part of the criminological debate, there is a long tradition of studies focusing on criminal behaviour as the result of long-standing criminal predispositions with a strong role played by the motivations of the offender. Criminologists

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[3] The term 'criminology of place' was introduced for the first time by Sherman, Gartin, and Buerger (1989).

have always been interested in understanding why certain people become offenders opposed to certain people who do not commit crimes (Hirschi 1969; Gottfredson and Hirschi 1990) and explaining why certain offenders become involved in criminal activities at certain stages of their life and why some give up in others (Sampson and Laub 1990; Moffitt 1993; Laub and Sampson 1993; Laub and Sampson 2001). Between the 1970s and the 1980s, the emerging opportunity theories shifted the focus of attention of the criminological debate from the offender to the crime and especially to the crime opportunities (Wortley and Mazerolle 2008, 22).

This change of prospective, which did not happen globally but only in a few countries, led to a different understanding of criminal actions no longer being related to the motivational sphere, but more concentrated on the crime opportunities coming from the environment. The understanding of motivation having a connection to criminal behaviour was replaced by a renewed necessity of analysing the environmental factors that could influence the commitment of crimes. This analysis was conducted at a very small units of geographical locations. Indeed, one of the most important problems holding back the development of a micro approach was the lack in the theoretical interest in micro places as contrasted with research on individual criminality or crime across macro geographical units (Weisburd, Bruinsma, and Bernasco 2009, 17). This theoretical interest emerged only in the 1970s and 1980s when two big shifts involved the criminological thought: a place-oriented approach replaced by an offender-based approach and the introduction of smaller units of analysis.

Originally, research efforts invested in programmes to prevent the development of criminality viewed as a collection of complex attitudes, personality traits and dispositions to offend. These research efforts were used for situational crime prevention efforts and environmental modifications to reduce crimes. Event-prevention strategies seemed to have a dramatic and immediate impact on specific crime problems, whereas rehabilitation programmes involving offenders resulted less effective in the short-term period and in the immediate reduction of crimes (Clarke 1992). According to Weisburd, Groff and Yang, the origins of the criminology of place have to be found in a group of new theoretical perspectives that developed as a reaction to the limitations of the offender-based criminology of the seventies (Weisburd, Groff, and Yang 2012, 7). It is worth mentioning that this shift

has occurred in the United States, in the United Kingdom and in other primarily English speaking areas. However, in other countries, such as Italy, an offender-based approach is still predominant in the criminological debate. Indeed, the Italian Journal of Criminology, the official journal of the Italian Society of Criminology, primarily publishes studies on clinical criminology, forensic psychiatry, psychology and sociology of deviance in recent years.

The innovative change of perspective, which involved some countries, can be summarized in three related and critical shifts that separate contemporary environmental criminology from the nineteenth century and early twentieth century research (P. L. Brantingham and Brantingham 1981a, 18):

1) The shift from a disciplinary to a criminological relationship;
2) The shift from concern with offender motives to concern with criminal events;
3) The shift from the sociological to the geographic imagination.

To explain these shifts, it is necessary to first explain that criminology was not traditionally seen as an independent matter of study. Since its beginning, sociologists studied crime as a special case of the more general problem of social deviance, whereas psychologists as the extremism of some general psychological processes. According to the new environmental approach, crime events were finally seen as discrete events separated from other similar forms of behaviours (P. L. Brantingham and Brantingham 1981a, 18–19).

Second of all, the objective of the new criminological perspective was to organize patterns regarding the where, when, and how crimes occur and no longer trying to understand the motivations of the offenders' behaviours and why offenders commit crimes. Moreover, in the explanation of the crime event, the criminologists gradually added to the social scenery, around and through which social beings move, the geographical scenery in order to better understand the criminal problem. The geographical approach usually answers the questions "where" and "what is where" in both absolute and relative space.[4] In this way, it became fundamental to understand punctual locations of crimes and their characteristics together with movement paths that brings offenders and victims in the same place.

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[4] The absolute space is measured by Euclidian metrics on the surface of the earth, whereas relative spaces can be defined by economic metrics, political metrics, time metrics, information and knowledge metrics (P. L. Brantingham and Brantingham 1981a, 20).

In addition, the environmental approach permits not only to develop a more comprehensive analysis of crime events, but also to implement new prevention techniques and strategic policies against crimes. Environmental criminologists started to analyse the criminality taking into account both the social and the geographical approaches to better understand, describe and control criminal events (P. L. Brantingham and Brantingham 1981a, 21). The theoretical framework of the environmental criminology takes root on the crime pattern theory elaborated by Paul and Patricia Brantingham in the eighties. This is a complex paradigm deriving from the most important opportunity theories elaborated between the late seventies and the early eighties: the routine activity theory and the rational choice theory.

I.2.1 Routine Activity Theory

The routine activity theory, which was elaborated by Cohen and Felson, was presented through a ground-breaking article in 1979.[5] The theory was not originally proposed as a general theory of crime, but as a theory of human behaviour that can also influence criminal events. According to the authors, the activities that people undertake every day, week, or month are their routine activities, which are most often based on movements of different people through space and time. The differences in these routines across time, space or between individuals can influence crime rates and generate new possibilities for committing crimes (Andresen 2010, 15). These opportunities are represented by the confluence in the same space-time of at least one motivated offender, one suitable personal or property target and the absence of a guardian capable of preventing the violation. These three elements, known also as the crime triangle, are recognized as the minimal elements needed for committing a crime. The simultaneous presence of these elements it is the precondition for its occurrence. The concept of the crime triangle was then updated by Eck and Clarke in 2003. In the latest elaboration the "controllers" are different depending on the different elements of the triangle (Clarke and Eck 2003):

1) A *capable guardian* who is in charge to protect the *victim/target*;
2) A *handler* who is in charge to control the *offender*;
3) A *manager* who is in charge to protect the *place*.

The capable guardians are usually people protecting themselves, family members, friends, and co-workers. Guardians can also include public police and private security. The handlers

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[5] An in-depth analysis of the routine activity theory can be found in Cohen and Felson(1979) and Felson (2008).

are usually people who knows the offender and that can have an impact on his/her choices, for example: parents, siblings, teachers, friends and spouses. Probation and parole authorities often substitute for normal handlers. The managers are usually the owners of the places or specific people who have some responsibility for controlling behaviour in specific locations such as a bus driver or a teacher in a school, bar owners in drinking establishments, landlords in rental housing, or flight attendants on commercial airliners (Clarke and Eck 2003). In this way Cohen and Felson, along with Clarke and Eck, suggested that crime could be prevented without changing the motivation structure but affecting the suitable target, the absent guardian or more in general the opportunity structure.

I.2.2 Rational Choice Theory

The rational choice theory was elaborated by Cornish and Clarke in the late 1980s. The focus of attention of this approach is the decision making process of the offender in the commitment of crimes. According to the authors, the crime event is the result of a number of personal and rational choices made by the offenders (Cornish and Clarke 1986). In 1986, the Cornish and Clarke published *The Reasoning Criminal*, where they collected a number of studies on the decision-making process leading offenders' behaviours.[6] According to their theory, the familiar, social and economic factors still played an important role in the decision of committing a crime, but the important thing to recognize is that the event represents the consequence of a decision that the offender usually makes taking into account benefits and costs of his/her involvement (Andresen 2010, 24). Therefore, Cornish and Clarke where able to establish the argument that crime occurs when the perceived rewards are higher than the perceived costs (Cornish and Clarke 1986; Cornish and Clarke 2008).

Since human beings are rational actors who seek to minimize costs and to maximize rewards, offenders must also be regarded as decision-making agents who commit crimes according to a cost-benefit calculation. The benefits deriving from these evaluations do not always present an economic nature, since not all crimes are driven by an economic return. In the case of sexual abuse, assault, terrorism and other violent crimes the benefit is represented by sexual satisfaction, revenge, vengeance, excitement, social status or group support (Luckenbill 1977; Clarke and Newman 2006; Beauregard and Leclerc 2007; Mann and Hollin

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[6] Other important references to this theory are in Clarke and Felson (1993) and Cornish and Clarke (2008).

2007). However, the cost-benefit calculation may not always be correct. So it must also be known that the rationality theorised by Clarke and Cornish is not perfect but limited. Offenders may not be able to accurately calculate perceived costs and perceived benefits because of a lack of information or simply because of an error (Cornish and Clarke 2008). The rational choice perspective constitutes a continuum with the routine activity theory analysing the decision making process of the motivated offender well-described by the previous theory (Clarke and Felson 1993). Indeed, the decision making process is strongly influenced by the crime triangle since offenders tend to weight costs and benefits based on the limited knowledge they have on victims and guardians in a specific situation (E. Johnson and Payne 1986)..

I.2.3 Crime Pattern Theory

The joining link between the two previous theories is represented by the crime pattern theory which combines routine activity and rational choice theories to help explaining the distribution of crime across places (Eck 1997, 6). This theory was developed by Patricia and Paul Brantingham (1981b; 1993) and it represents the first attempt to develop a meta-theory within the field of environmental criminology (Andresen 2010, 25).[7] The main concept of this approach is that offenders engage in routine activities just like other non-offending individuals and become aware of crime opportunities while conducting their normal legitimate activities. Offenders are more likely to notice suitable targets and opportunities of crime while they are doing their routine activities than when they are in contact with non-familiar places and contexts. So, the majority of the offenders that are involved in criminal events will commit crime around the places of their daily life like home, school, work and recreational activities places (P. L. Brantingham and Brantingham 1993). The rational choices are present at each stage of the pattern and they guide the behaviour of the motivated offender who will find possibilities for committing a crime in and around his/her most frequented places, in the moment in which he/she will encounter a suitable target not properly protected by a capable guardian.

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[7] References to this theory can be found also in Brantingham and Branthingam (2008).

I.2.4 Situational Crime Prevention

As the opportunity theories were born in contrast to the ineffectiveness of the offender-based theories, the situational crime prevention strategies grew up in contrast to the offender-based approaches to crime prevention which focus on the dispositions of criminals. Dispositional approaches were strongly criticized as being too broad and general, which failed to explain the variation of crime in terms of time and targets, and not able to provide solutions to crime problems in the short-term period. On the other hand, the situational crime prevention approach is very practical and its main goal is to build an environment resilient to crime. According to Clarke, who theorised this approach, the two main mistakes of the modern criminology can be summarised in the tendency of criminologists to confuse the explanation of crime with the problem of explaining the criminal and to confuse the problem of controlling crime with that of dealing with the criminal (Clarke 1992). The situational crime prevention is oriented on the modification of the environment and it "comprises opportunity-reducing measures that are directed at highly specific forms of crime, involve the management, design or manipulation of the immediate environment in as systematic and permanent way as possible, make crime more difficult and risky, or less rewarding and excusable as judged by a wide range of offenders" (Clarke 1980; Clarke 1992).

The first concept theorised by Clarke in the definition of situational crime prevention is the importance of tailoring the target of each situational preventive action. This means that distinctions must be made not between broad categories such as theft, burglary or robbery, but looking at the different typologies of offences present in each of these single categories. Targeting is the first step to create effective preventive measures able to impact the opportunity structure of a society. Once the target of a preventive measure is clear, the situational crime prevention modifies the immediate environment connected with that specific type of crime reducing the opportunities to commit crime in that environment. This second concept of the definition is strongly connected to the concepts of "defensible space" elaborated by Newman in 1972 and "crime prevention trough environmental design" (CPTED) theorised by Jeffery in 1971. Newman's defensible space underlines the importance of the construction of a residential environment whose physical characteristics - building layout and site plan - function to allow inhabitants themselves to become key agents in ensuring their security and reduce the opportunity for committing crime (Newman 1972). The

evolution of this concept was the development of crime prevention through environmental design (CPTED) which is a popular prevention technique used by law enforcement agencies and city planners (Lersch and Hart 2011, 168).

The main characteristic of this approach is the importance of the direct controls over environmental conditions prior to the commission of an offence. The three interrelated strategies associated with CPTED can be considered as the following: the access control, the surveillance and the territorial reinforcement (Jeffery 1971). The third concept of the situational crime prevention deals with the idea that all people have some probability of committing crime, so Clarke did not assume any distinction between offenders and other people. Ideally, this approach can be applied to any type of crime in order to reduce crime opportunities. Starting from these standpoints, Clarke practically elaborated first 16 and then 25 prevention techniques that aim at increasing the perceived effort of crime: increasing the perceived risks of crime, reducing the anticipated rewards of crime, reducing provocations of crime and removing the excuses for crime in order to make the commitment of crime more difficult (Clarke 1992). Through new prevention strategies, including defensible space, CPTED and situational crime prevention, crime can be prevented by reducing opportunities (Lersch and Hart 2011, 178).[8]

It is important to mention that the environmental approach and the generalized situational crime prevention measures have been criticised for being too oriented on finding short-term resolutions without solving the problems in the long-term. As a consequence, there are conflicting opinions in the interpretation of the effectiveness of these preventive measure. The major critique that it is connected with the implementation of situational measures is the displacement effect. "Critics of situational preventions […] often state that the approach is useless because it only displaces crime to other places" (Hesseling 1994, 198).

There are different types of displacement: temporal, spatial, of target, tactical and of offence (Clarke and Eck 2003; Guerette 2009). According to this critique, crime prevention measures are not effective because after the implementation of an environmental change in a specific place, criminals tent just to change the place, the time of the day, the types of targets,

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[8] More insights on situational crime prevention and crime prevention through environmental design can be found, respectively, in Clarke (2008) and Cozens, Saville, and Hillier (2005) ; Cozens (2008).

their techniques or the types of offence, but they would not stop committing crimes. Many studies tried to test the displacement effect and diffusion of benefit effect, which is the unexpected reduction of crimes not directly targeted by the preventive action (Hesseling 1994; Bowers and Johnson 2001; Weisburd et al. 2006; Guerette 2009; Guerette and Bowers 2009). Some of them strongly discard the displacement hypothesis because of the difficulties of recreating the same crime opportunities that are "just around the corner" (Weisburd et al. 2006), but the discussion is still wide opened and the supporters of the two different approaches remain.[9]

I.3 The development of computerised techniques and the hot spot analysis

Early attempts to map crime using digital processes were hindered by technological and data limitations (Maltz, Gordon, and Friedman 1991; Weisburd and McEwen 1997), organizational issues (Openshaw et al. 1990), an inability to convert digital addresses into points on a map (Harries 1999; Ratcliffe 2001; Bichler and Balchar 2007) and functional obstacles because police and criminal justice databases were not organized to record spatial information (Ratcliffe and McCullagh 1998).[10] The develop of computer mapping application and new techniques using GIS programmes were the fundamental starting points for permitting a micro-study of crime events. The innovative implementation of GIS and the technological development of these new tools were mainly carried out by the National Institute of Justice's Crime Mapping Research Center (CMRC) of the United States, which was renamed in 2002 to the Mapping and Analysis for Public Safety (MAPS) programme.

The U.S. initiative soon involved also other countries such as the United Kingdom, Australia, South Africa and some others across South America (Chainey and Ratcliffe 2005, 3). This system of digital cartography came from a fusion between the system of technical design CAD (Computer Aided Design) and the database DBMS (Data Base Management System). The new GIS tools permit flexible measurements at different spatial aggregations and the creation of simple continuity matrices for representing neighbour relationships between different areal units (Anselin et al. 2000). GIS allows to visualize, modify, query and analyse geographic and tabular data. The programs permit to visualize data behind geographic

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[9] A review of studies on displacement and diffusion of benefits can be found in Hesseling (1994) and Guerette and Bowers (2009).

[10] For more detailed information see Ratcliffe (2010).

features manipulating data and maps to create aggregation of features and perform statistical functions (Boba 2005, 104).

The development of new GIS software was a fundamental step in the growth of crime mapping, which represents one of the most important techniques used today in order to understand the dynamics of crime events at their specific location. According to Ratcliffe (2010), the evolution of crime mapping has introduced a new era in spatial criminology giving the opportunity to transpose rudimental pins manual maps to computerized software that have the possibility to re-elaborate spatio-temporal information through descriptive and statistical tools. In addition, mapping efforts are useful not only to produce retrospective knowledge of the past events, but also to identify early warning signs and inform a proactive approach to police problem solving and crime prevention (Groff and LaVigne 2002; Kennedy, Caplan, and Piza 2011; Dugato 2013). Maps are composed by surfaces where points, lines and polygons are located. Point features are discrete locations with unique latitude and longitude coordinates such as locations of crime, schools, bus stops or shopping malls. Lines commonly represent the streets of a city, however, line segments can also stand for rivers, bus or tram itineraries and movements or trajectories. Polygons, which are multi-sided closed features, can represent geographic areas such as regions, provinces, neighbourhoods, parks and buildings (Boba and Velasco 2000, 3–4). GIS programmes can produce different types of maps depending on which types of elaborations are needed and on which is the level of complexity of the analysis. Boba and Velasco (2000) illustrated the most basic and important types:

- *Single symbol maps* visually represent points, lines and polygons into computerized maps. They are used for detailed analysis of small amount of data trying to replace old pins maps. Using this maps it is difficult to determinate risk of multivictimization because it is hard to displace incidents that happen at the same address.
- *Graduated size maps* summarise the data, so symbols (point or line features) are altered in size to reflect the frequencies in the data. Graduated size maps can show, in this way, more incidents in a punctual locations with a larger symbol and more incidents along a line segment with a thicker line. However, it is difficult to use this type of map to show different types of crime and the map can became cluttered if a large number of incidents are mapped on it.

- *Graduated colour maps* present points, lines and polygon features shaded according to a statistical formula, custom setting or unique value. There are several approaches to classifying information when creating colour maps and a strong point of this map is the possibility to aggregate and displace large amount of data.[11]

- *Combination maps* represent multiple data sources combining different types of techniques. These maps are very useful for analysing in the same time different and multiple information and producing more advanced analysis and results.

One of the most common and innovative uses of crime mapping is the aggregation of crime events into hot spots maps (Ratcliffe 2010, 8–10). Georeferentiation and spatial location of crimes became extremely important to understand where crimes occur and which areas are the most dangerous inside of a city.[12] This approach started to be used to identify high crime areas and problem locations to develop responses to improve law enforcement efficacy and the quality of life in these parts of the city (Lersch and Hart 2011). The problematic and dangerous zones were recognized as "hot spots" of criminality, which are clusters of crime events across the same addresses, streets or neighbourhoods of the city. The terms "hot spot" has a number of different meanings depending on the different level of the disaggregation of the analysis.

Researchers underline these differences and refer themselves to hot dots, hot spot blocks or clusters of hot spot blocks defining them as "areas that present a grated than average number of criminal or disorder events, or an area where people have a higher than average risk of victimization" (Eck et al. 2005). The average is calculated on the total number of events happened in a certain city, in a certain neighbourhood or in a certain area. Opportunities for crime, indeed, are not equally distributes across places and micro-units of analysis (Kennedy, Caplan, and Piza 2012, 15), they cluster following the so-called 80/20 rule that predicts that 80% of crimes occurred in 20% of places. In general, this concept comes from the idea that 80% of the outcomes are the results of only 20% of the related causes

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[11] The classification methods are: 1) Natural breaks; 2) Equal area; 3) Equal interval; 4) Quantile; 5) Standard deviations; 6) Custom; 7) Unique value.
[12] Georeferentiation is the process through which addresses are converted to features on a map assigning an X-Y coordinate pair to the description of a place (Lersch and Hart 2011, 226).

(Clarke and Eck 2003; Boba 2005).[13] The distribution of these clusters of crime across the city can be monitored thanks to the availability of punctual data offering law enforcement agencies the opportunity to highlight critical areas of the city and concentrate their efforts in counteracting and preventing crimes in these zones.[14] Depending on the size of the geographical area that has to be analysed there are different types of hot spot analysis (Eck et al. 2005). The different methods fall into three different categories (Lersch and Hart 2011, 225):[15]

- *Global statistical tests* – mean centre; standard deviation distance and ellipse; global tests for clustering; Nearest Neighbour Index; Moran's I; Geary's C statistic.
- *Hot spot mapping techniques* – point mapping; spatial ellipses using hierarchical or K-means clustering; thematic mapping using enumeration areas; quadrat mapping; kernel density estimation.
- *Local indicators of spatial association statistics* – Gi and Gi* statistics.

A visual and statistical understanding of hot spots is often not enough to produce efficient policies to fight and prevent crime events. What it is needed to reduce crime in an hot spot area is a deep comprehension of the causes of criminal acts (Clarke and Eck 2003). Brantingham and Brantingham (1995) have defined the hot spot places in *crime generators*, *crime attractors* and *crime enablers* depending on the different reasons that are linked with their growth and evolution. These reasons are related to the different features that these places present. *Crime generators* are places that attract a large number of people. In public events, parades, shopping malls, airports and festivities both offenders and victims are sharing the same space, for this reason, in these locations occur a high number of criminal incidents. The spatial coexistence of suitable targets and possible offenders create many opportunities for crime to occur. *Crime attractors* are places which are known to provide many criminal opportunities to commit crimes. Possible offenders in crime generator places are looking to have a good time or they are doing their normal activities not specially oriented in committing

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[13] It is important to notice that 80 and 20 are taken into account only to represent "large" and "small" amounts. The actual proportion change in accordance with type and nature of the phenomenon that is studied (Boba 2005, 67).
[14] The complete information about the location of a crime event includes the street address and number. Not always these information are collected by law enforcement agencies. Indeed, it sometimes results extremely difficult to locate precisely a crime event such as a bag-snatching or a theft in a public place.
[15] In-depth information about these different methods can be found in Eck et al. 2005, whereas comparative analysis between different techniques in Chainey 2005; Grubesic 2006; Chainey, Tompson, and Uhlig 2008.

crimes, whereas offenders usually reach crime attractor places because they know that these spaces are havens of high criminal activity.

Open market drug sales, prostitution districts and unsecured parking areas can be good example of crime attractors. *Crime enablers* are places with a low level of regulation and guardianship. Because of their reputations and the high risk many possible victims avoid going to these locations. For this reason, these places are characterized by a low number of victims and a high number of possible offenders (Clarke and Eck 2003, chap. 18; Lersch and Hart 2011, 224). Recognizing the causes of the different hot spots of criminality is necessary to carry out specific and efficient prevention policies. In the case of the presence of crime generators, the possible solutions for preventing crimes are linked with the increase of the level of protection and security, whereas the crime attractors discourage the frequenting of these locations. In the case of crime enablers the solutions are connected with the reinforcement of the level of guardianship and the community involvement in the life of the hot spot neighbourhoods. In any cases, it is always important to remember that preventive measures have to be studied case by case implementing specific policies taking into account the features of the hot spot, the community living in the neighbourhood and its structure.

I.4 How crime at place has been studied in the last few decades: A review of research

The topic of crime and place is well-developed and many scholars have conducted research on it, especially in the United States. The large amount of literature present nowadays can be catalogued in different sub-groups depending on the specific characteristics of the studies. The aim of this paragraph is to summarise and briefly describe the existing literature based on these different characteristics.

I.4.1 Different unit of analysis in crime and place studies

The unit of analysis of the earliest studies on crime and place was the country and the interrelation between countries. This level of aggregation is still in use for studies of macro crime trends, even if the recent literature is more oriented on a micro level analysis of crime events. The first cross-regional (Quételet 1831; Guerry 1833) and the cross-national (Guerry 1864) analysis performed in the nineteenth century were centred on the comparisons between crime levels. The comparative approach is nowadays one of the most important method for studying macro international crime trends and their historical evolution among different

countries. For this reason, many studies have also recently focused on the comparison of crime trends among countries (Neapolitan 1997; Neapolitan 1999; LaFree and Drass 2002; Rushton and Whitney 2002; Farrington, Langan, and Tonry 2004; LaFree and Tseloni 2006; Aebi and Linde 2012; Alvazzi del Frate and Mugellini 2012). Consequently, a large number of other researchers studied the possible obstacles to the comparability of data stressing the importance of creating comparable data in terms of crime definitions and methods of collection of data by law enforcement agencies (Neapolitan 1996; Aebi et al. 2000; Barclay 2000).

Neighbourhood level analysis represent another group of studies, more focused on the dynamics of crime in districts, territories and areas of the city. Neighbourhoods and districts have always been taken into account for the analysis of crime at place since the beginning of the twentieth century, this is because it is easier to recollect data at district level rather than at street and address level. Many studies on neighbourhoods centred their analysis on the comparison between data on crime trends and socio-economic variables in different districts or blocks highlighting the socio-economic conditions of the communities living in those high crime areas. The hypothesis of these studies tried to relate crime with socio-economic conditions of the neighbourhoods as poverty, immigration, presence of schools. These studies are often supported by a more general descriptive analysis of variables trends and statistical regression models (Sampson, Raudenbush, and Earls 1997; Bursik 1999; Bursik and Grasmick 2012; Willits, Broidy, and Denman 2013). Other researchers tried to understand the spatial dynamics that can link crime and different neighbourhoods conducting spatial analysis, hot spot analysis in different blocks and spatial regression models (LaGrange 1999; Martin 2002; Tita, Petras, and Greenbaum 2006; Hipp 2007; Kikuchi 2010).

The growth of the new environmental paradigm and the development of new geographical techniques to geocode crimes allowed a micro-level analysis of the dynamics of crime at place. The smallest unit of analysis in these studies is represented by the single address that can indicate the place in which a crime occurred, an offender lives, a crime generator/attractor is located or a special event takes place. For the first time, Shaw and McKay (1942) mapped juvenile delinquents home addresses by hand for Chicago, Philadelphia and other cities. Their map shows individual dots for every address identifying that delinquency rates varied by

zones depending on expansion and migration patterns in the cities. Over the course of time, other studies have based their analysis in the identification of dots and groups of dots forming hot spots areas (Eck 1997; Anselin, Griffiths, and Tita 2008). Hot dots analysis mainly aims to understand where crime occurs and which are the reasons connected with the high crime incidence in specific territories. For doing this, many studies have also mapped crime generators and crime attractors trying to understand the vicinity between the place where crime events occur and possible crime facilitators such as train station, bus stop and more in general public transport, shopping mall, school, park, bar, pub and aggregation centre (Levine, Wachs, and Shirazi 1986; Roncek and Maier 1991; LaVigne 1997; LaGrange 1999; Loukaitou-Sideris 1999; Roncek 2000; M. F. Smith and Clarke 2000; Murray and Roncek 2008; Groff and McCord 2011; Yu 2011).[16]

In most of the cases, hot dot studies are connected with a more general hot spot analysis that can flow into a more comprehensive study of the conditions of the neighbourhoods and the communities in which the hot spot areas are particularly present. Regarding hot lines, the majority of researches that have taken into account these units focused their attention on streets. Some researchers use group-based trajectory analysis to study the distribution of crime at street segments in order to understand if macro-places have generally stable concentrations of crime across time (Weisburd et al. 2004; Groff 2007; Weisburd, Morris, and Groff 2009; Groff, Weisburd, and Yang 2010), whereas others stressed the correlation between street design and the possibility of committing crime (Beavon and Brantingham 1994) or the cultural habits that can influence crime at street level in the United Kingdom and in the United States (Wright, Brookman, and Bennett 2006; Braga, Hureau, and Papachristos 2011).

I.4.2 Different types of crime in crime and place studies

Besides the different unit of analysis, the studies on crime and place can be also classified depending on the different types of crime analysed. In most of the cases, hot spot analysis is conducted on property crime rather than on violent crime. Homicides, attempted homicides, rapes and assaults tend to follow different patterns and different logic rather than property crimes. Generally speaking, it seems that robberies, burglaries and thefts are more likely to

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[16] For a more comprehensive analysis of facilitators of crime see Clarke and Eck (2007).

follow the rational choice pattern. These crimes are indeed more prone to depend from costs-benefits logics, whereas other violent crimes from a more impulsive behaviour. Nevertheless, in recent years, the environmental criminology found positive correlations between violent crimes and opportunity oriented behaviour. In addition, the environmental criminologists started to map also unusual crimes such as organized crime and terroristic acts (B. L. Smith, Damphousse, and Roberts 2006; Braithwaite and Li 2007; Damphousse et al. 2008; B. L. Smith et al. 2008; Tita and Radil 2011; LaFree et al. 2012). The develop of studies on violence and urban context (Morenoff and Sampson 1997; Morenoff, Sampson, and Raudenbush 2001; Rushton and Whitney 2002; Berg and Loeber 2011; R. B. Felson et al. 2013; Light and Harris 2012) generate a new interest on spatial analysis of homicides (Cork 1999; Messner et al. 1999; Messner and Anselin 2003; Wang 2005; Kim, Chun, and Gould 2013), serial murders (Goodwill and Alison 2005), rape and serial rapists (Linnell 1991; Goodwill and Alison 2005), assaults (Suresh and Vito 2007; Murray and Roncek 2008), guns violence (Sherman et al. 1991; Cork 1999; Braga, Papachristos, and Hureau 2010; Wells, Wu, and Ye 2012), robberies (Linnell 1991; Matthews, Pease, and Pease 2001; Ceccato and Oberwittler 2008; Braga, Hureau, and Papachristos 2011; Dugato 2014) and drug related crimes (G. Rengert et al. 1992; Weisburd and Green 2000; McCord and Ratcliffe 2007).

Despite this growing interest on the relationship between violent crimes and place locations the most studied types of crime remain property crimes, especially in the case of burglaries and domestic burglaries (T. Bennett 1995; Martin 2002; S. D. Johnson and Bowers 2004a; S. D. Johnson and Bowers 2004b; Goodwill and Alison 2005; S. D. Johnson et al. 2007; Rey, Mack, and Koschinsky 2011). This might be due to the fact that burglaries can be easily located and mapped because they occur in a specific physical place breaking and entering a building that can be an apartment, a single house or an office. In addition, this type of crime is often reported to law enforcement agencies for requesting an eventual insurance payment. This is not the case of rapes, assaults and violence episodes that are more difficult to be disclosed by victims because of the their physiological involvement in the criminal act and in the case of drug related crimes because of the direct role of victims in dealing and selling drugs. Consequently, the law enforcement and the researchers have less availability of data for these types of crime and less opportunity to correctly geocode the crime events.

I.4.3 Multi-victimization and crime prevention in crime and place studies

One of the beneficial aspects introduced by the environmental approach and more generally by conducting research at small units of geography is the possibility to better target crime prevention measures. In this sense, multi-victimization studies are crucial because they analyse what has already happened, identify which are the weak targets and present possible preventive solutions. In addition, according to the literature, preventing repeat victimization would prevent a large proportion of all crime (Farrell, Phillips, and Pease 1995, 384). A large number of studies on multi-victimization and crime prevention measures have been developed in order to prevent crime occurrence.

The first studies on repeat victimization included the work of J. H. Johnson et al. (1973), Zeigenhagen (1976), Sparks et al. (1977) and Sparks (1981). The motivations pushing the offender to victimize a person or a place more than once are multiple, but, according to the most recent studies, a rational behaviour may guide the criminal acts. The repeated offences do indeed require less effort and have fewer risks rather than conducting a new criminal act (Farrell, Phillips, and Pease 1995, 386). Domestic violence, child abuse and racial attacks are identified as the most common repeat crimes due to the intimate relationship between the victim and the offender and the inequality between majorities and minorities and the "processual" nature of the crime itself.[17]

The literature that has addressed these types of crime do not usually take into account the spatial dimension of these offences (Dobash and Dobash 1979; Browne and Finkelhor 1986; Finkelhor and Baron 1986; Finkelhor 1991; Sherman et al. 1991; Bowling 1993). This is mainly because the location where these crime events occur is the private residence of the victim, his/her familiar context and the causes are often difficult to be interpreted. On the contrary, types of crime that seem to be taken less into consideration for a further victimization are the centre of the most recent study of multivictimization and spatial analysis. Especially in the case of burglary, a large amount of studies tested the relationship between repeated burglaries and spatial locations of houses (Polvi et al. 1991; Townsley, Homel, and Chaseling 2000; Townsley and Chaseling 2003; Bowers and Johnson 2005; Short et al. 2009;

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[17] "It is argued that if racial harassment and other forms of crime are to be described and explained adequately and controlled effectively, they should be conceptualized as processes set in geographical, social, historical, and political context" (Bowling 1993, 231).

Rey, Mack, and Koschinsky 2011). The same offender can decide to return to the previous victimized house to finish the work or spread the voice to other offenders about the structure of the house and its alarm systems in order to give them the possibility of stealing again. If the area around the victimized house is particularly weak of guardianship the offender can also decide to burglar the houses closest to the previous victimized one (Polvi et al. 1991).

According to a quite recent research, 35% of the burglaries recorded in Cambridge were the result of a previous victimization (T. Bennett 1995). Another study in Florida shows that 25% of the burglary re-victimization occur in the further week and 51% in the further month that follow the first crime event (M. B. Robinson 1998). More recently, other studies have based their analysis on the multivictimization effects and the near repeat phenomenon that predicts when a crime occurs in a given area, according to the elements of a surrounding area, it may exhibiting an increased risk for subsequent crime in the days following the original incident (S. D. Johnson and Bowers 2004a; Youstin et al. 2011). These researches have not only focused their attention on burglary and property crime, but also on bank robbery (Matthews, Pease, and Pease 2001; Dugato 2014), personal fraud (Richard and Dover 2001) and violent crime such as shooting patterns (Ratcliffe and Rengert 2008) and gun assault (Wells, Wu, and Ye 2012).

The environmental approach and the analysis carried out by the new spatial techniques, including the development of crime mapping and hot spots analysis, are often the starting point of new prevention policies to improve law enforcement activity. Since crimes cluster in space and time, crime prevention resources should be similarly concentrated and distributed on the territory in order to achieve a maximum impact (Kennedy, Caplan, and Piza 2012, 67). A large number of studies focused their attention on place-based policing practices that offer a more efficient method of policing and distributing the resources around the territory taking into account the hot spots areas and the most problematic neighbourhoods. The effectiveness of place-oriented strategies is well-proved through the literature (Braga et al. 1999; Weisburd and Green 2000; Braga 2001; G. F. Rengert, Ratcliffe, and Chakravorty 2005; Braga and Weisburd 2010). In addition, to improve the law enforcement efficacy, some studies focused their attention on the redistribution of the police resources in the territory (Tacher 2011), on the rational reorganization of the law enforcement itself (Kennedy, Caplan, and Piza 2011)

and on the implementation of training to police officers to learn how to use spatial techniques and crime mapping tools (Ratcliffe 2004). As suggested by Kennedy, Caplan, and Piza (2012), the implementation of this new approach cannot exclude a more comprehensive understanding of the socio-economic factors and the physical environment in which the offender operates. Indeed, the environmental approach and more in general the situational crime prevention measures have been criticised for being too oriented on finding short-term resolutions without solving the problems in the long-term period. As a consequence, there are conflicting opinions in the interpretation of the effectiveness of these preventive measure. A good middle ground in implementing short-term and long-term answers to the crime problem may be the right solution to better address this issue.

I.5 Conclusions

The birth of the opportunity theories and the development of the environmental criminology have led to a micro level approach in analysing the crime problem. Despite the relationship between crime and space has been studied since the 1800s, only in the last decades the geographical criminology has switched its attention from large and middle administrative areas to micro units of place. This is mainly due to problems connected with the unavailability of micro crime data and inadequate statistical tools unable to support a micro level analysis. In addition, a theoretical interest in micro places has only emerged starting from the 1970s when the rational choice theory, the routine activity theory and the crime pattern theory distinguished themselves in the criminological debate. Before these emerging theories, the offenders have been the predominant focus of criminology.

Traditionally, the criminological research has been centred on individuals and the motivations of criminal behaviour. In the same direction, efforts on crime prevention have been invested for a long time in programmes to prevent criminality viewed as complex of attitudes and personality traits. The change of prospective from an offender-based to a place-based approach led to a different understanding of the criminal act and to a reorientation of the crime prevention measures in order to modify the environment to reduce opportunities for crime. These opportunities are represented by the confluence in the same time and space of at least one motivated offender, one suitable target and the absence of a capable guardian. The simultaneous presence of these three elements is the precondition of crime occurrence.

According to the situational theorists, crime could be prevented without changing the motivation structure but affecting the three main elements of the opportunity structure. Event-prevention strategies seemed to have immediate impact in reducing crime, whereas rehabilitation programmes involving offenders resulted less effective in the short-term period.

Studying clusters of crime at very small units of geography permits to better analyse crime patterns and to be more precise in targeting possible preventive measures. Indeed, large geographic areas present degree of spatial heterogeneity of crime that would be missed without exploring what happens at a smaller level. The develop of computer mapping applications and new techniques using GIS programmes were the fundamental starting points for permitting a micro-study of crime events. Moving from the growth of these new software, a large number of studies, especially in the United States, have conducted analysis on micro units of place such as addresses, street segments or clusters of these micro units of geography. These studies were conducted especially on property crime, even though spatial dynamics of violent crime, organised crime and terrorism were also investigated. It is the birth of the criminology of place that developed in reaction to the limitations of the offender-based criminology of the seventies.

It is worth mentioning that this shift has primarily occurred in only a minority of countries around the world, whereas in the majority of them predominantly still refer to an offender-based approach. In addition, it is necessary to recall that the environmental approach has been criticised for being too oriented on finding short-term resolutions without solving the crime problem in the long-term period. As a consequence, there are conflicting opinions in the interpretation of the effectiveness of these preventive measure. A good middle ground in implementing short-term and long-term answers to the crime problem may be the right solution to better address this issue.

CHAPTER II. The street segment analysis in the criminology of place

Choosing the appropriate geographical unit of analysis to study urban criminality has always been an issue in the criminological debate. Since the middle of the nineteenth century, Glyde (1856) questioned the validity of the research based on administrative large units of analysis supporting smaller disaggregation levels. He realized that taking into account large unit of geography could lead to a homogenisation of the results in the same area where there are instead different crime patterns. Later, scholars belonging to the Chicago Schools called for the identification of units of geography not driven by administrative boundaries, but from the social units created by the social structure itself. Otherwise, the criminological research risks to incur in what William Robinson (1950) defined as 'ecological fallacy'. This concept is drawn starting from the famous example of the correlations between immigration and literacy in the United States. This relationship is described as an *ecological correlation* because the statistical sample is composed by a group of *persons*. This *ecological correlation* between the percentage of immigrants and the percentage of literacy is strong and positive for the 48 U.S. States. However, the same correlation took into account at individual level was small and negative.

The positive results at state level were driven by the fact that immigrants tend to move to states where the level of education of the U.S. population was already high, so the generalized results were very high also for the immigrant population. Robinson moved strong criticisms to the analysis conducted by the scholars of the Chicago School who often used ecological correlations in large geographical studies such as neighbourhoods and cities. He stated that "ecological correlations are used in an impressive number of quantitative sociological studies […] simply because correlations between properties of individuals are not available" (W. S. Robinson 1950, 352). Generally speaking, "the ecological fallacy is a not necessarily a spatial unit of analysis issue, but applies to all situations where issues of aggregation need to be resolved before proper conclusions can be arrived at" (Weisburd, Bruinsma, and Bernasco 2009, 218). In line with this criticism and in support of small micro units of analysis, one of the most recent studies on crime at place conducted in Seattle by Weisburd, Groff, and Yang (2012) shows that there is a high variability of crime patterns street by street within the same city. In this way, a street segment can register a high number of offences, whereas its neighbour segment can register no crime at all. This variability could have been lost analysing

the crime patterns at a larger aggregation of geography, whereas it can be recognised studying crime at a street segment level.

The criminology of place developed in answer to the necessity of analysing the crime problem at a smaller level providing a better understanding of the phenomenon. The evolutions in the field of GIS technology and the application of these technologies in the criminological research made possible the development of studies on crime and place at micro level. These studies drew important distinctions between the sites where crime occurs and much larger geographical areas such as cities, neighbourhoods and communities. Places in this micro context are specific locations within the larger social environments of communities and neighbourhoods (Eck and Weisburd 1995). The theoretical and practical benefits of focusing the criminological research in micro places is well pointed out by a large number of studies. Cross-sectional and longitudinal studies have demonstrated that crime is concentrated at a small number of micro places. According to the longitudinal studies of crime trajectories, these crime concentrations seem quite stable over time (Weisburd et al. 2004; Weisburd, Morris, and Groff 2009). Since "the extent of the concentration of crime at place is dramatic" (Weisburd, Groff, and Yang 2012) a large number of U.S. studies started to focus on street segments and analyse patterns of crime variability among street segments. Indeed, according to several scholars, the street segment represents an important "behaviour-setting" and an appropriate unit of analysis (Appleyard 1981; Taylor 1997; Weisburd, Morris, and Groff 2009; Weisburd, Groff, and Yang 2012). This is particularly true for the U.S. cities, so most of the times these studies have been developed in the United States.

This chapter describes the introduction of this new unit of analysis in the criminology of place. Despite the critiques arise to the studies on micro units of geography, street segments seem to be quite central in the study of crime at place in the United States. One of the major critiques to this approach is that this paradigm is often too much concentrated on the micro level and it tends to forget about the biggest picture. These studies often radicalize the importance of the micro level over the meso/macro level and they do not explain crime occurrence through a more complex and extensive theoretical framework. To focus only at a very small units of geography can lead to the risk of not being able to really understand crime patterns, as well as to look only at the macro level can lead to the risk of generalizing patterns

which are only present in a small number of micro places. The answer of these critiques can be working for a more comprehensive understanding of the crime problem. This means that a comprehensive approach should be able to conjugate the micro level analysis with the more general framework where micro units are identified.

II.1 Street segments as unit of analysis

Recently, the criminological research has developed a growing interest in studying crime at street segment level. Among the micro units of geography such as addresses, streets and groups of streets, the street segment unit has been tested by a group of emerging studies of crime at place. A street segment is commonly referred to as a street block or a face block. Weisburd and his colleagues in most recent studies define the street segment as "both sides of the street between two intersections" (Weisburd et al. 2004; Weisburd, Groff, and Yang 2012; Weisburd, Telep, and Lawton 2013; Weisburd and Amram 2014). The same definition is also adopted by Groff and Lockwood (2013). According to *The Criminology of Place*, one of the most complete studies newly published, the theoretical and operational reasons to study street segments are multiple. "In geographic terms, it [the street segment] is a very small building block from which to examine the criminology of place. At the same time, it is a social unit that has been recognized as important in the rhythms of everyday living in cities" (Weisburd, Groff, and Yang 2012, 23).

Previous theories have stated that human actions are driven by the behavioural-settings in which individuals are involved and the exposure to different social environments can determine the involvement in criminal actions (Appleyard 1981; Taylor 1997; Wikström 2004). "A behaviour-setting may be defined as the part of the environment which an individual, at a particular moment in time, can access with his or her senses, including any media present" (Wikström 2006). Different behavioural-settings can influence an individuals' moral actions as well as impact the development of individual characteristics related to their crime propensity. From this point of view, it is essential to be able to measure units of geography that approximate the behavioural-settings. According to Oberwittler and Wilkström, "because behaviour-settings are the parts of the social environment the individual can access with his or her senses, these units have to be geographically small" (Oberwittler

and Wikström 2009, 37). In order to capture the essence of the social environments in which the individuals move their steps, it is necessary to think at a very micro level.

Taylor (1997) believed that street blocks, or street segments, can be considered as a perfect example of behaviour-setting because people that live in the same street segment get to know each other and become familiar. Residents of the same street segments develop roles they play in the street segments' daily life and usually share the same norms. Each street segment also shares the same rituals such as the mail carrier who delivers at the same time of the day, the same cleaning service of the roads and the same days for the collection of the recycle bins. Moreover, street segments, as other types of behaviour-settings, are dynamic since residents change over time and house markets can rise or decrease. All these changes have an impact on the social and physical environment and have a consequence on the behavioural-settings. In addition, street blocks have specific boundaries, at each cross streets or at each end of the street, that contain its setting.

Specific boundaries make the street segment easy to recognise by the residents and the community, whereas this was not the case of neighbourhoods' boundaries. In this way, residents of the same street block can share a common feeling of identity. Generally speaking, these statements can easily be the object of critiques and they have to be carefully taken. It is not unknown that in big cities and complex urban centres the level of anonymity and individualism is much higher as compared to rural areas where community ties still play a very important role in people's daily lives. Often in cities, people that live in the same building do not know each other, as well as people that are formally part of the same community. In light of these considerations, the concept of behavioural-setting can play an important role in understanding the crime problem, but it can also have a controversial nature if related to the street segments. Operationally, the choice of using street segments instead of smaller unit of analysis such as addresses also arise from the necessity to minimise the errors coming from miscoding of addresses in official crime data (Sherman, Gartin, and Buerger 1989). Indeed, prior studies often pointed out that it is difficult to geocode official crime data at a precise address level since these data are usually reported with a certain degree of error (Klinger and Bridges 1997; Weisburd and Green 1994).

A pioneering study published by Sherman, Gartin, and Buerger, found that 50% of all calls to the police in Minneapolis were registered in only about 3.5% of the total street segments of the city. All the calls for robberies were coded at 2.2% of places, all rapes at 1.2% and all auto thefts at 2.7% (Sherman, Gartin, and Buerger 1989). The authors considered these findings as particularly break-ground and they called for a new area of scientific inquiry named 'criminology of place'. Already in 1988 a similar concentration of incidents were reported by Pierce, Spaar, and Briggs in Boston, whereas more than twenty years later, in the same city, Braga, Papachristos, and Hureau (2010) found that more than half of gun violence incidents were concentrated in micro places with volatile trajectories which represent less than 3% of street segments and intersections of the entire city.

In 2004, Weisburd et al. confirmed the results of the Minneapolis study finding that between 4% and 5% of street segments in Seattle accounted for 50% of crime incidents (Weisburd et al. 2004). For the latter study they also conducted a group-based trajectory analysis confirming that these crime concentrations are stable over time. Group-based trajectory analysis was developed by Daniel Nagin in order to understand if micro-places have generally stable concentrations of crime over time (Nagin and Land 1993; Nagin 1999). Longitudinal data are the basis of this analysis and this "developmental trajectory is used to describe the progression of any phenomenon, whether behavioural, biological, or physical" (Nagin 2010, 53). This method is often used to study distribution of crime at micro-places (Groff 2007; Weisburd, Morris, and Groff 2009; Braga, Papachristos, and Hureau 2010; Groff, Weisburd, and Yang 2010; Weisburd, Groff, and Yang 2012).

The study of Seattle was enlarged in 2012 taking into account crime among a 16-year period confirming previous results. Between 4.7% and 6.1% of the street segments each year account for about 50% of crime incidents and the proportion of street segments with no crime vary between 34% and 41% (Weisburd, Groff, and Yang 2012, 49). In line with the findings of the studies in Minneapolis, Seattle and Boston, Weisburd, Telep and Lawton found that the top 5% of the street segments in New York registered a concentration of crime incidents equal to 52.2% in 2009 and 52.6% in 2010. The same patterns were confirmed for 5% of the street intersections that account for 50.1% and 50.8% of offences, respectively, in 2009 and 2010 (Weisburd, Telep, and Lawton 2013). Most recently, in 2014, the same crime concentration

was found in Tel-Aviv Jaffa where 4.5% of the street segments produced approximately 50% of crime (Weisburd and Amram 2014). In 2009 a similar study was conducted in Rotterdam in the Netherlands on street violence. According to the author 40% of all recorded violence takes place in 4% of the streets of the four neighbourhoods under scrutiny (van Wilsem 2009).

Studies on street segments are not only focused on crime concentrations in hot spots streets and in longitudinal analysis studying these concentrations. Scholars have also stressed the correlation between street design and risk of victimization in Vancouver (Beavon, Brantingham, and Brantingham 1994) or the cultural habits that can influence crime at street level in the United Kingdom and in the United States (Wright, Brookman, and Bennett 2006; Braga, Hureau, and Papachristos 2011). In addition, Groff and Lockwood recently published an article on the influence of facilities such as bars, subways stops and schools on crime in 40,371 street segments in Philadelphia (Groff and Lockwood 2013). Their findings are consistent with crime pattern theory strengthening the importance of the exposure to facilities when explaining crime occurrence.

The results also suggest that facilities influence crime at a specific place, but also at those places nearby. Recently, Elisabeth Groff published other works on the relationship between facilities, the proximity of those facilities and street segments. This is the case of a study that tries to quantify the exposure of street segments to drinking places at seven distance thresholds from the facilities (400, 800, 1,200, 1,600, 2,000, 2,400 and 2,800 feet). Distance is measured as the street length from a street segment to a drinking place along the street network (Groff 2013). The author has always been interested in the relationship between different types of crimes and different types of facilities as generators of crime opportunities (Groff 2011; Groff and McCord 2011), following previous works by Roncek and Maier (1991), LaGrange (1999), Loukaitou-Sideris (1999), Newton (2004), Murray and Roncek (2008), Newton (2008), Yu (2011) and many others. In 2013, Groff published a study regarding how to measure these relationships using geoprocessing models better defining this area of scientific inquiry (Groff 2013). She implemented two different methods to measure the impact of the cumulative 'exposure' of drinking facilities to violent crime at street segments. Exposure measured as an inverse distance weighted count produces the best fitting

model and is significantly related to violent crime at longer distances than simple count (from 400 to 2,800 feet).

II.2 The Seattle Study and the law of crime concentrations

As already mentioned, in the light of the findings of Sherman et al. in 1989 and Weisburd et al. in 2004, Weisburd, Groff and Yang expanded the analysis of crime concentrations in the city of Seattle publishing in 2012 the *Criminology of place*. The study represents one of the most complete and updated longitudinal analysis at a street segment level. The authors used one of the longest time series available for studying the criminology of place (16 years) confirming the strong concentration of crime at micro units of geography and the stability of crime concentrations over time. Guided by their findings, Weisburd and his colleagues raise the question as to wheatear there is a sort of "law of crime concentrations" at places applicable not only across time but across cities.

II.2.1 The street segments grid

Previous literature has constructed the street segments grid relying on what are often defined as hundred blocks to approximate the geography of street segments (Weisburd et al. 2004; Groff, Weisburd, and Morris 2009; Weisburd, Morris, and Groff 2009). Following this approach, "the researchers assume that the actual streets of a city follow the overall rule that a street segment includes addresses ranging a hundred numbers, for example from 1-100, or 101-200" (Weisburd, Groff, and Yang 2012, 25). In efforts to update the Seattle study, Weisburd and his colleagues wanted the street segments grid to match as much as possible to the real street segments distribution among the city. They realized that hundred block ranges were "not always confined to a single street segment between two intersections, but sometimes spanned street segments" (Weisburd, Groff, and Yang 2012, 25). In this way, the risk is to construct a grid which does not match with the definition of street segment itself which is defined as both sides of the street between two intersections. To overcome this problem, the authors used a geographically-based file to create the street segments grid which permits to fit the street segments definition and the theory of street segments as behaviour-settings.

The street centreline file was obtained from Seattle GIS. The study only included in the analysis residential streets, arterial streets, and walkways/stairs connecting different streets.

The grid does not include: freeways and freeway ramps, transit streets, railroads, trails, and administrative street designations. A set of rules, used to formulate decisions, were taken to create the unit of analysis used throughout the entire study. These rules are summarised in the note number 10 at page 224 of the *Criminology on place*. Street segments intersections were created:

1) when a street crossed beyond Seattle city limits;
2) at a "T" intersection;
3) when street changed names or switched from public to private concomitant with a physical change of direction;
4) when street length would be over 2,400 feet, which is equal to 732 meters, except for private streets and park streets.

Around 64% of the street segments are between 200 and 600 feet, which are equal respectively to 61 and 183 meters, whereas less than 2% of the street segments are longer than 1,000 feet (305 meters). The average length is 387 feet (118 meters).

II.2.2 Crime incident data

Weisburd and his colleagues geocoded almost 1.7 million crime incidents in Seattle occurred between 1989 and 2004 linking these offences to 24,023 street segments. Incident computerised reports were recorded by the law enforcement agencies and represent "only those events reported to the police and deemed to be worthy of a crime report by the officers in charge" (Weisburd, Groff, and Yang 2012, 26). Incident reports are less inclusive than calls to the police, but more inclusive than arrest reports. The authors chose incidents data mainly because of data availability, even though this data represented a good measure of crime due to the probability that people are less likely to include false crime compared to calls to the police or misclassify events (Schneider and Wiersema 1990). In addition, to support their choices, they reported the results of a study conducted in 2007 by Cynthia Lum who compared crime incidents and crime calls in Seattle finding similar distributions across the city (Lum 2003).

This study examined only crime on street segments and not crime on intersections for a technical and a substantial reason. Technically, intersections are the junction of two or more streets and there is not a direct way to link a crime that happens in an intersection to a specific street. Substantially, the intersections usually record more traffic related crimes which

represent different types of crime compared to the ones registered in the streets. For this reason, intersections can be seen as different type of behaviour-settings then the streets segments (Weisburd, Groff, and Yang 2012, 26). The authors also excluded from the analysis crimes geocoded at a police precinct or a police headquarter. Indeed, Seattle Police Department usually records data at these addresses when no other address can be connected with the crime event. Moreover, they did not take into account crimes geocoded outside the city limits and at the University of Washington campus. In the latter case, the University of Washington Police Department began to collect their own data after 2001 which are no longer recorded by the Seattle Police Department. Regarding these data, "given the relatively small number of street segments involved, and the absence of data in the latter part of our time series, we decided to exclude these street segments [and their crime incidents] altogether" (Weisburd, Groff, and Yang 2012, n. 12, 224).

Among the 1,697,212 incidents geocoded the most common were property crime (52.2%) and disorder, drug and prostitution offences (14.4%). Person crimes recorded 10.7%, whereas other non-traffic related events 18.9% and traffic-related events 3.8%. A very small percentage stands for unknown incidents/events (0.02%).[18] Between 1989 and 2004, Seattle street segments experienced a 24% decline in the number of incidents, a crime drop similar to the decline experienced by the entire nation. In the 16-year period, 9.2% of the street segments (2,218) did not register a single crime incident, whereas the mean number of incidents per segment per year at street segments that had any crime was 4.42 (sd = 14.14) (Weisburd, Groff, and Yang 2012, 48–49).

II.2.3 A law of crime concentrations

The results of the Seattle study conducted in 2012 confirmed findings from previous studies and showed that "between 4.7% and 6.1% of street segments each year account for about 50% of crime incidents" (Weisburd, Groff, and Yang 2012, 49). These findings are slightly different from the ones reported in the prior study of 2004 where 4% to 5% of street segments accounted for 50% of the total offences. According to Weisburd and his colleagues, these differences primarily depend on the different definition of street segments and the

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[18] Property crime includes any form of theft, burglary and property destruction, whereas person crimes are homicide, any type of assault, rape, robbery and kidnapping. Among other non-traffic crime related events were identified weapon offences, violations, warrants, domestic disputes, missing persons, juvenile related, threats and alarms. Finally, traffic-related events include hit and run, drunk driving and accidents with injuries.

different construction of the grid they used in this study. As explained above (see II.2.1 The street segments grid), to build the new street segments grid they abandon the hundred blocks approach for a more geographically-based approach and they delete hundred blocks that were not seen as relevant for studying street segments as behaviour-settings (Weisburd, Groff, and Yang 2012, n. 4, 225).

The overall distribution of crime incidents are very similar year-to-year confirming a great stability among the 16-year period. All incidents are stable between 60% and 66% of segments every year, whereas 80% of the all offences around 20% of the total segments each year. These concentrations are consistent across the 16-year period whether calculated on the proportion of street segments that account for 50%, 80% and 100% of the crime incidents or whether took into account the average counts per year (Weisburd, Groff, and Yang 2012, 50). Weisburd and his colleagues considered these finding as particularly important because they found a regularity in crime concentrations among the years, despite a period of a substantial crime drop in the city of Seattle. This means that the overall crime has decline by more than 20%, but the concentrations of crime at place have remained constant over 16 years.

While crime counts has varied between 1989 and 2004 decreasing, respectively, from 121,869 to 93,324 incidents, the extent of crime concentrations remained stable. In the light of these considerations, "might this imply that there is a 'normal level' of crime concentrations across very micro units of geography?" (Weisburd, Groff, and Yang 2012, 50). This concept may be directly connected with Durkheim's proposition claiming that the level of crime is stable in societies, because each healthy society presents a normal level of crime (Durkheim 1895). According to the sociologist, indeed, crime is not an indicator of illness, but a way in which societies define and solidify their norms. Exponents of Durkheim's proposition later explained how societies simply draw the boundaries between acceptable and unacceptable behaviours by defining others as deviants. In this way, people can know which are the acceptable moral behaviours in contrast with people that are labelled as deviant and sanctioned because of their deplorable conducts (Becker 1963; Erikson 1966).

The crime drop experienced in the last decades by the United States (Blumstein and Wallman 2000) and more globally around the world (Farrel, Van Dijk, and Tseloni 2012)

seems to contradict Durkheim's proposition. Crime rates are globally decreasing and this would not confirm the normal level of crime theorised by the French sociologist. On the contrary, the results of Weisburd et al. 2012 seem to suggest that there is a sort of "normal level of crime" among cities. Durkheim's original proposition is here applied at concentrations of crime at places and not to the overall crime rate. Indeed, despite the decreasing in the crime trends, almost the same number of street segments produce the same proportion of crime in the 16-year period under study. In the light of these findings, Weisburd et al. called for a "law of crime concentrations" at micro places. Specifically, the authors asked themselves whether there is a law of crime concentrations at places applicable not only across time, as they found in Seattle, but across cities and whether this law would be stable over time also in other cities.

The importance of studying crime concentrations are multiple. First of all, investigate the laws regulating the deviant behaviour is interesting from a scientific and comparative prospective. Comparative criminology attends mainly to understanding criminal and deviant behaviour as it is manifested globally. The most important goals for this approach are extending theories beyond cultural and national boundaries, assessing the performance of national criminal justice systems and evaluating national criminal justice policy (Howard, Newman, and Pridemore 2000, 200). In line with these goals, the analysis of micro places can be useful to policy makers and law enforcement agencies to target specific preventive measures and to orient law enforcement activities. As demonstrated by Weisburd et al., bad neighbourhoods are not always all bad, because there is a very high street to street variability in the distribution of crime incidents. In addition, if crime is strongly concentrated at a small number of places and such concentrations are stable across the years, then these concentrations are also predictable and preventable (Weisburd, Groff, and Yang 2012, 10).

II.3 The Seattle Study and the explanation of crime concentrations

The main findings coming from the Seattle study conducted by Weisburd, Groff and Yang in 2012 were the confirmation of the crime concentrations within the city and the identification of a strong street to street variability in the distribution of crime incidents across the 16-year period under study. One of the major challenge of the study was explaining the reasons of this variability. Traditionally, the scholars of the criminology of place have mainly

explained crime hot spots at micro units of geography through the theoretical framework of the opportunity theories. Specific opportunities offered by specific situations in a specific environment play important roles in understanding the crime problem. Routine activity theory, situational crime prevention and crime pattern theory centred their theoretical approach on opportunities given by the environment to motivated offenders in order to commit crimes.

On the other hand, the study of crime at a higher level of geography has usually centred its analysis on the social characteristics of places reflecting an approach more generally associated with the social disorganization theory and the work of the Chicago School.[19] For a long time, the two theoretical frameworks have been seen as two opposing positions and scholars who study criminology of place have ignored social disorganization theories. This happened for two main reasons. First of all, the orientation for an analysis of micro units of geography came directly from opportunity theories, so it is more natural that scholars adopting a micro approach were more prone to find the explanations of crime at micro places in the multiple opportunities given by the environment. Second of all, studies on crime at place were originally born in contrast with previous theoretical frameworks and in opposition with the Chicago School and its approach mainly based on larger unit of geography. This dynamic, called "theoretical competition" by Bernard and Snipes (1996) and Bernard (2001), reflects the concept that each theory originally is in competition with the former theoretical frameworks because the new ideas usually developed from the lacks of the previous theories, which result unable to investigate certain aspects of the problem in question or fail to explain and solve it.

However, it is also possible to favour a more inclusive perspective and support the "theoretical integration" between different theories in order to better understand the crime problem. This approach has the benefit to be more comprehensive and to present different causes which can concur in the explanation of the crime event. Indeed, according to Bernard and Snipes (1996), often theories are different, but not contradictory in their predictions. Recently, some pieces have supported this theoretical integration combining the explanatory powers of both social disorganization and routine activity theories to explain robbery

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[19] For a more in depth analysis of social disorganization theory see Bursik (1988) and Sampson and Groves (1989).

occurrence in North American and European cities (Barker, Geraghty, and Webb 1993; W. R. Smith, Frazee, and Davison 2000; J. Smith 2003; Ceccato and Oberwittler 2008; Dugato 2013).

As suggested by the supporters of the theoretical integration of the criminological theories, Weisburd, Groff and Yang (2012) in their most recent study the *Criminology of Place* opt for using both opportunity and social disorganization theories to explain crime concentrations and crime variability in the city of Seattle. According to their view, street segments do not only represent physical entities within the city, but also small communities per-se. As it was previously mentioned, if street segments are considered as behaviour-settings, they share routines, norms, behaviours and roles in the daily life of the city (see II.1 Street segments as unit of analysis). "In this context, we can see street segments as 'micro communities' as well as 'micro places'. They have many of the traits of communities that have been seen as crucial to social disorganization theory, in that these physical units function also as social units with specific routines" (Weisburd, Groff, and Yang 2012, 45). Understanding street segments as micro communities will directly link social disorganization theory with the criminology of place giving the possibility to face the crime problem with a more comprehensive and complete approach.

In a recent article published by Braga and Clarke in 2014 this more comprehensive approach was partially criticised for four main reasons. According to the authors, the work of Weisburd and his colleagues used a limited range of variables associated with situational opportunities, it needed to improve measures of social disorganization and collective efficacy, it needed to determine the proper theoretical domain of collective efficacy and finally it needed to determine whether collective efficacy can be increased at the street level. Braga and Clarke conclude emphasising the great work conducted by Weisburd, Groff and Yang (2012) and considering their study "an important step in criminological research […] that will inspire new theory-based empirical research in this area" (Braga and Clarke 2014, 483). But they also called for the necessity of an "appropriate data collection systems and measurements [able] to capture the characteristics and dynamics of small areas such as street segments and intersections" (Braga and Clarke 2014, 492). According to the available empirical data the opportunity theories seem to play a much more central role in explaining the dynamics at

street segments rather than social disorganization variables. Nevertheless, the findings of Weisburd, Groff and Yang (2012) open new possibilities for a theoretical integration between opportunity and social disorganization theories "developing a new and potentially powerful research agenda" (Braga and Clarke 2014, 493). This is why, according to Braga and Clarke, it is particularly important to better shape and define this theoretical integration and improve data collection of a large range of opportunity and social disorganization variables to explore as many aspects as possible that might be implicated in crime explanations at street segment level.

In the same issue of the *Journal of Research in Crime and Delinquency* where Braga and Clarke published their article, Weisburd, Groff, and Yang (2014) published a piece called "The Importance of Both Opportunity and Social Disorganization Theory in a Future Research Agenda to Advance Criminological Theory and Crime Prevention at Places". In this article, they stressed the important findings of their work *Criminology of Place* and they answered to the critiques raised by the colleagues pointing out again the importance of a theoretical integration. They explained how streets cannot be seen only as physical units, but they also must be understood as social units in the moment in which there are residents who live the streets, people who move around the streets, and mechanism of mutual trust, routines, acceptance of moral behaviour, informal control are connected with these micro units of geography. The authors agreed wholeheartedly with the need of more and better data expressed by Braga and Clarke in their piece. Moreover, they agreed also with the fact that they were not able to measure all the aspects of opportunity and social disorganization in the city of Seattle. Both Braga and Clarke stated, "although our data are the most exhaustive available for examining crime trend at the street segment level, we could not measure directly some key dimensions of either opportunity or social disorganization. Like any study that explores new territory, our work is necessarily a first step." (Weisburd, Groff, and Yang 2014, 502).

Taking into account the work of Weisburd, Groff and Yang (2012), the critiques moved by Braga and Clarke (2014) and the subsequent answer to those critiques elaborated by Weisburd, Groff and Yang (2014), the next paragraphs will describe which are the

opportunity and social disorganization variables used to explain crime concentrations and crime variability in Seattle.

II.3.1 Opportunity Theory

Opportunity theories mainly concern situational prevention (Clarke 1980; Clarke 1992), routine activity theory (Cohen and Felson 1979) and environmental criminology (P. L. Brantingham and Brantingham 1981a). All of them place a great emphasis on the role of situation and context in providing opportunities for crime. In the Seattle study, the operationalization of these theories in usable variables was conducted taking into account the difficulties in collecting longitudinal data at street segments. According to the authors, "identifying retrospective longitudinal data on crime opportunities represented a major challenge for our study, as did the identification of measures of social disorganization" at very small unit of geography such as street segments (Weisburd, Groff, and Yang 2012, 91). They continue by stating "this meant we had to draw information for our study from available data sources, collected often for reasons having little to do with crime or crime theory, that reflected as best as possible the concepts and perspectives that inform our work" (Weisburd, Groff, and Yang 2012, 91).

Based on the opportunity theory, the authors included in the study data on sixteen characteristics for each street segment which were aggregated in ten final characteristics. These variables represent proxies of different key aspects of the theory: motivated offenders, suitable targets, informal guardians and accessibility to places. The operationalization of these concepts was briefly summarized as follows:

- Motivated offenders:

  "High Risk Juveniles" were identified as a good proxy for motivated offenders. Data on the total number of public school students with ten or more unexcused absences and/or flagged as low academic achievers were collected at street segment level.

- Suitable targets:

  "Employment", which stands for the number of employees at businesses located on the street segments, is the first proxy identified for the category suitable targets. *"Residents"*, which is a composite variable that combines the total number of public school students and the total number of registered voters in a street segments,

represent the second proxy for suitable targets. *"Public facility-related crime generators and attractors"* is the third measure of suitable targets. In Seattle, this measure included the average number of community centres, hospitals, libraries, parks, and middle and high schools present within 1,320 feet (403 metres) from each street segment. The authors decided for this operationalization because of the small number of facilities at each specific street segment and because previous research proved that the influence of facilities is widespread also in the adjacent areas (Knutsson 1997; LaGrange 1999; Groff and McCord 2011). *"Business-related crime generators and attractors"* is the last measure of opportunities and it includes the total retail business sales on the street segment. Data on retail sales were available only for 4 years out of 16 years. This variable was included in the analysis because "people who shop at stores may have money when they enter or goods that can be stolen when they leave. In turn, businesses themselves are often attractive targets for offenders" (Weisburd, Groff, and Yang 2012, 103).

- Guardianship:

  "Fire and Police stations" is one of the measures of guardianships chosen by the authors in their analysis, whereas *"Vacant land"* is the second variable that expresses a low level of guardianship. In conclusion, *"Street lighting"* has often been associated with lower level of crime. Indeed, well-lighted areas are more likely to experience less crime events compared to dark areas.

- Accessibility:

   "Street type" is the first measure of accessibility. In the Seattle study, the streets were divided between arterial, which carry larger volumes of traffic, and residential, which are smaller and less congested. *"Bus stops"* are often used as a measure of public transport accessibility and several studies have studied their effects on criminal behaviour (LaGrange 1999; Loukaitou-Sideris 1999; Yu 2011).

The majority of the variables representing proxies for opportunity theories are strongly concentrated at a very low geographic level. Indeed, in the city of Seattle, the spatial analysis identified not only hot spots of criminality, but also hot spots of crime opportunities.

II.3.2 Social Disorganization Theory

As it has been previously mentioned, social disorganization theories are usually associated with the study of crime at city, neighbourhood, or community level. These theories were born with the Chicago School that wanted to understand how social factors and social structure could influence crime events. Poverty and socio-economic status, racial heterogeneity, collective efficacy, formal and informal control, and mechanisms of trust were tested in relation to crime. Since the Chicago School was particularly interested in neighbourhoods and communities, these studies are mainly focused on these levels of disaggregation. On the contrary, the criminology of place is oriented on much more smaller units of geography and has never applied social disorganization theories to micro units and street segments.[20]

The Seattle study represents one of the first attempts to integrate the criminology of place and social disorganization theories. A set of variables were took into account as proxies of social disorganization dynamics. The variables were divided between structural and intermediating factors. The structural factors included "structural characteristics of neighbourhoods and communities [that] were seen as key element[s] in the production of crime" (Weisburd, Groff, and Yang 2012, 120). Intermediating factors "link the structural factors and outcome variables like crime. These mediating factors reflect more generally the degree to which people who live in communities can exercise social control over the behaviour of residents and visitors" (Weisburd, Groff, and Yang 2012, 137). The variables chose to express these factors are:

- Structural factors:

   "Socioeconomic status" represents one of the most classic and traditional variables explaining structural factors within a city. Shaw and McKay (1942) used socioeconomic conditions to measure disadvantages, resources, capabilities of the residents to protect their community and willingness to move. In the Seattle study, socioeconomic status was measured using the average property values of housing on each street segments. Data were collected for 6 years out of 16 years.

   A composite measure were took into account to include in the analysis *"Housing assistance"* and a dichotomous variable identified streets that present a *"Mixed land*

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[20] Weisburd, Groff and Yang (2012) identified some exceptions to this statement represented by Perkins et al. (1990); Kurtz, Koons, and Taylor (1998); W. R. Smith, Frazee, and Davison (2000) and Rice and Smith (2002).

use". According to different scholars, land use can be directly correlated with the strength of social control and it is an important measure of the presence of a community. *"Racial Heterogeneity"* represents one of the most traditional measure of social disorganization. Indeed, "an area with a more heterogeneous racial composition is in this perspective likely to be considered less cohesive and has lower levels of community social control" (Weisburd, Groff, and Yang 2012, 128). *"Distance to the city center – Urbanization"* represents a key element starting from the first theorization of Burgess's concentric zone model (Burgess 1925). Central and peripheral areas of the city can experience different patterns in the distribution of socioeconomic conditions. This can impact crime. *"Physical disorder"* is a variable connected with the likelihood of a degraded place to experience higher levels of crime. This concept is directly coming from the idea that disorganized place including litter, broken windows, abandoned buildings and other forms of physical disorder are more prone to experience crime (Shaw and McKay 1942; Kelling and Wilson 1982; Perkins et al. 1990; Skogan 1990).

- Intermediating factors:

"Informal social control" is a concept operationalized by Weisburd, Groff and Yang as the total number of unsupervised teens calculated on the total number of public school students with 10 or more unexcused absences. According to the authors, this variable was used as mediating factor for the first time by Sampson and Groves (1989), who stated that communities that are not able to control their teenage groups will experience higher levels of delinquency.

II.3.3 Most important findings and limitations

The study conducted by Weisburd, Groff and Yang (2012) produced extremely interesting results that gave new insights to the criminology of place. First of all, it is based on one of the most complete longitudinal data collection that has never been collected for studies of crime at place. "Our data go beyond prior studies by not only identifying strong concentrations of crime at micro levels of geography, but also identifying a stability of crime at place over a long time series" (Weisburd, Groff, and Yang 2012, 168).[21] Through the longitudinal analysis

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[21] This concept was expressed also in Weisburd et al. (2004).

of crime using group-based trajectories the authors found the presence of eight types of street segments in Seattle:

1) Crime free

2) Low stable

3) Low decreasing

4) Low increasing

5) Moderate stable

6) High Decreasing

7) High Increasing

8) High chronic

Despite the support to the law of crime concentrations, the analysis also suggested that there is a tremendous street by street variability in developmental patterns of crime at street segments in the city. This variability is stable over time as well as the eight different crime patterns are stable over time. Descriptive maps on the distribution of crime across the street network showed crime hot spots across the entire city as well as the high chronic crime hot spots seemed to be widespread around the city. High chronic segments can be adjacent to a group of crime free segments and on the other hand low stable segments can be close to high increasing segments. The analysis showed how large geographic areas present a degree of spatial heterogeneity of crime that would be missed without exploring what is happening at a smaller level. This concept reinforced the idea that it is necessary to look also at micro units of geography otherwise scientific knowledge will miss great discoveries. The authors used multivariate statistical methods to assess which were the opportunity and social disorganization variables directly related to the different crime patterns defined through the group-based trajectory analysis. "Multivariate statistical analyses allow us to include multiple measures (or independent variables) in a single model of crime patterns. Our independent variables in this model are the opportunity and social disorganization measures" (Weisburd, Groff, and Yang 2012, 147–148). The dependent variable is represented by the eight trajectory crime patterns identified above. Number of employees and number of residents, both measures of suitable targets, are the single variables having the most important effects in the model. More in general, "a large array of opportunity and social disorganization measures influence the likelihood of street segment being in the chronic-crime pattern as contrasted with the crime-free patter" (Weisburd, Groff, and Yang 2012, 160).

The main limitation of this study is the impossibility to collect several measures at street segment level. Indeed, many of the measures that were presented in the analysis represent proxies for variables that the authors would have liked to collect but they were impossible to be found. The second main limitation is that the study does not examine crime trends within the years and does not take into account seasonality.

II.4 Testing the presence of crime concentrations outside the US

Different cities among the United States, such as Boston, Minneapolis and New York, present the same crime concentrations as it was recorded in Seattle (Pierce, Spaar, and Briggs 1988; Sherman, Gartin, and Buerger 1989; Braga, Papachristos, and Hureau 2010; Weisburd, Telep, and Lawton 2013). However, what is considerably more interesting is that similar patterns were also found in the city of Rotterdam in the Netherlands (van Wilsem 2009) and in Tel Aviv-Jaffa in Israel (Weisburd and Amram 2014).

Weisburd and Amram published in 2014 a study that confirmed the presence of a law of crime concentrations in Tel Aviv-Jaffa pointing out how in the Israeli city about 4.5% of the street segments produced approximately 50% of crime. They included in the analysis 39,392 crime incidents occurred in the city in 2010 which represent nearly 91% of the total incidents experienced by the city in that year. They defined 17,160 valid street segments with an average length of 220 feet (62 meters), whereas the majority of the street segments (75%) between 131 and 220 feet (50-67 meters). Reinforcing previous theories, this study found that 25% of the incidents registered in the city occurred in 0.9% of the street segments, whereas 100% of the offences in 36.8% of the segments. In addition to this data concerning Tel Aviv-Jaffa, the majority of the street segments that were taken into account have little or no crime. The study strongly supports the law of crime concentrations and it also suggests a street by street variability in the city. This variability is tested describing hot spot areas in the city using the counts of crime incidents of each street segment in 2010. This was not a longitudinal group-based trajectory analysis, as Weisburd and his colleagues did for the Seattle study, but it shows that in different areas, and in different neighbourhoods, there are street segments with a high number of crime events and other streets that did not record a single offence in the entire year.

The study pointed out how "even in the best neighbourhoods in Tel Aviv-Jaffa, there are crime hot spots" and the contrary, "in neighbourhoods that are often seen as problematic, most streets have little or no crime" (Weisburd and Amram 2014, 9). According to the authors, "the consistency of crime concentrations at micro places in Tel Aviv-Jaffa and American cities suggests that there is some underlying social process pushing crime to certain levels of concentration in modern cities" (Weisburd and Amram 2014, 10). This study critically places itself in the branch or research that follows the idea that a normal level of crime concentration in urban cities may be considered as possible. Perhaps, this normal level of crime may be due to the normal concentrations of other social activities and the theory of the normal level of crime can be extended to a more general stability of concentrations of specific aspects of social and economic life in the city. Surely, it is remarkable that "cities thousands of miles apart from each other, with very different populations and social norms, have virtually identical crime concentrations at micro places" (Weisburd and Amram 2014, 11). This evidence gives strong reasons to continue orienting the research in understanding the presence of crime concentrations.

This common pattern should be studied across other metropolitan cities to further test whether the results can be confirmed or discarded. As of now, the theory has been tested in the U.S. and in Israel, even though the study in Tel Aviv-Jaffa only lasted for a year. Regarding this topic, the lack of literature that involves Europe is enormous. As it was mentioned previously, Europe was the centre of the geographical approach in criminology from the nineteenth century to the beginning of the twentieth century. Then, the focus switched to the United States with the growing of the emerging Chicago School. Recently, a micro level approach to the crime problem has also developed in the European context. Especially through the work of the UCL Jill Dando Institute of Security and Crime Science based in London and the Netherlands Institute for the Study of Crime and Law Enforcement (NSCR) based in Amsterdam the environmental approach has been widespread in the north part of Europe. Many studies tested the opportunity theories and the situational crime prevention, and many scholars such as, just to mentioned a few, Paul Ekblom, Graham Farrell, Ron Clarke, Richard Wortley, Gerben Bruinsma and Wim Bernasco put their efforts in studying crime at place. Nevertheless, to the author's knowledge, there is only a study that

analysed crime at street segments in Europe. This study analysed a sample of 600 violent incidents and more than 200 streets in three neighbourhoods of Rotterdam in the Netherlands.

According to van Wilsem, the author of the study, his work represents the first "street-oriented study on the qualitative aspects of violence" (van Wilsem 2009). In this way the study distances itself from the quantitative approach developed in the US on street segments, but at the same time it seems to present similar findings. Indeed, 40% of all recorded violence takes place in 4% of the streets under scrutiny. For street robbery, the concentration of incidents is even higher, with 3% of the streets having 48% of all incidents, and 75% of the streets having no robberies at all (van Wilsem 2009, 208). The data collection of this study, even though the sample includes only three neighbourhoods and 200 selected streets, offer the opportunity to test the law of crime concentrations in a different context and to examine within-neighbourhood differences. As already mentioned, the author in accordance with Hipp (2007) stated that "street-level analysis also offers insight into crime variations that are lost when they are aggregated to the neighbourhood level" (van Wilsem 2009, 201).

II.5 Conclusions and research problem

The criminology of place was born in the United States in answer to the necessity of analysing the crime problem at a smaller level of geography providing a better understanding of the phenomenon. A pioneering study published by Sherman, Gartin, and Buerger found that 50% of all calls to the police in Minneapolis were registered in only about 3.5% of the total street segments of the city (Sherman, Gartin, and Buerger 1989). The authors considered these findings as particularly ground-breaking and they called for a new area of scientific inquiry named 'criminology of place'. These new ideas reintroduced in the criminological debate the importance of using appropriate units of geography in studying crime at place. This issue was already discussed many times in the previous centuries (Mayhew 1850; Glyde 1856), but also more recently (Oberwittler and Wikström 2009; Weisburd, Bruinsma, and Bernasco 2009). The attention to the level of aggregation or disaggregation led scholars belonging to the criminology of place to choose much smaller units of analysis for their studies. The evolutions in the field of GIS technology and the application of these technologies in the criminological research made possible the development of studies on crime and place at micro level.

To examine crime trends and crime patterns, the criminologists of place started to use a new unit of analysis: the street segment. According to several scholars, the street segment represents an important "behaviour-setting" and an appropriate unit of analysis (Appleyard 1981; Taylor 1997; Weisburd, Morris, and Groff 2009; Weisburd, Groff, and Yang 2012). Studies on street segments underline a regular concentration of crime among the street network. Different US cities present almost the same percentage of crime concentrated in the same percentage of the street segments around the city. In the light of these findings, Weisburd et al. called for a sort of "law of crime concentrations" at micro places. Specifically, the authors asked themselves whether there is a law of crime concentrations at places applicable not only across time, as they found in Seattle, but across cities and whether this law would be stable over time also in other cities. In addition, what is maybe more interesting is that similar patterns were found in the city of Rotterdam in the Netherlands (van Wilsem 2009) and in Tel Aviv-Jaffa in Israel (Weisburd and Amram 2014). To test the stability of these crime concentrations across years, scholars have been using the group-based trajectory analysis developed by Nagin (Nagin and Land 1993; Nagin 1999; Nagin 2010). Especially in the Seattle study, published in 2004 by Weisburd et al. and then extended in 2012 by Weisburd, Groff and Yang, the group-based trajectory analysis showed a tremendous stability of crime in the street fabric of the city. This means that, over time, high chronic street segments tend to remain the same and they are often surrounded by crime-free street segments. In support of the statement that bad neighbourhoods are not all bad, criminologists of place are in favour of micro units of geography to be able to intercept the anomalous behaviours in both bad and good neighbourhoods in the city. They also conclude that opportunity and social disorganization variables at street level are very important in understanding patterns and dynamics of crime events.

Starting from this theoretical framework, which is directly connected with the most important opportunity theories such as situational crime prevention, routine activity and crime pattern theory, the present study aims at extending the existing literature testing the presence of crime concentrations outside the United States. Indeed, a lack of knowledge on this topic involves the European context as well as other parts of the world. Studies on street segments testing crime concentrations are several in the United States. In addition, a recent study tested

the same patterns also in Tel Aviv-Jaffa, Israel (Weisburd and Amram 2014). To the knowledge of the author, the only European study on streets and crime concentration was published by van Wilsem in 2009. It represents a qualitative analysis of violent crime at street level taking into account a limited sample of 600 streets within three neighbourhoods of Rotterdam, the Netherlands. No research has been conducted taking into account the entire street network of a city yet concerning an increase of crime incidents (i.e. property crimes) from a quantitative approach.

Weisburd, Groff and Yang (2012) asked themselves whether there is a "normal level" of crime at micro units of geography. They transposed on street segments the classic Durkheim's proposition claiming that the level of crime is stable in societies, because each healthy society presents a normal level of crime (Durkheim 1895). They argued that crime trends are not stable over time, as Durkheim suggested, but crime concentrations at very small units of geography may be. Crime is recently dropping in many parts of the world (Blumstein and Wallman 2000; Alvazzi del Frate and Mugellini 2012; Farrel, Van Dijk, and Tseloni 2012), whereas, according to the most recent studies, the same percentage of crime is concentrated in the same percentage of street segments in different cities (Sherman, Gartin, and Buerger 1989; Braga, Papachristos, and Hureau 2010; Weisburd, Groff, and Yang 2012; Weisburd, Telep, and Lawton 2013; Weisburd and Amram 2014). This assumption has recently been made and more research is needed to scientifically support this thesis. Weisburd, Groff and Yang in their *The Criminology of Place* called for the need of more information on these concentrations of crime in different cities, belonging to different contexts.

Compared to the United States, Europe is extremely different in terms of definition and use of spaces, street network and life-style. This is the interesting part of this study. Testing the theory in a completely different context can give new insights to the criminology of place, underline different findings, or simply confirm crime concentrations in Europe. From a comparative point of view, the differences of the two contexts are both in terms of urban conformation and city life organization. The importance of studying crime concentrations are multiple. First of all, investigate the laws regulating the deviant behaviour is interesting from a scientific, comparative perspective and in finding efficient preventive measures to contrast the crime problem. Adopting a comparative approach between different context and export

theories beyond the origin territories mainly attend to understand criminal and deviant behaviour as it is manifested globally and inevitably yield useful insights about the control of deviant behaviours. The most important goals of this approach are extending theories beyond cultural and national boundaries, assessing the performance of national criminal justice systems and evaluating national criminal justice policy (Howard, Newman, and Pridemore 2000). In line with these goals, the analysis of micro places can be useful to policy makers and law enforcement agencies in understanding the criticisms connected with their cities. Indeed, as demonstrated, bad neighbourhoods are not always all bad and it is necessary to better targeting the preventive measures in order to increase their effectiveness.

According to the previous literature review, this work arises two main questions in order to extend the knowledge on the criminology of place:

Question 1: Is the presence of crime concentrations confirmed outside the U.S.? If yes, are crime concentrations stable over time?

Question 2: Do opportunity theory and social disorganization theory play a central role in explaining crime concentrations outside the U.S.?

The overall aim of the study is testing the law of crime concentrations outside the U.S. and understanding if opportunity and social disorganization theories are playing a central role in the explanations of crime concentrations. This aim can be divided in two specific objectives:

Objective 1: Testing the presence of crime concentrations outside the U.S. and the stability of these concentrations

Objective 2: Testing the effect of opportunity theory and social disorganization theory in explaining crime concentrations outside the U.S.

On the basis of the review of the current knowledge on the criminology of place, the law of crime concentrations and more in general the analysis of dynamics of crime at place, two working hypotheses can be developed:

Hypothesis 1: Crime concentrations are supposed to be identified at street segment level also outside the U.S. and this concentrations are supposed to be stable over time

As demonstrated by studies in Boston, Minneapolis, Seattle and New York, 50% of crime events are concentrated in about 3% to 6% of the street segments (Sherman, Gartin, and

Buerger 1989; Weisburd et al. 2004; Braga, Papachristos, and Hureau 2010; Weisburd, Groff, and Yang 2012; Weisburd, Telep, and Lawton 2013). These findings were also confirmed by a study conducted in Tel Aviv-Jaffa (Israel) (Weisburd and Amram 2014) and a qualitative analysis of violence in the streets of Rotterdam (the Netherlands) (van Wilsem 2009). This may suggest that also in Europe the quantitative analysis of crime concentrations in the cities may produce similar results. In addition, the results of the few studies on spatial distribution of crime conducted in some European cities underline the presence of temporal and spatial hot spots among European cities. Ceccato, Haining and Signoretta (2002) investigated offence statistics in Stockholm (Sweden) using spatial analysis tools. Ceccato and Oberwittler (2008) identified spatial patterns for robbery in Cologne (Germany) and Tallinn (Estonia), as well as Dugato (2013) in Milan (Italy). Later, Ceccato (2009) extended her analysis on Tallinn analysing other crime types and Uittenbogaard and Ceccato (2012) updated the analysis on Stockholm. None of these studies focus on micro units of geography such as street segments, but it can be assumed that as crime concentrates in hot spots in European cities, as well it can concentrated at street segment level.

Hypothesis 2: Both opportunity and social disorganization theories are supposed to play a central role in explaining crime concentrations outside the U.S.

Recently, studies have tried to combine opportunity and social disorganization theories in a perspective of theoretical integration (W. R. Smith, Frazee, and Davison 2000; Rice and Smith 2002; Weisburd, Groff, and Yang 2012; Weisburd, Groff, and Yang 2014). A few of them have also involved European cities (Ceccato and Oberwittler 2008; Uittenbogaard and Ceccato 2012; Dugato 2014). Both opportunity and social disorganization factors seem to play an important role as determinants of crime at street segment level. For the purpose of the present study, this analysis follows the recent stand of research and hypothesizes that both situational and social factors contribute to the explanation of spatial distribution of crime in the city of Milan, which is the city taken into account from present work.

CHAPTER III. Data and Methodology

The first objective of this analysis is testing the presence of crime concentrations outside the U.S. context. According to the findings of prior research, this study hypnotizes that a certain law of crime concentrations may be also confirmed in the European context. In addition, it also assumes a certain stability of these concentrations over time. These hypothesis are tested through a street segments analysis in the city of Milan and a preliminary analysis of burglary and robbery distribution over the years. According to the author's knowledge, the quantitative street segments analysis presented in this study represents the first attempt to conduct a quantitative micro level analysis at street level in Italy and more in general in Europe. Indeed, the only piece of research taking into account streets and violent crime in Rotterdam was a qualitative analysis focuses only in certain neighbourhoods of the city (van Wilsem 2009).

The second objective is testing the effect of opportunity and social disorganization theories in explaining crime concentrations. The study supposes that both these theories may have an impact in explaining crime patterns outside the U.S. and especially in Europe. Since the analysis is focused on the city of Milan, as a reliable example of European city, a set of negative binomial regression models were conducted analysing crime concentrations at street segments and opportunity and social disorganization variables in this city.

This chapter presents in the following paragraphs the data and the different methodologies used to analyse the first and the second objectives of this study in order to answer to the main questions established in the previous chapter (see II.5 Conclusions and research problem).

III.1 Objective 1: testing the presence of crime concentrations and its stability

Prior studies on street segments and crime concentrations focused on U.S. cities and were replicated in Tel Aviv-Jaffa, Israel, a new city that also presents a street grid model very similar to the U.S. one (Weisburd and Amram 2014, 5). Street segments analysis and, more in general, studies on micro units of geography strongly depend on the structural and social characteristics of urban areas. The added value of a study conducted in Milan, a European city, is surely a complete opposite of an urban setting compared to Tel Aviv-Jaffa and the U.S. cities giving the possibility to test the same theory in a different context. It is well documented how U.S. cities with their "grid urban model" are very different from the

concentric European urban centres (Le Galès 2002; Vicari Haddock 2004; Häussermann 2005; Martens 2006). The great dissimilarities between these different contexts are in terms of "city life organization, residential mobility, functional diversion of urban space, and social-ethnical composition of the city. […] European cities are usually less extended and populated than the US ones but much more densely inhabited. Moreover, the shape of most of them evolves irregularly and gradually since the middle ages" (Dugato 2013, 65). The irregularity of the structure of the European cities and especially the "dense system of narrow streets with only few long and wide roads" (Dugato 2013, 65) it is what is particularly interesting for the analysis proposed by this study.

Milan presents a perfect fitting example of European city. It presents the typical concentric urban structure sharing the same characteristics with other European cities such as Prague, Paris, London, Berlin, Wien and Zurich. Their city-centres converge in the centre of the city itself and are surrounded by a dense and irregular streets network. The impossibility of collecting geocoded data for different cities in Europe forced the author to focus on a specific city in a specific context. The availability of data for the city of Milan was possible because of the collaboration between Transcrime - Joint Research Centre of Transnational Crime and the Servizio Analisi Criminale of the Italian Ministry of Interior for the project "Progetto sperimentale per la costruzione e analisi degli hot spot della criminalità nel comune di Milano".[22] This set of data represents a unique opportunity to study micro dynamics of crime in Italy and to improve the knowledge about the law of crime concentrations outside the United States and Israel.

In 2013, a study published by Dugato increased the knowledge on comparative studies applying and validating the Risk Terrain Modeling (RTM) in the European context.[23] Before this study, the RTM methodology to analyse urban risk factors in order to forecast future crimes has only been tested in U.S. cities. Nevertheless, the author took into account the city of Milan to test "whether RTM is flexible enough to be effectively exported and applied in a different urban environment outside the U.S." (Dugato 2013, 66). The choice of Milan was driven by data availability, but also because the city present "most of the distinctiveness of the

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[22] "Experimental project for the construction and analysis of crime hot spots in the Municipality of Milan".
[23] For an in-depth analysis of the Risk Terrain Modeling technique to forecast future crime events see Caplan and Kennedy 2010; Caplan and Kennedy 2011; Caplan, Kennedy, and Miller 2011.

European urban model […] characterized by a limited urban sprawl and a high population density" (Dugato 2013, 66). In line with this previous piece, the present study want to experiment the same comparative approach and implement a street segments analysis in order to understand crime concentrations in Milan.

III.1.1 The city of Milan

The city of Milan is located in the North part of Italy, in the region of Lombardy (Figure 2). Milan is the second most populated urban centre in Italy after the capital, Rome. According to the most updated census data of the Municipality of Milan the city counted 1,366,409 citizens in 2012 of which 52% are female and 48% male. With a surface of 181.76 km2, the city present a very high population density (7,404.76 inhabitants/km2) compared to the American cities, but an equal population density if compared to Tel Aviv-Jaffa.

Figure 2. Geographical location of the city of Milan

Source: author's elaboration

As it is shown in Figure 3, the structure of the city is concentric and regular. It represents the typical European city, with mono-centric radial structure characterized by a dense and

irregular street network (Comune di Milano 2001; Dugato 2013). The city has the typical medieval structure. Indeed, it was initially a smaller urban conglomerate surrounded by big fortified wall and then it started to expand itself absorbing close villages and towns. The streets are small and very close to each other since they were originally conceived as walking passages.

Today, Milan is divided in 9 big zones and in 88 NIL (Nuclei d'Identità Locali), which correspond to urban neighbourhoods (Figure 3). The central neighbourhood is "Duomo" where the big cathedral and "Duomo square" are located. Two circular rings, which are two big circular roads one closer to the city centre and another one more peripheral, run around the city dividing the Milanese territory in three idealistic concentric zones. The city is well-served by any kind of public transport. Underground stations, railway stations, busses and trailers cover almost the entire territory of the city with the widespread ramification of their lines. Four big highways connect the city with the Nord-east (A4), South (A1), South-west (A7) and North-west (A8) of Italy. The presence of an organized and well-developed public transport network and a set of highways can facilitate the entrance in the city and the movements across the city influencing crime patterns in the city itself.

Figure 3. The structure of the city of Milan and its 88 neighbourhoods
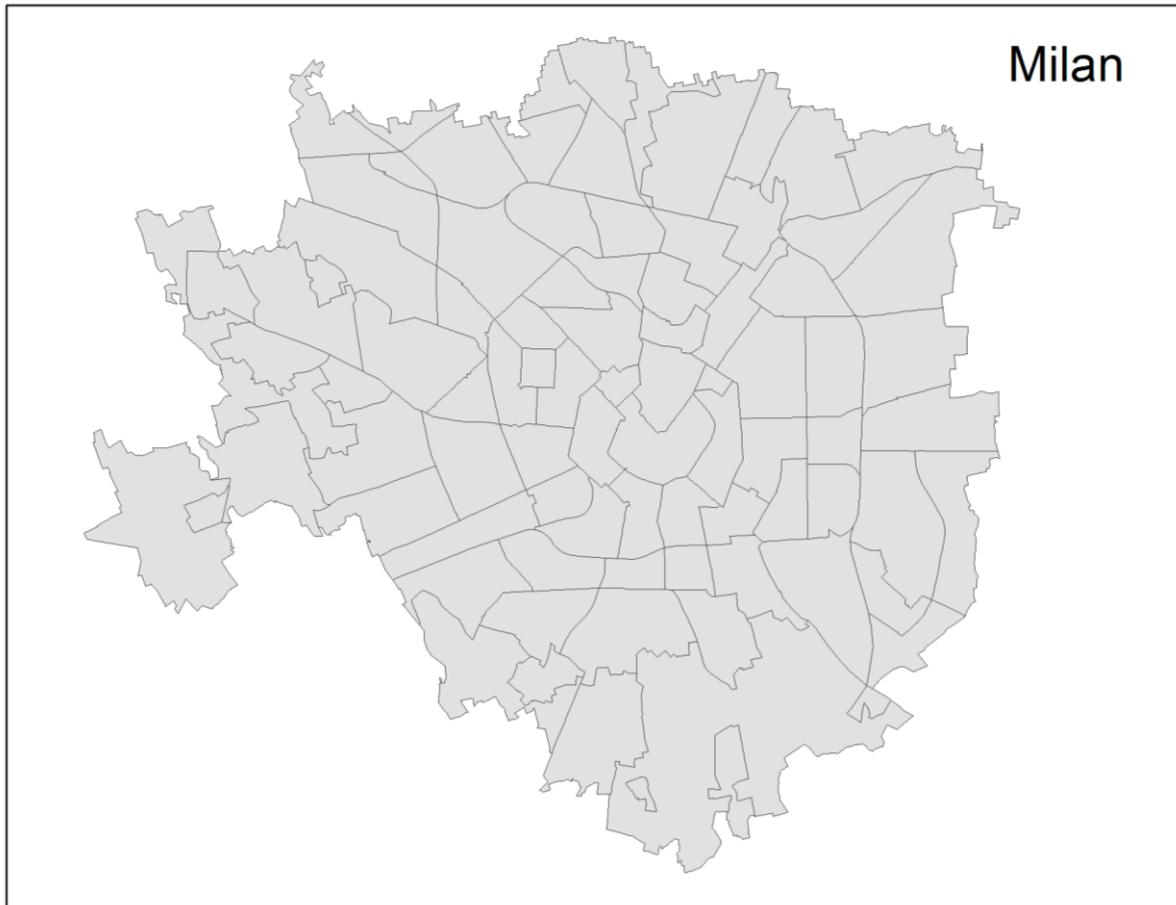
Source: author's elaboration of Municipality of Milan's data

Among the total population, 19.1% (261,412) represents foreign citizens. Foreign population is increasing since 2010 (+20.3%), as well as the total population (+3.3%). According to the official data of 2012, the Philippine community is the most present in the city followed by the Egyptian one. They respectively represent 15.2% and 13.8% of the total number of foreign citizens. Chinese and Peruvian are also heavily present in the Milanese territory representing 9.2% and 8.1% of the total foreign citizens (Comune di Milano 2012). According to Dugato (2013), "Milan has a low spatial segregation of well-off and disadvantaged people". This means that neighbourhoods present very heterogenic compositions and variability in the distribution of socio-economic conditions.

Milan is particularly rich and expensive compared to other Italian cities. It is the biggest industrial city of Italy with many different industrial sectors and it is famous for attracting designers, artists and photographers from all over the world. On average, the total monthly

expenditure of a household in 2012 was around 3,078 euros. Among the total expenditure, the highest costs were represented by the rent, the expenditures more in general connected with the house and food goods. These costs account, respectively, for 21.2%, 14.4% and 14.1% of the total expenditure per month (Comune di Milano 2012). Public transport represents another important category. In 2012, Milanese families have spent around 9.9% of their total expenditure in transportation.

Despite Milan is considered a very rich city, full of businesses and work possibilities, the unemployment rate is increasing since 2006. The occurrence of the economic crisis also played a key part in this industrial capital and the economy has been affected from an increasing unemployment level. The data on economic indicators were collected through the Municipality of Milan, but they come from the representative survey conducted by the Italian National Statistical Office, ISTAT, every three months. The survey, called "Rilevazione continua sulle forze di lavoro (RCFL)", shows how the unemployment rate has increased of 1.3% from 2010 to 2012 in the city of Milan (Figure 4). Indeed, 7.1% of the total population between 15 and 64 years was unemployed in 2012. Nevertheless, this percentage is still lower if compared to the unemployment rate of the region Lombardy (7.6%) and of the Italian national average (10.8%). Despite the increasing level of unemployment in the city of Milan, data in Figure 4 shows also how the employment rate seems to remain quite stable across the years. The rate registers a percentage of 69.2% in 2010 which slightly increased to 69.8% in 2012. If the employment rate remains stable, but the unemployment rate rises it means that a number of people that were considered inactive before, for example students, become active but without being able to find an occupation.

Figure 4. Employment and unemployment rate in Milan, 2004-2012. Population 15-64
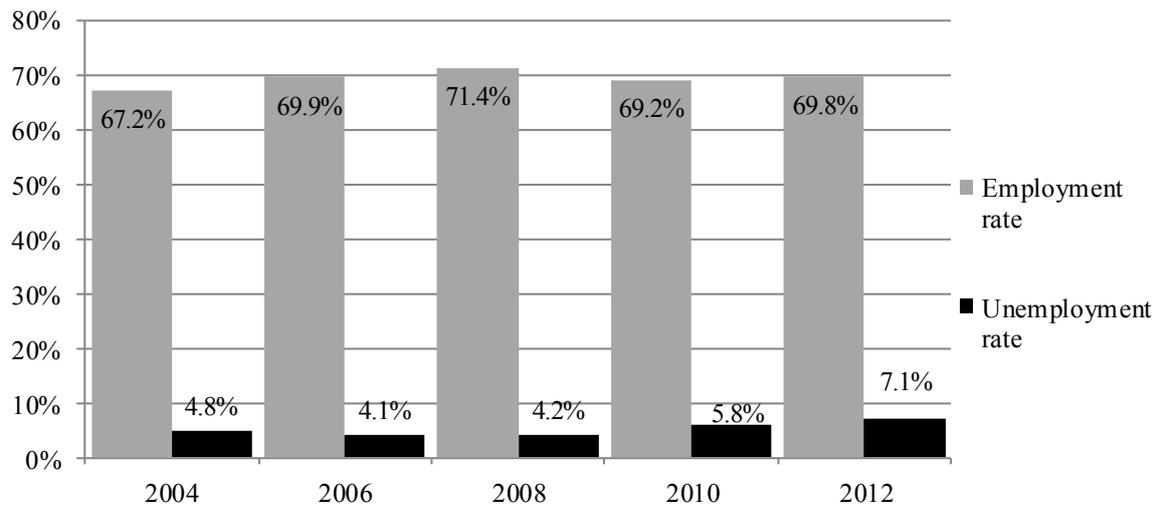
Source: author's elaboration of Municipality of Milan's data

This hypothesis can be confirmed if looking at the juvenile unemployment rate trend synthetises in Figure 5.

Figure 5. Juvenile unemployment rate in Milan, 2004-2012. Population 15-24
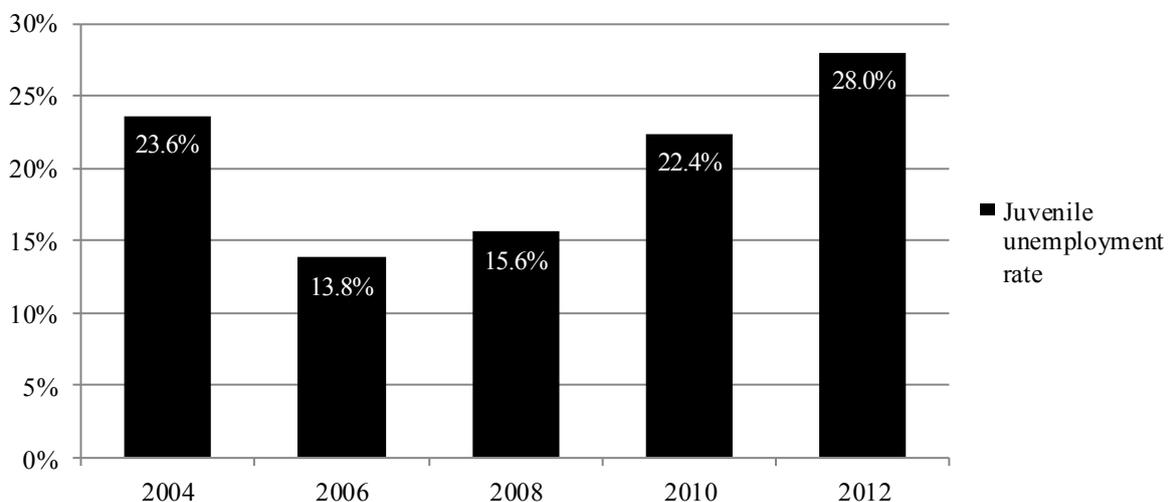
Source: author's elaboration of Municipality of Milan's data

According to the Municipality of Milan reporting ISTAT's data, in 2012, 28.0% of juveniles in the city of Milan were unemployed, 5.6% more compared to 2010 and 12.4% more compared to 2008. The unemployment rate for juveniles is increasing since 2008 and this is maybe due to the difficulties that young people experience in finding a job after the university. The labour market seems not able to absorb the number of inactive young people

who have become active during the economic crisis. In this way, more and more juveniles are found without a job, a condition that could generate an increase of crime trends in the city.

III.1.2 The construction of the street segment network

In the construction of the street segment network this study followed the methodology used by Weisburd, Groff, and Yang (2012) and Weisburd and Amram (2014).[24] The willingness of the author was to follow as much accurately as possible the geographical conformation of the street network, so the preparation of the division of the street segments started from a shape-file of the streets obtained through the SIT - Sistema Informativo Territoriale of the Municipality of Milan. All the streets of the city were merged together in a unique set of streets and then split again at each intersection with other streets using the "Planarize line" tool in ArcGIS 10.1. The results of this first step was the identification of 24,116 street segments which were specifically created:

1) when a street crossed beyond Milan city limits;
2) at a "T" intersection.

A number of changes of this first street network were applied in order to be consistent with prior researches. The author decided to delete from the sample highways, highway entrances, railways and big provincial orbital roads connecting the highways with the city. These types of roads present different characteristics compared to residential and arterial roads of the urban centres. In addition, these types of streets are "not relevant to examine crime in the behaviour-settings of street segments" (Weisburd, Groff, and Yang 2012, 25).

The study introduces other changes to the original streets network in order to make the analysis more solid and better consistent with the Seattle study. Because of the irregular and concentric streets network of the city of Milan, a number of streets were cut in too short segments, small secondary segments connected to principal streets or junctions for the U-turn were counted as independent. To solve this problem, all the street segments with a length minor and equal to 25 meters were aggregated with the much longer street segments they belong.[25] This was a long procedure conducted manually street by street, but it was necessary

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[24] References to the construction of the street segment grid conducted by previous studies can be found in II.2.1.
[25] Since there were no prior studies conducting a street segments analysis in Europe, the author made some arbitral methodological choices in the construction of the street segments network. In this case, segments shorter than 25 meters were considered too short to represent a street segment per se and were aggregated with a longer

not to have too small portions of the streets network which actually do not represent street segments per se. Following the influence of Weisburd, Groff and Yang (2012), who cut a street segment when the street length would be over 2,400 feet (732 meters), the author decided to divide street segments with a length major and equal than 700 meters (77 street segments) in equal segments with a length equal to the average length calculated on the entire street segments network (109 meters).

Figure 6. Distribution of street segments in the city of Milan
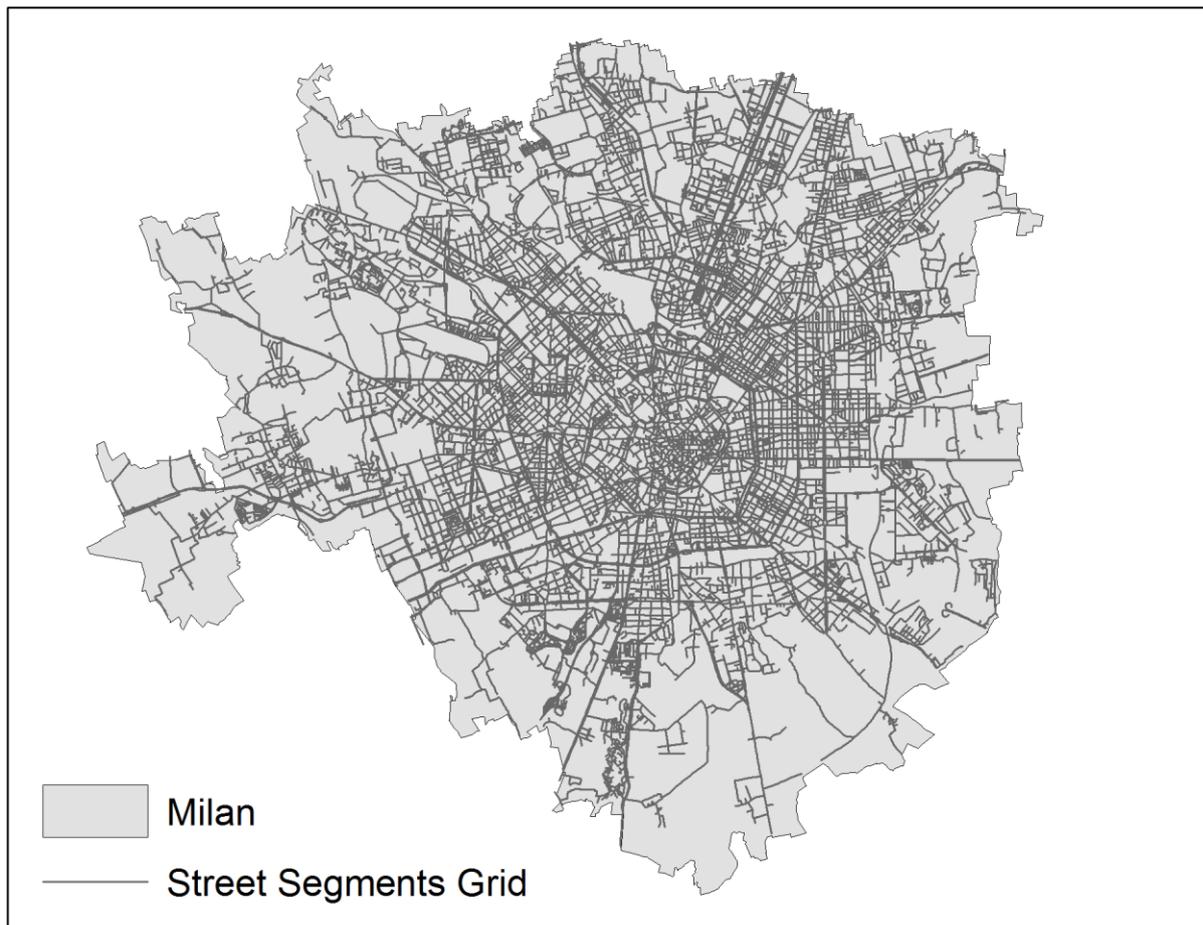
Source: author's elaboration of Municipality of Milan's data

After all the changes made to the original street segments network the final number of segments present in the city of Milan is 18,973. The number of street segments in the Seattle and Tel Aviv-Jaffa was, respectively, equal to 24,023 and 17,160. Figure 6 shows how street

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one. Most of the times these short segments are junctions for the U-turn or other secondary, small junctions connecting much bigger roads with other parts of the streets network.

segments are distributed in the city of Milan. The street segments network is very dense in the proximity of the city centre and less dense in the peripheral areas.

The enlargement of the street segments network presented in Figure 7 points out how the street network is dense and irregular in a city such as Milan compared to the classic "grid urban model" present in both U.S. cities and in Tel Aviv-Jaffa. The average length of this new set of street segments is 106 meters, very similar to the average length of the street segments grid constructed for the Seattle study (118 meters) but much longer than the average length of the streets in the Tel Aviv-Jaffa study (62 meters). In the present study the longer segment is equal to 698,5 meters, whereas the shorter is 25,5 meters long.

Figure 7. Enlargement of the street segments network in proximity of the city centre

Source: author's elaboration of Municipality of Milan's data

In the Seattle study around 64% of the street segments are between 200 and 600 feet, which are equal respectively to 61 and 183 meters, whereas less than 2% of the street segments are longer than 1,000 feet (305 meters). In this study the street segments between 61 and 183 meters are 57,4%, whereas the segments that measure more than 305 meters are 2,8% of the total.

In conclusion, the street segment network presented in this study it is very different from the street segments grids of the Seattle and Tel Aviv-Jaffa studies because of the structural

conformations of the street network per se. But they present also several similarities in the total number of street segments identified, in the average lengths of the segments and in the percentage of streets having the same length.

III.1.3 Crime data and the geocoding process

Crime data included in the analysis are crime incident data provided by the Italian Ministry of the Interior between 2007 and 2013.[26] Originally, the dataset included homicide, theft, burglary, robbery and drug related crime, but it was not possible to geocode the entire available database. The categories theft and drug related crime present a high number of missing information most of the times not reporting the addresses where the events occurred, whereas homicide represents a very residual category which was excluded from the analysis because of the few events occurred in the period under analysis. In most of the cases, homicides are not as related to the territory as other types of crime are. Nevertheless, it was possible to geocode 50.4% of robberies and 70.8% of burglaries occurred in Milan between 2007 and 2013. The total number of crime events included in the study is 43,615 of which 25.5% are robberies (11,138) and 74.5% are burglaries (32,477) (Figure 8). Among the robberies, 88.8% of the incidents represented completed events, whereas 11.1% attempted events. Among the burglaries, 79.9% of the incidents represented completed offences, whereas 20.1% attempted events. Robberies were took into account as a reliable proxy for *violent crime*, whereas burglary as a proxy of *property crime*.[27]

The geocoding process was managed using PTV Map&Market. In processing these data many problems have been faced. First of all, many crime incidents were recorded without an address, without a street name or a house number. Secondly, crimes were recorded at non-existent addresses or, third of all, crime events were registered with incomplete information. It was not possible to geocode the crimes presenting the first two types of error, whereas it was sometimes possible to correct the information and geocode the crimes presenting the third

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[26] Data on reported crime events between 2007 and 2010 have been provided to Transcrime – Joint Research Centre on Transnational Crime within the framework of the project "Crime in Metropolitan Areas" started in December 2009 after a proposal coming from the Ministry of the Interior. The aim of the project was to analyse hot spots in the Italian metropolitan area of Milan and experiment different spatial analysis techniques in the territory of the Municipality of Milan. An integration of those data has been provided in March 2014 giving the possibility to include in the analysis also most updated years from 2011 to 2013.
[27] The definition of "robbery" is the one specified in the Art. 628 of the Italian Penal Code, whereas "burglary" as the one specified in the Art. 624 bis of the Italian Penal Code.

type of error. For example, crimes that were generically registered at Central Station were geocoded at the address of the central station in Milan. In Italy, the precision of law enforcement records is still very low if compared to other countries, especially if compared to the United States where the geocoding percentages are usually higher than 90%. This means that scholars are most of the times able to geocode almost the entire datasets.

Figure 8. Distribution of burglaries and robberies in the city of Milan. Years 2007–2013
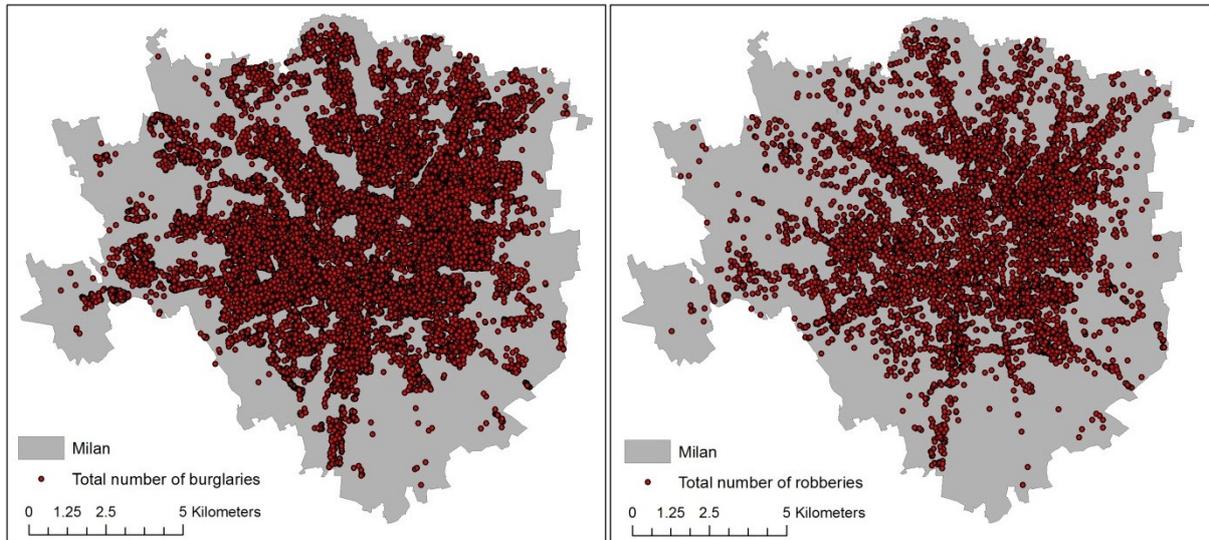
Source: author's elaboration of Ministry of the Interior's data

According to the recorded crimes, robberies and burglaries present similar trends between 2007 and 2013. Both types of crime register a decline from 2008 to 2009 and a subsequent increase, respectively, in 2010 in the case of burglary and in 2011 in the case of robbery. Looking at the geocoded crime data aggregated per years, it is immediately visible how the trend of geocoded burglaries follows the distribution of the registered burglaries between 2007 and 2013 (Figure 9), whereas the trend of geocoded robberies in 2012 and 2013 do not match the distribution of the registered robberies (Figure 10). The number of burglaries rises between 2009 and 2013 of about +93.9%, whereas the number of robberies between 2010 and 2013 of about +45.5%. This increasing trend is also visible for the pattern of geocoded burglaries, on the contrary it is not reflected if looking at the trend of geocoded robberies. The results coming from the analysis of 2012 and 2013 data on robberies have to be commented carefully and interpreted with particular caution. Unfortunately, in 2012, 19% of the incidents of robbery does not record the address, whereas 40% does not collect the address number. As well as, in 2013, 17% of incidents do not present any address, whereas 46% do not present the

address number. Problems related to a low geocoding rate could lead to bias results or misleading interpretations. It is important to comment the results are taking into account the possible errors that may have originated from these problems.

Figure 9. Number of geocoded and registered burglaries per year
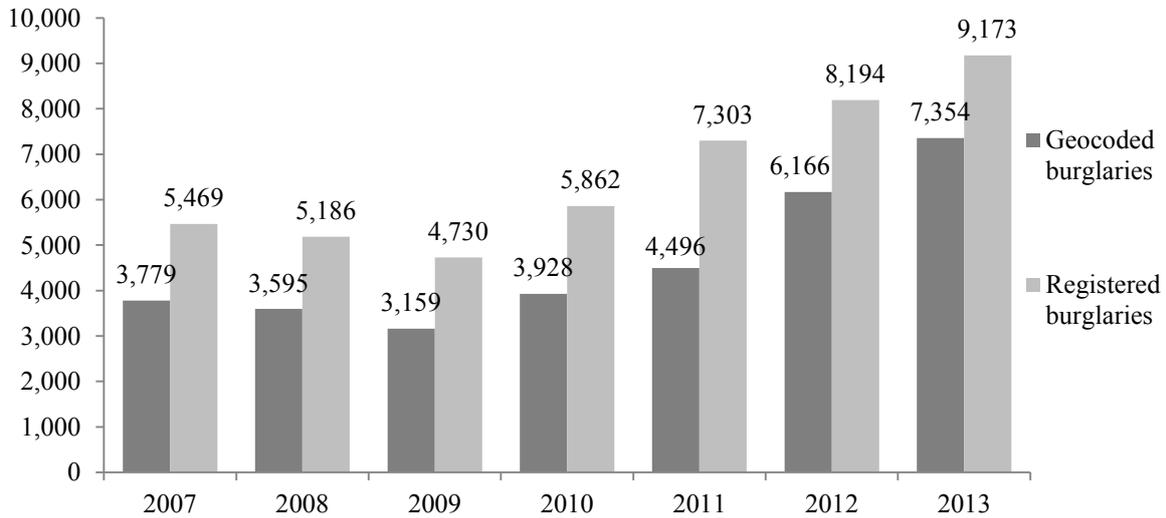
Source: author's elaboration of Ministry of the Interior's data

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Figure 10. Number of geocoded and registered robberies per year
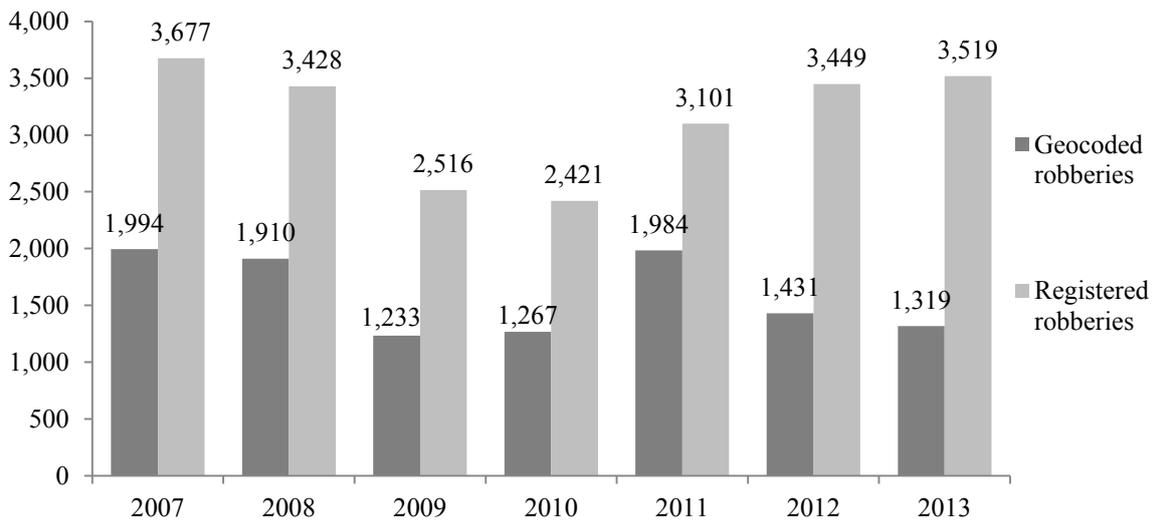
Source: author's elaboration of Ministry of the Interior's data

The total number of geocoded robberies and burglaries were joined with their corresponding street segments using the "join data" tool in ArcGIS 10.1. Crime incidents and

street segments were joined based on their spatial location. Each crime were connected with the closest street segment assuming that crime incidents that happened in a street were geocoded very close to the street segment itself. To avoid possible errors, all the crime incidents found at more than 5 meters from the street segment were manually controlled to assure that they were effectively joined to the right portion of the street. This was a long but necessary procedure in order to avoid possible mistakes and biased results of the analysis. The final sample included 11,138 robberies and 32,477 burglaries joined with 18,973 street segments.

III.2 Objective 2: testing the effect of opportunity and social disorganization theories

To understand the effects that influence crime concentrations in the city of Milan, a set of negative binomial regressions models will be conducted using STATA 12.0. This method was chosen because of the over-dispersed nature of the count variables included in the analysis (Long 1997; Hilbe 2011).[28] Negative binomial regression models are largely used in crime and criminal justice studies where dependent variables are countable and skewed at the same time. The dependent variables of this analysis are represented by the number of robberies and burglaries at street segment level registered each year between 2009 and 2013, whereas the independent variables are a set of variables able to measure opportunities coming from the environment and social disorganization factors. The negative binomial models do not include the entire period under study (2007-2013), but only the last five years (2009-2013). Since it was not possible to collect information on independent variables over time, the effects of these factors were observed in a fixed time and space. It has been assumed that these factors have remained quite stable in the past five years. This cannot be assumed if going back to 2007 and 2008. The economic crisis that hits the entire world, but especially the South European countries started in 2008 and it changed economic, social and political assets. From a theoretical point of view, it is risky to assume stability before and after 2008.

For these reasons, opportunity and social disorganization variables were collected for the last available year, but not going back to the years before 2009. The only exception to this rule is represented by the variable disorder which includes a number of single events reported

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[28] The over dispersion of the dependent variables was tested through a likelihood test of the dispersion parameter (α). The likelihood ratio test compares Negative binomial model to a Poisson model. The results of this test suggests that alpha is non-zero in all the models, so the negative binomial model is more appropriate.

by the Milanese Local Police between 2000 and 2010. The entire dataset of ten years was took into account in order to create a larger sample and do not incur in problems of misrepresentation of the phenomenon. Since burglaries and robberies present peculiar characteristics, the choice of the opportunity variables were differentiated depending on which crime type will be took into account. Indeed, situational factors are supposed to change depending on the specific crime, whereas the same social disorganization conditions are supposed to influence a wide range of criminal acts.

According to previous studies, both opportunity and social disorganization theoretical frameworks should give interesting insights in the explanation of crime patterns at micro units of geography. For a very long time, studies at micro places have explained the crime problem only from the point of view of the opportunity perspective. Social disorganization theories have been seen in an opposite position compared to opportunities theories for a very long time. This dynamic, called "theoretical competition" by Bernard and Snipes (1996) and Bernard (2001), reflects the concept that each theory originally is in competition with the previous theoretical frameworks because the new ideas usually develop from the lacks of knowledge experienced by the old theories which result unable to investigate certain aspects of the problem in question or fail to explain and solve it. On the contrary, recent U.S. and European studies have proved how an integration between social disorganization and routine activity theories can be effective in explaining patterns of robberies (W. R. Smith, Frazee, and Davison 2000; J. Smith 2003; Ceccato and Oberwittler 2008; Dugato 2014).

In the same vein, Weisburd, Groff and Yang (2012), in their study on Seattle, also support the "theoretical integration" between different theories. Starting from the assumption that most of the theories are different, but not necessarily in contradiction to each other. This study opts for a more comprehensive approach and integrate in both opportunity and social disorganization theories. This is in line with the idea that street segments do not only represent physical entities within the city, but also small communities per se. Indeed, if street segments are considered as behaviour-settings, they share routines, norms, behaviours and roles in the daily life of the city (Weisburd, Groff, and Yang 2012). In addition, a theoretical integration approach gives the possibility not to focus only on opportunities and micro dynamics, but also on other contextual factors which could influence crime occurrence in the

city. One of the major critiques moved to the opportunity theory and more in general to the micro approach is that this paradigm is often too much concentrated on the micro level and it tends to forget about the biggest picture. Conjugating opportunity and social disorganization factors in a more comprehensive analysis will help in understanding micro dynamics, but also in analysing the surrounding context in which this micro factors are located.

III.2.1 Dependent variables

The dependent variables used in the different models are the total number of burglaries and the total number or robberies experienced by each street segment from 2009 to 2013. Two different sets of models were computed depending on which crime type will be took into account. Opportunities and social disorganization factors can have different impacts on different types of crime. Indeed, burglaries are supposed to be more affected by residential land use, proximity with municipal housing or the value of the real estate, whereas robberies are more likely to be more influenced by the proximity with retail shops, licensed premises, bank counters or by mixed land use and crowded places. Both the different sets of models were run for each year of the period 2009-2013 in order to understand which are the factors that have a major impact and if there are factors that remain stable over time.

III.2.1.1 Burglaries

Burglaries were included in the analysis as a proxy for property crime. Data on thefts and other types of property crime were impossible to geocode because of the high missing information regarding their addresses. In Italy, the precision of the law enforcement records is still very low if compared to the data collection of other countries. This means that it is usually very difficult to geocode all of the datasets. The geocoding percentage for burglaries in the city of Milan is around 70% between 2007 and 2013. This geocoding percentage is the highest ever recorded in the city. This may be due to the fact that burglaries can be easily located and mapped because they occur in a specific physical place. In addition, this type of crime is often reported to the law enforcement agencies for requesting an eventual insurance payment. A total number of 25,103 incidents were geocoded from 2009 to 2013, which are 77% of the total burglaries geocoded.

Table 1 presents the descriptive statistics of the dependent variables for burglary. The number of observations represents the number of street segments of the city of Milan,

whereas the total number of burglaries geocoded in the city per each year is summarized in the "Sum" column. The trend of burglaries has increased since 2010.

Table 1. Descriptive statistics of the dependent variable "burglary". Years 2009-2013

Variable	Observations	Mean	SD	Min	Max	Sum
Burglary 2009	18973	0.1665	0.5848	0	24	3,159
Burglary 2010	18973	0.2070	0.6495	0	11	3,928
Burglary 2011	18973	0.2370	0.7196	0	18	4,496
Burglary 2012	18973	0.3250	0.8606	0	16	6,166
Burglary 2013	18973	0.3876	1.0175	0	23	7,354

Source: author's elaboration of Ministry of the Interior's data

On average per each year, 85% of the street segments are crime free, whereas the maximum number of burglaries were registered in 2009 when a single street segment experienced 24 burglaries. Also in 2013 and in 2011 single street segments recorded, respectively, 23 and 18 incidents of burglary. The average number of burglaries per street segment remained above 0.2 incidents in 2009, but increased between 2010 and 2013. This is may be due to the fact that the general crime trend have increased in the same period. In 2013, the average number of incidents per street segment more than doubled if compared to the one of 2009 passing from 0.167 to 0.387 burglaries.

III.2.1.1 Robberies

A total of 7,234 robberies were recorded in the city of Milan between 2009 and 2013. This percentage represents 65% of the total robberies geocoded for this study. Robberies were took into account as a proxy for violent crime.[29] At the first stages of this analysis homicides were also geocoded and included in the analysis. They were furthermore excluded because their number was too small compared to the one of the robberies and it could have been conducted to bias results if included in the category of violent crime. The geocoding percentage for robbery is around 50% from 2007 to 2013, which is 20 percentage points less than burglaries.

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[29] According to Dugato, who conducted an aggregated analysis on robberies reported in the city of Milan from 2004 to 2010, on average street robberies represent between 50% and 60% of the total robberies recorded yearly in the urban center, whereas bank robberies or robberies in private houses account only for, respectively, 3% and 5% of the total number of robberies recorded in that year (Dugato 2013, 67).

Table 2 shows the descriptive statistics of the dependent variables for robbery. As it was for Table 1, the number of observations represents the street segments, whereas the total number of robberies geocoded per each year is expressed in the column "Sum".

Table 2. Descriptive statistics of the dependent variable "robbery". Years 2009-2013

Variable	Observations	Mean	SD	Min	Max	Sum
Robbery 2009	18973	0.0650	0.3947	0	17	1,233
Robbery 2010	18973	0.0668	0.4162	0	28	1,267
Robbery 2011	18973	0.1046	0.5854	0	25	1,984
Robbery 2012	18973	0.0754	0.3710	0	7	1,431
Robbery 2013	18973	0.0695	0.3408	0	7	1,319

Source: author's elaboration of Ministry of the Interior's data

The trend for the geocoded robberies has registered an increase between 2009 and 2010, then it has decreased again from 2010 to 2011 and finally in the last two years it has strongly decreased. On average, the percentage of the crime free street segments is around 94%, value much higher compared to the burglaries. The higher maximum value of robberies recorded in a single street segment was registered in 2010, whereas the lower among the maximum values was recorded in the last two years (2012-2013). As mentioned above, it is important to point out that these years suffer from a problem of low geocoding rates. For this reason, the low values displayed in Table 2 can be influenced by the lower number of robberies geocoded in 2012 and 2013 compared to other years.

III.2.2 Explanatory variables

The explanatory variables included in the analysis come from the opportunity and social disorganization theoretical frameworks. In the majority of the cases, data on these factors were collected taking into account the data availability of the Municipality of Milan and the Italian National Statistical Office (ISTAT). In some other cases, it was possible to geocode data at street segment level because of special requests to the Italian Ministries. It was quite challenging to collect and geocode information at such a small unit of geography. Because of these difficulties and taking into account data availability, the opportunity and social factors were collected for a fixed point in the time series assuming they remain quite stable in the

period 2009-2013. Unfortunately, it was not possible to collect these information for the entire time series and conduct a longitudinal analysis on the entire period.

The description and the explanation of the independent variables will be divided in two main groups: variables to measure crime opportunity and variables to measure social disorganization. Both these groups present the variables divided by burglary and robbery because, as mentioned before, different set of models will be conducted depending on the different types of crime. Indeed, burglary and robbery differ in modus operandi, in types of property stolen, in the interaction with the victim, and in many other dynamics. In line with these considerations, it seems crucial to create different models in order to better understand which are the factors influencing these different types of crime. Clarke (1980; 1992) has already stressed the importance of targeting specific preventive measures to specific types of crime. To better address further policies or preventive measures it is necessary to understand the influencing and mitigating factors making differences between different types of crime.

III.2.2.1 Variables to measure opportunity theory

In explaining the tight concentration of crimes in few street segments and the very high street to street variability in the distribution of crime events across the years, Weisburd, Groff and Yang (2012) took into account several variables coming from the opportunity theory framework. These explanatory variables were included in a multivariate statistical analysis conducted through a multinomial logistic regression model. The crime trajectory pattern represents the dependent variable of the model. The authors specifically focused their attention on Chronic-crime trajectory pattern compared to Crime-free trajectory pattern in order to understand which are the variables influencing the stability of the chronic crime presence. In line with this analysis and taking into account the risks and mitigating factors also used by Dugato (2013) in his application of the RTM model in the city of Milan, this analysis identifies a set of opportunity variables in order to understand which are the factors explaining possible crime concentrations in Milan.

The theoretical framework in which these variables were chosen is the one drawn by the routine activity theory (Cohen and Felson 1979), the situational crime prevention (Clarke 1980) and the crime pattern theory (P. L. Brantingham and Brantingham 1981a). This study identified key characteristics of this theoretical framework following previous studies on

crime at place. As suggested by Dugato (2013), in Italy there is a lack of research on the correlation of urban and social environmental factors and crime events. The environmental criminology is not developed, as well as the criminology of place has not been improved yet. For this reason, the opportunity variables identified for this analysis will be selected on existing literature on other countries and being consistent with Weisburd, Groff and Yang (2012) which represents the starting point of this analysis. However, this study choses a set of variables that were reshaped on the peculiarities of the city of Milan and readapted taking into account data availability.

BURGLARY

Suitable targets

Suitable targets are one of the central factors connected with crime opportunities according to the theorists of the routine activity. Opportunities for committing crimes developed by the confluence in the same space and time of at least one motivated offender, one suitable target and the absence of a guardian capable of preventing the violation (Cohen and Felson 1979). The simultaneous presence of these elements it is the precondition for crime to occur. In the light of these considerations, it is more likely that crime will increase where suitable targets are concentrated. In the case of burglary, suitable targets can be considered the number of apartments, housing units or the number of residents.

1. Resident population

Resident population is the first variable adopted to measure suitable targets' presence in the street segments. It was not possible to find direct information on the number of houses or apartments present on each street segments. Residents represent potential victims and if the number of residents is high in a street segment, so it is the number of houses and apartments that can become possible targets for motivated offenders. This variable was calculated through the data made available by the Municipality of Milan that divided the total population of the city in 6,079 small cells (Figure 11). These small cells, called "Sezioni censimento", define the minimum unit of detection of the Municipality of Milan. The cells are used for conducting the census survey which in Italy is conducted every 10 years by the Italian National Statistical Office (ISTAT). The last data available represent Milanese resident population at the 31st December 2010.

Figure 11. Distribution of residents among the 6,079 census cells. Year 2010
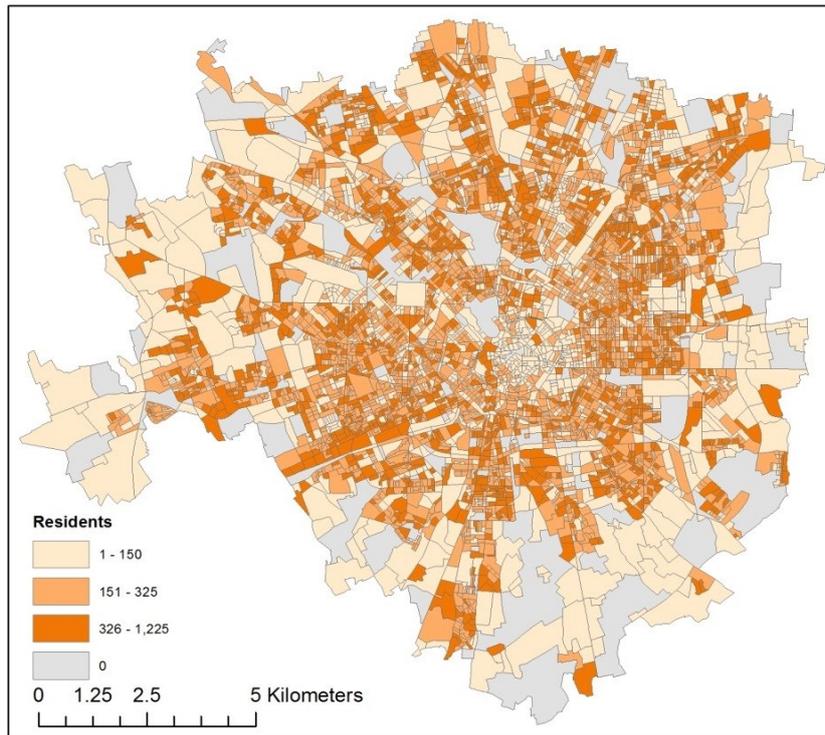
Source: author's elaboration of ISTAT's data

Data at a census cell level were redistributed at street segment level using the house numbers present in each segment. The house numbers are punctual data that were geocoded in the city of Milan. A total number of 50,957 house numbers were geocoded in the whole city. The number of residents in each cell were divided by the total house numbers present in each cell. Then, the number of residents present in each house number was summed for each street segments. Figure 11 and Figure 12 shows the distribution of residents, respectively, at census cell level and at street segment level. Dark orange cells and segments present the most populated areas in absolute values, whereas light orange the less populated. Grey areas present cells and segments without any resident.

Figure 12. Distribution of residents among the 18,973 street segments. Year 2010
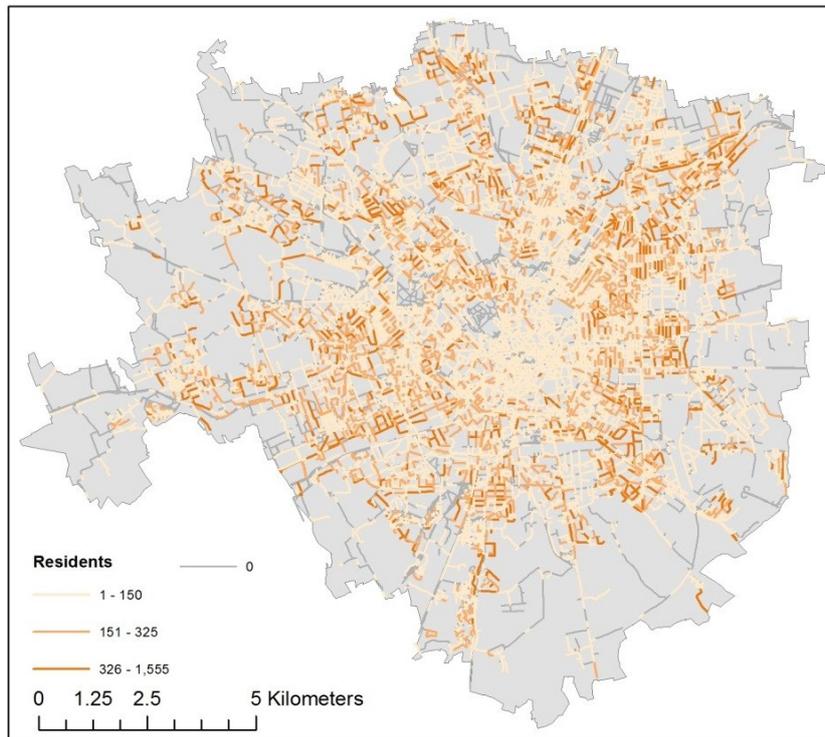
Source: author's elaboration of ISTAT's data

Table 3 presents the descriptive statistics of the variable resident population. The average number of residents per each street segments is around 69. There are street segments which do not register any resident, whereas the highest number of residents per street segment is 1,554. The second most populated street segment counts 1,390 people, whereas the third 1,292.

Table 3. Descriptive statistics of resident population. Year 2010

Variable	Observations	Mean	SD	Min	Max
Residents	18973	68.92715	114.9692	0	1553.5

Source: author's elaboration of ISTAT's data

2. Schools

Schools usually represent suitable targets and are considered nodes of the routine activities of victims and offenders. According to the crime pattern theory crime clusters close to home or at major activities nodes of the daily life (P. L. Brantingham and Brantingham 1981a). However, burglaries do not follow the typical dynamics of predatory and street crimes. In the case of this type of crime, schools are seen as attractors of motivated offenders because they are usually concentrated in residential areas. A total number of 852 schools were

geocoded in the city of Milan including kindergartens, elementary schools, junior and senior high schools. A buffer of 100 metres was created around each school (Figure 13). The schools and their buffers were joined with the street segments if the segment falls inside the buffer. The buffer was created because crime attractors are supposed to have an impact also in their proximity. This choice permits to extend the sample which is quite small in the case of schools. Weisburd, Groff and Yang (2012) and Groff and McCord (2011) used the same technique explaining how the effects of crime generators and attractors are often extended to their surrounding area. Table 4 shows the descriptive statistics for the number of schools at each street segment. The variable is expressed as a dummy. 78.7% of the segments do not have any schools, whereas 21.3% present at least a school.

Figure 13. Distribution of schools with a 100 metres buffer in Milan. Year 2013
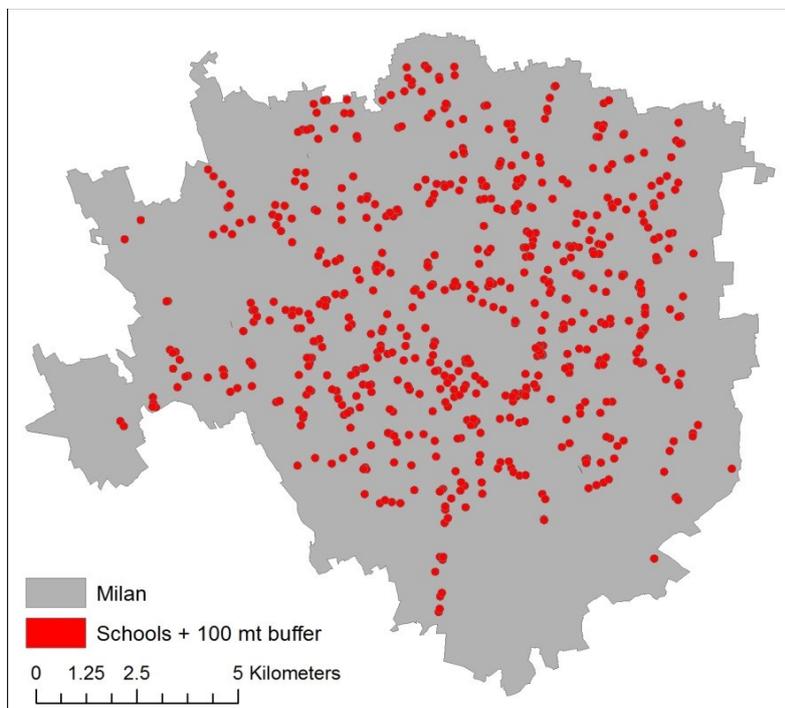
Source: author's elaboration of Municipality of Milan's data

Table 4. Descriptive statistics of schools. Year 2012

Variable	Observations	0	At least 1	0 (%)	At least 1 (%)
Schools	18973	14,933	4,040	78.7%	21.3%

Source: author's elaboration of Municipality of Milan's data

Capable guardians

Guardianship represents another key aspect of the crime triangle theorised by the routine activity. Formal social control represented by the law enforcement and people who have the authority to intervene to re-establish public order are very important managers of places. Their presence in the territory should influence the opportunities structure and discard motivated offenders to commit crime. The presence of elements of guardianship at the street segments is supposed to be negatively related with crime occurrence in Milan.

1. Police Stations

"Fire and Police stations" is one of the measures of guardianships chosen also by Weisburd, Groff and Yang (2012). The presence of a fire or a police station in a street segment or in its proximity is expected to be correlated with less crime events compared to streets without any stations. This variable was operationalized using the same methodology that was used for the presence of schools. The total number of police stations were geocoded in the city of Milan and a buffer of 100 metres was created around each point. Street segments were joined with the buffer including each point representing a police station. This method was applied mainly because of the small number or stations and because the influence of this variable is expected to impact also the vicinity of each station. A total of 91 police stations were geocoded in Milan. The distribution of these police stations are presented in Figure 14 and Figure 15 which show, respectively, the single police station with its buffer and the join with the street segments. As Table 5 shows, on average, each street segment present 0.05 police stations and the maximum concentration of these stations is 3 in a single street segment.

Table 5. Descriptive statistics of police stations. Year 2012

Variable	Observations	Mean	SD	Min	Max
Police stations	18973	.0469615	.2217792	0	3

Source: author's elaboration

Figure 14. Distribution of police stations with a 100 metres buffer in Milan. Year 2012
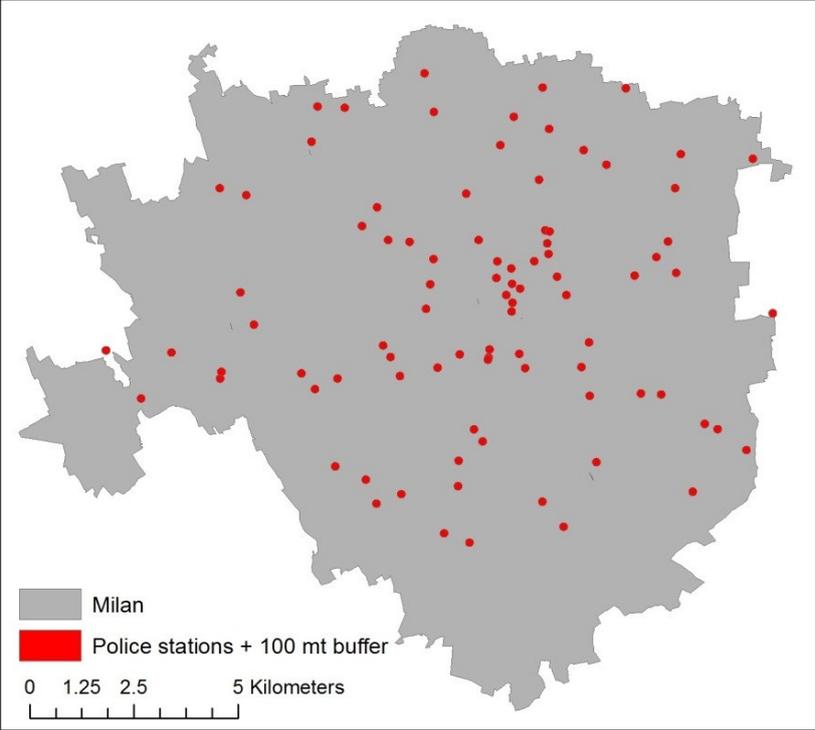
Source: author's elaboration

Figure 15. Distribution of police stations with a 100 metres buffer at street segment level. Year 2012
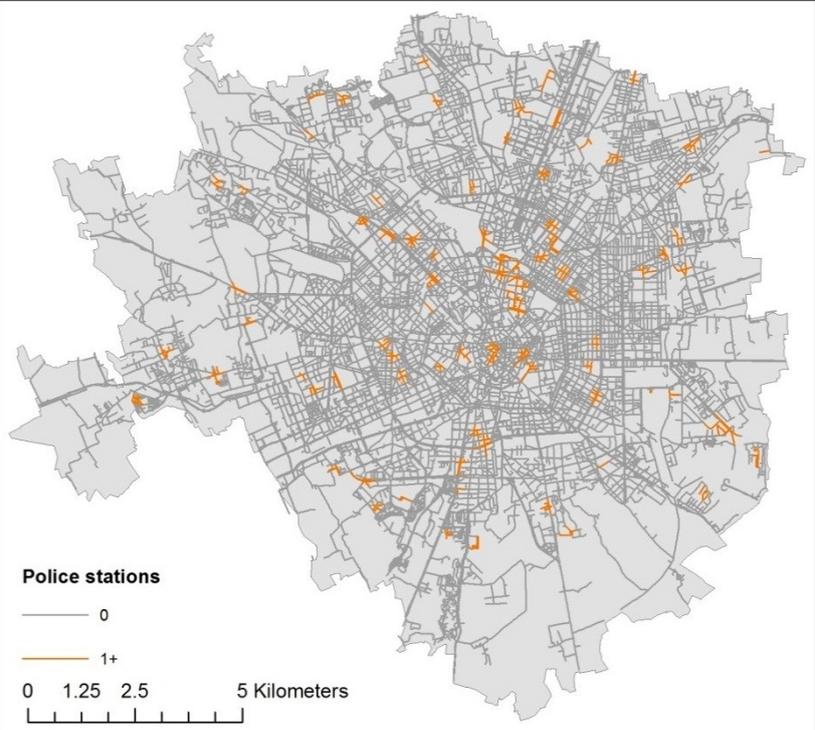
Source: author's elaboration

Accessibility

Accessibility assumes a key role in the opportunity theories in the moment in which it has been proved that crime is more likely to occur on arterial roads and places where there are easy public transportation access (M. Felson 2006). Indeed, "perhaps the most important component of the accessibility of offenders, victims, and guardians to places is determined by the street network itself" (Weisburd, Groff, and Yang 2012, 109). The present study wants to test both the accessibility through public transportations such as buses and trams and through private cars and motorcycles.

1. Bus and tram stops

Bus stops are often used as a measure of public transport accessibility and several studies have studied their effects on criminal behaviour (Levine, Wachs, and Shirazi 1986; LaGrange 1999; Loukaitou-Sideris 1999; Yu 2011). Weisburd, Groff and Yang (2012) hypothesized a positive correlation between bus stops and crime occurrence in Seattle, as well as Groff and McCord in their study on parks and crime (2011). The presence of bus and tram stops is supposed to have a positive relationship on crime events. In the case of burglary, but also for robbery, the presence of a stop on a street segment should increase crime events in that segments and in its surroundings. Indeed, in Milan, buses and trams are the most numerous types of public transport. Surface transports are very widespread and they cover almost the entire territory of the city from the city centre to the suburbs (Figure 16). Even though, as it can be deduced from Figure 17, big areas of the city are not served by the bus and tram lines. A total number of 3,169 bus and tram stops were geocoded in Milan in 2012.

The descriptive statistics summarized in Table 6 express the distribution of bus and tram stops in Milan. On average, each street segment present 0.2 stops and 87.8% of the segments do not have any stop.

Table 6. Descriptive statistics of bus and tram stops. Year 2012

Variable	Observations	Mean	SD	Min	Max
Bus stops	18973	.1674485	.5108467	0	11

Source: author's elaboration of Municipality of Milan's data

Figure 16. Distribution of bus and tram stops in Milan. Year 2012
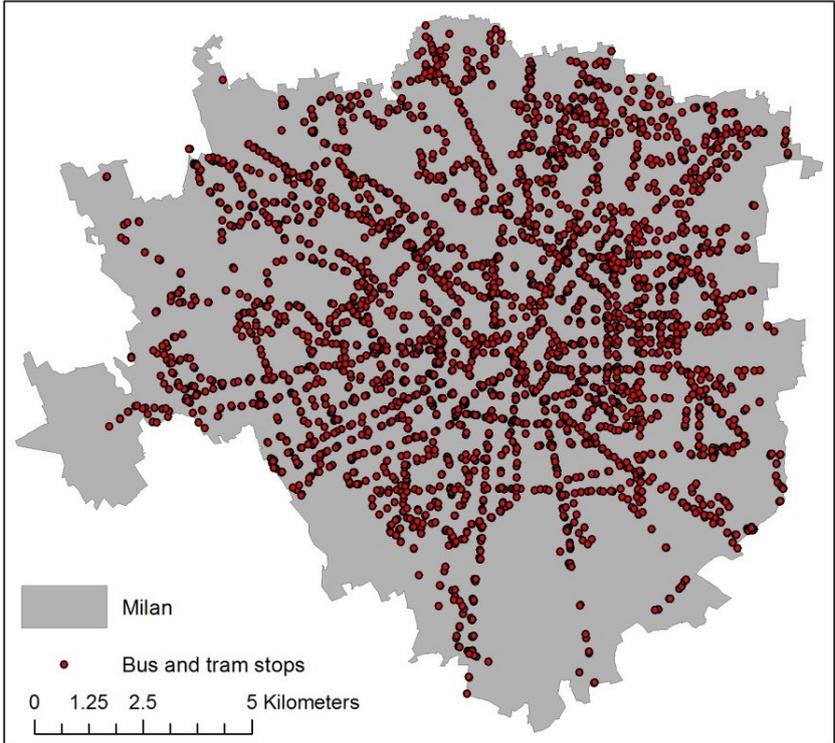
Source: author's elaboration of Municipality of Milan's data

Figure 17. Distribution of bus and tram stops at street segment level. Year 2012
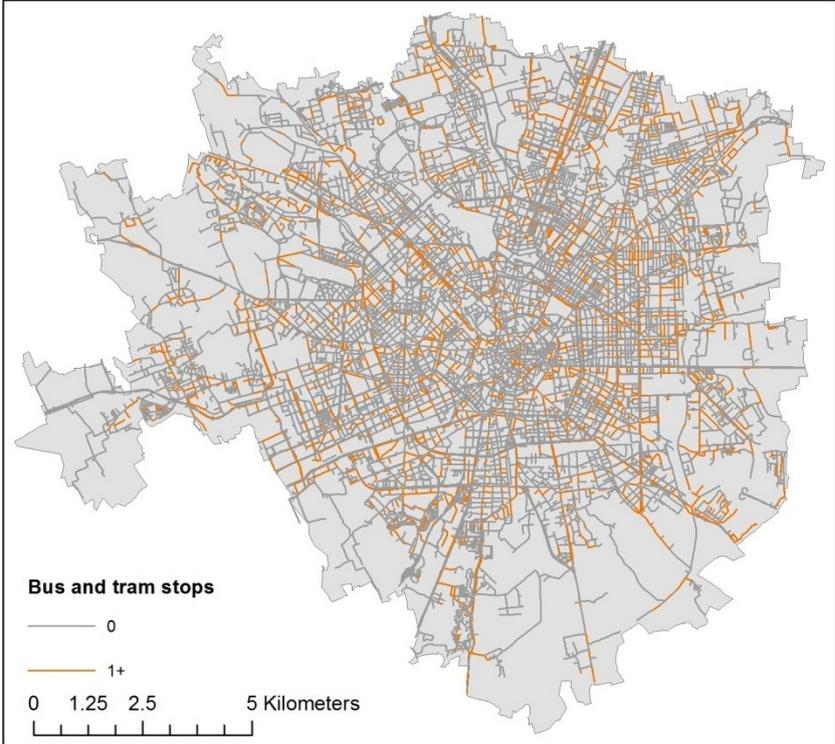
Source: author's elaboration of Municipality of Milan's data

2. Streets with limited access

Milan present several streets with limited access called ZTL areas (Figure 18). The Limited Traffic Zone ZTL are areas where access of vehicles is allowed only at certain hours for specific categories of users and for particular types of vehicles. They limit the traffic in specific congested areas of the city at specific hours. Only the residents of ZTL areas can have special permissions to transit in these streets upon request to the Command of the Local Police.

Figure 18. Distribution of ZTL areas in Milan. Year 2013
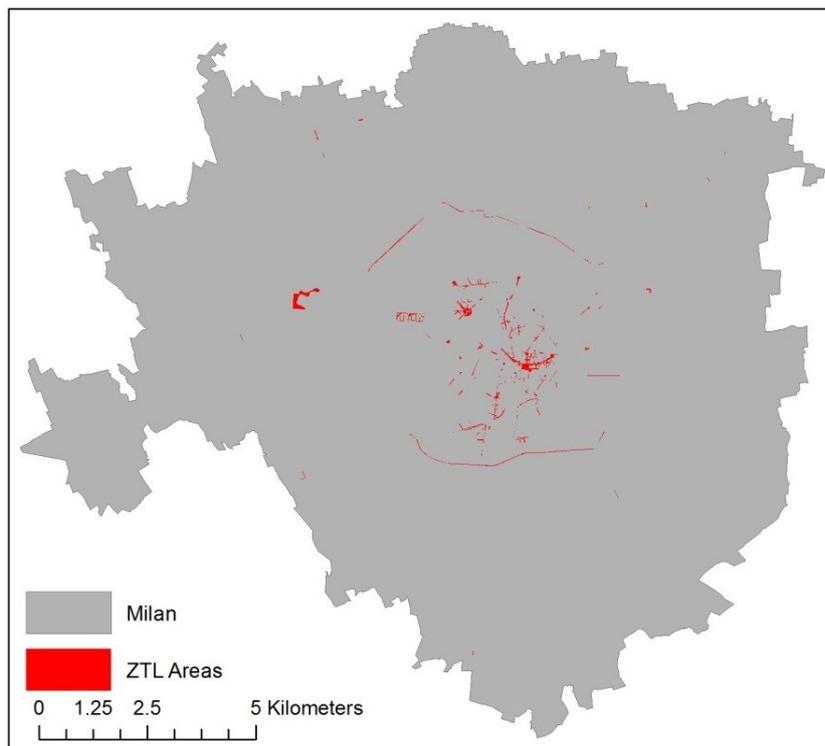
Source: author's elaboration of Municipality of Milan's data

Table 7. Descriptive statistics of streets with limited access. Year 2013

Variable	Observations	0	1	% (0)	% (1)
Streets with limited access	18973	18,206	767	96.0%	4.0%

Source: author's elaboration of Municipality of Milan's data

ZTL areas were joined with street segments in order to identify which street segments present this type of limited access (Figure 19). Those specific segments are supposed to be negative related with crime occurrence, especially in the case of burglaries. People cannot freely

circulate with vehicles in segments with limited access and vehicles are often used to commit crimes such as burglaries because offenders need to carry out stolen properties or run fast from the crime scene. Only the 4.0% of segments are at limited access in Milan, whereas the 96.0% are not (Table 7).

Figure 19. Distribution of streets with limited access (ZTL). Year 2013
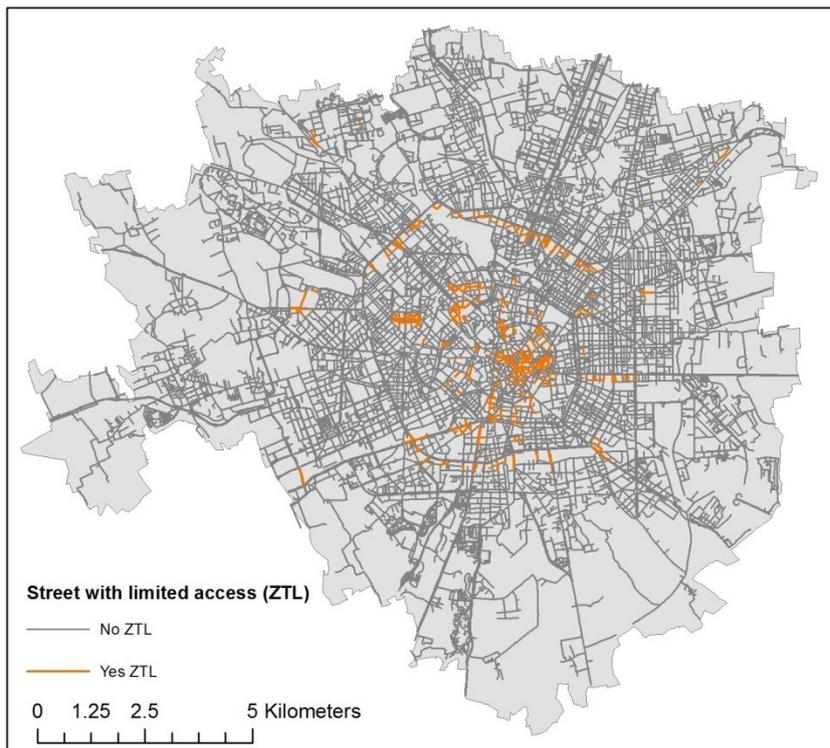
Source: author's elaboration of Municipality of Milan's data

Control Variables

A set of control variables were kept under control in the models regarding burglary. These variables are supposed to affect only indirectly burglaries, so they were kept under control. Retail shops, licenced premises and personal care shops are three of the controls included. These measures are three explanatory variables of the models for robbery and they will be explained extensively afterwards. The presence of a retail shop, a licenced premise or a personal care shop should improve guardianship in the street segments. This relationship has not been yet tested and this remain only an assumption because these kinds of facilities are widespread in the entire territory, so it is difficult to hypnotize they could really make the difference in improving the guardianship. In conclusion, Table 8 is a summary table of the opportunity theory factors that will be included in the models for burglary. It refers to both

explanatory and control variables with indication of the name, description, source, year, proxy and type of variable per each measure.

Table 8. Summary of the explanatory variables connected with the opportunity theory used in the model for burglary

Variable	Definition	Source	Year	Proxy	Type of variable
Opportunity theory - BURGLARY					
Residents	Resident population on each street segment	ISTAT	2010	Target	Explanatory
Schools	Total number of schools with a 100mt buffer that are on or intersect street segments	Municipality of Milan	2013	Target	Explanatory
Police Stations	Total number of police stations with a 100mt buffer that are on or intersect street segments	Polizia di Stato	2012	Guardian	Explanatory
Bus stops	Total number of bus stops on each street segment	Municipality of Milan	2013	Accessibility	Explanatory
Streets with limited access	Total number of street segments with limited access	Municipality of Milan	2013	Accessibility	Explanatory
Retail shops	Total number of retail shops on each street segment	Municipality of Milan	2013	Guardian	Control
Licensed premises	Total number of licensed premises on each street segment	Municipality of Milan	2013	Guardian	Control
Personal care shops	Total number of personal care shops on each street segment	Municipality of Milan	2013	Guardian	Control

ROBBERY

Suitable targets

As explained for burglaries, suitable targets are one of the elements of the crime triangle. First Cohen and Felson (1979) and later Clarke and Eck (2003; 2007) suggest that crime could be prevented without changing the motivation structure but affecting the suitable target, the absent guardian or more in general the opportunity structure.

A high presence of targets is usually concentrated in crime generators and attractors of opportunities. (P. L. Brantingham and Brantingham 1995) have defined the hot spot places in crime generators and crime attractors depending on the different reasons that are linked with their growth and evolution. These reasons are related to the different features that these places present. Crime generators are places that attract a large number of people. In public events, parades, shopping malls, airports and festivities both offenders and victims are sharing the same space, for this reason, in these locations occur a high number of criminal incidents. The spatial coexistence of suitable targets and possible offenders create many opportunities for crime to occur. Crime attractors is a place which is known to provide many criminal opportunities to commit crimes. Possible offenders in crime generator places are looking for having good times or they are doing their normal activities not specially oriented in committing crimes, whereas offenders usually reach crime attractor places because they know that these spaces are highly criminal locations. Open market drug sales, prostitution districts and unsecured parking areas can be good example of crime attractors.

In the light of these considerations and trying to be consistent with Weisburd, Gross and Yang (2012), this study identifies different types of places that can be considered as generators and attractors of opportunities. Weisburd and his colleagues in their study took into account both number of employees at businesses located on the street segments and the total retail business sales on each segment (see II.3.1 Opportunity theory). These measures are the operationalization of two main concepts: "Employment", which wants to catch the "work dimension" of each person assuming that people who work on a street segments can be potential victims, and the "Business Crime Attractors/Crime Generators", which are the expression of the "shopping dimension" of people who shop at stores and may have money to spend that can be stolen. In the city of Milan it was not possible to find these information at a

very small level of geography, but a number of similar variables were chosen to simulate the work and shopping dimensions.

1. Retail shops

Retail shops are the first measure of suitable targets for robbery. For the last available year, 2013, it was possible to geocode 24,020 retail shops taking all the information through the databases of the Municipality of Milan. This category includes any kind of business who sells products: supermarkets, deli-shops, clothing and shoe stores, newspapers' kiosks, pharmacies, butcher shops, bakeries, tobacco shops, perfume shops and many others. Figure 20 shows how retail shops are concentrated in the city centre of Milan, whereas they are less widespread in the peripheral areas. As shown in Figure 21 the majority of the segments register 0 or 1 retail shop. Indeed, almost 70% of the street segments do not have retail shops in their portion of the street, whereas the average retail shops present in a street segments are 1.3 (Table 9). The maximum number of shops in a street segment is 62.

Figure 20. Distribution of retail shops in Milan. Year 2013
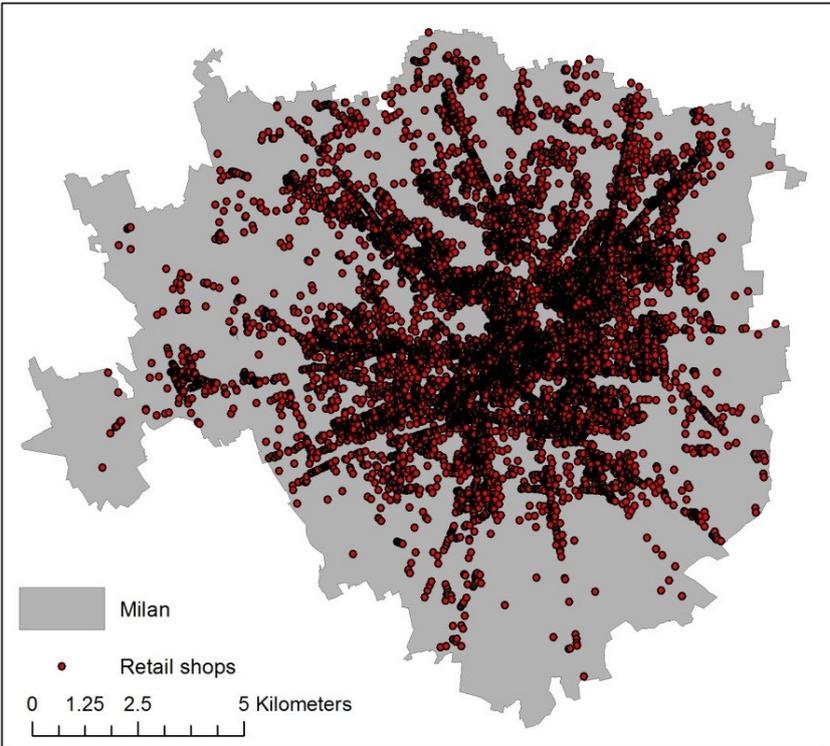
Source: author's elaboration of Municipality of Milan's data

Table 9. Descriptive statistics of retail shops. Year 2013

Variable	Observations	Mean	SD	Min	Max
Retail shops	18973	1.289991	3.284674	0	62

Source: author's elaboration of Municipality of Milan's data

Figure 21. Distribution of retail shops at street segment level. Year 2013
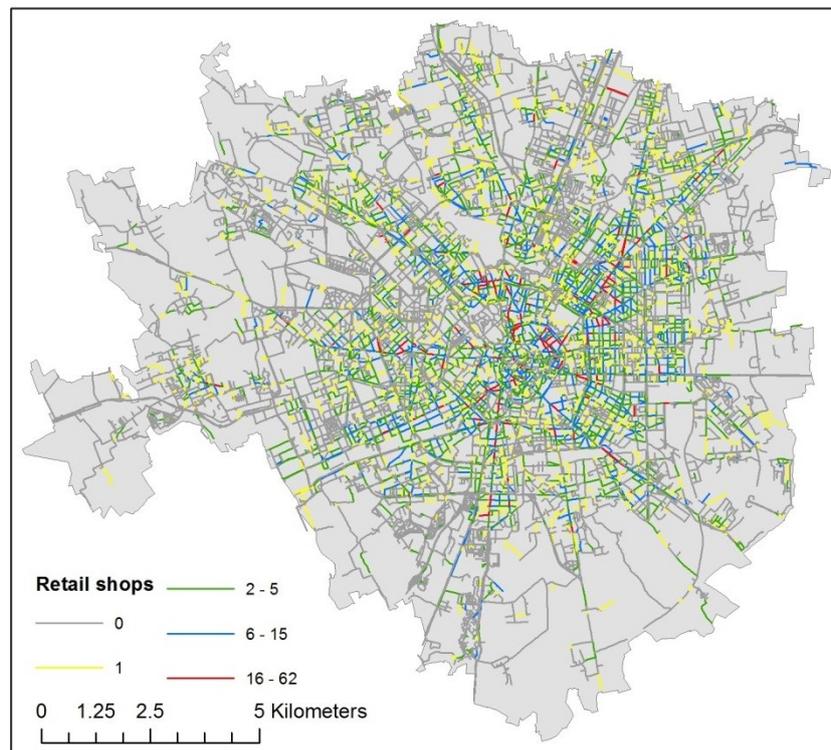
Source: author's elaboration of Municipality of Milan's data

2. Licenced premises

Licenced premises are the second measure of suitable targets and it represents bars, restaurants, night clubs and other premises who have the licence to sell and distribute alcohol to their clients. These places are often connected with crime events, usually violent crimes (Murray and Roncek 2008; Abbey 2011; Ayres and Treadwell 2012; Brady and Li 2013), and especially robberies (Ceccato and Oberwittler 2008; Gaziarifoglu 2011). From one hand, the use and abuse of alcohol makes people more aggressive and prone to be engaged in fights, assaults and other form of violence. From the other hand, drunk people can be the target of motivated offenders for street robberies. Dugato (2013) stressed the importance of taking into account these kinds of commercial venues in Milan because the licenced premises are highly concentrated in few parts of the city centre. According to the author, the neighbourhoods

Navigli-Ticinese, Brera, Corso Como and Arco della Pace represent perfect crime attractors and generators for motivated offenders. In the city of Milan, 7,082 licenced premises were geocoded at street segment level using the databases of the Municipality of Milan (Figure 22). Also in this case the majority of the street segments do not present any licenced premise or have at least a premise (Figure 23).

Figure 22. Distribution of licensed premises in Milan. Year 2013
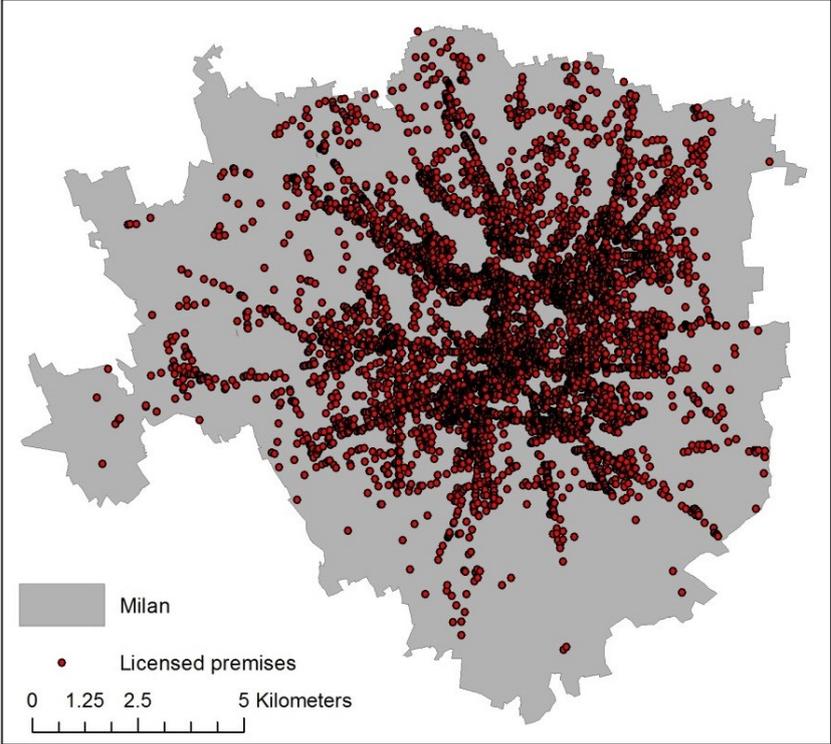
Source: author's elaboration of Municipality of Milan's data

Figure 23. Distribution of licensed premises at street segment level. Year 2013
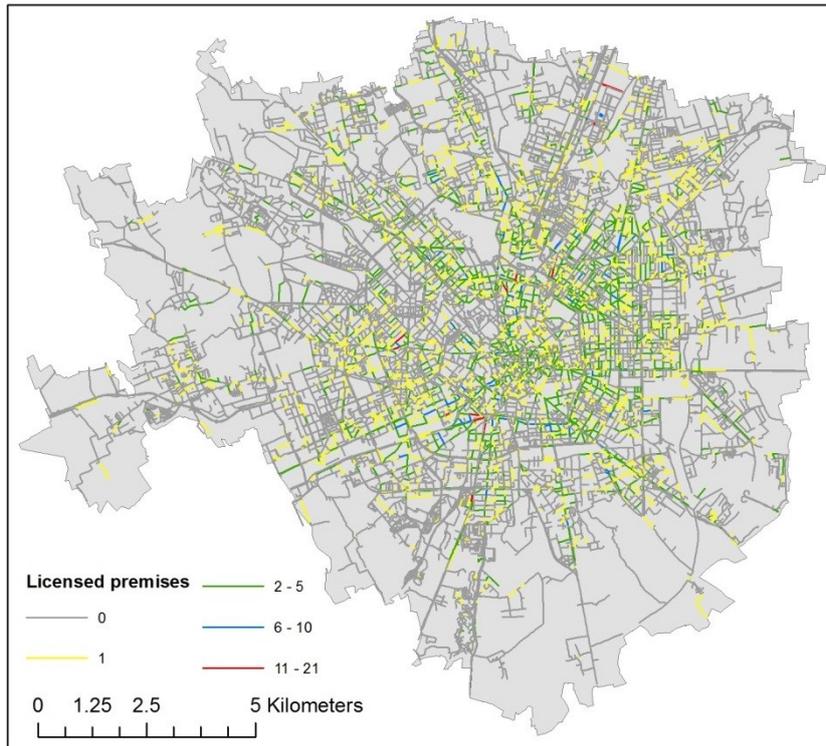
Source: author's elaboration of Municipality of Milan's data

Table 10 shows how the average of licensed premises present at each street segment is 0.4, a much lower number compared to the retail shops. The highest number of these commercial venues in a segment is 21, but there is almost 80% of the street segments which do not present any of these premises. Licensed premises seem to be very concentrated in few places, instead of being widespread in the Milanese territory.

Table 10. Descriptive statistics of licensed premises. Year 2013

Variable	Observations	Mean	SD	Min	Max
Licensed Premises	18973	.3732673	.9854658	0	21

Source: author's elaboration of Municipality of Milan's data

3. Personal Care Shops

As well as retail shops and licenced premises, personal care shops represent a measure of suitable targets. A total number of 4,323 personal care shops were geocoded in the Milanese territory (Figure 24).

Figure 24. Distribution of personal care shops in Milan. Year 2013
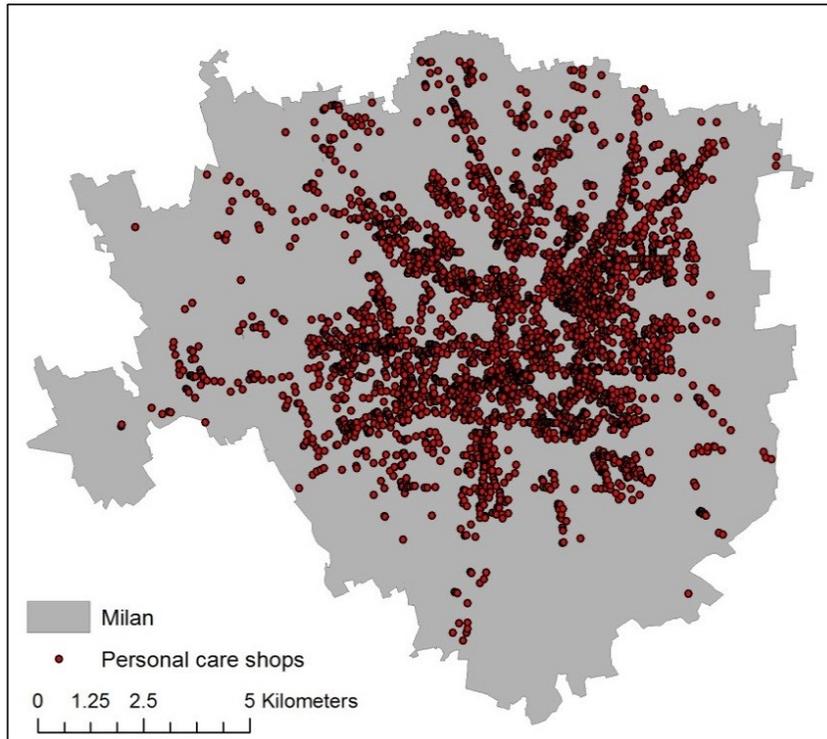
Source: author's elaboration of Municipality of Milan's data

This category comprises hairdressers, aesthetic shops, massage centres and spas. These commercial property were included because they are supposed to attract female possible victims of robbery. Indeed, men are more likely to spend more time in licenced premises, whereas women in personal care shops. These places have a quite specific target, which is usually female and quite wealthy. This will permit to take into account different targets in the analysis of robberies' patterns. Figure 25 shows how street segments that register more than 6 personal care shops are very rare if compared to the majority which have 0 or 1 shop per segment.

Figure 25. Distribution of personal care shops at street segment level. Year 2013
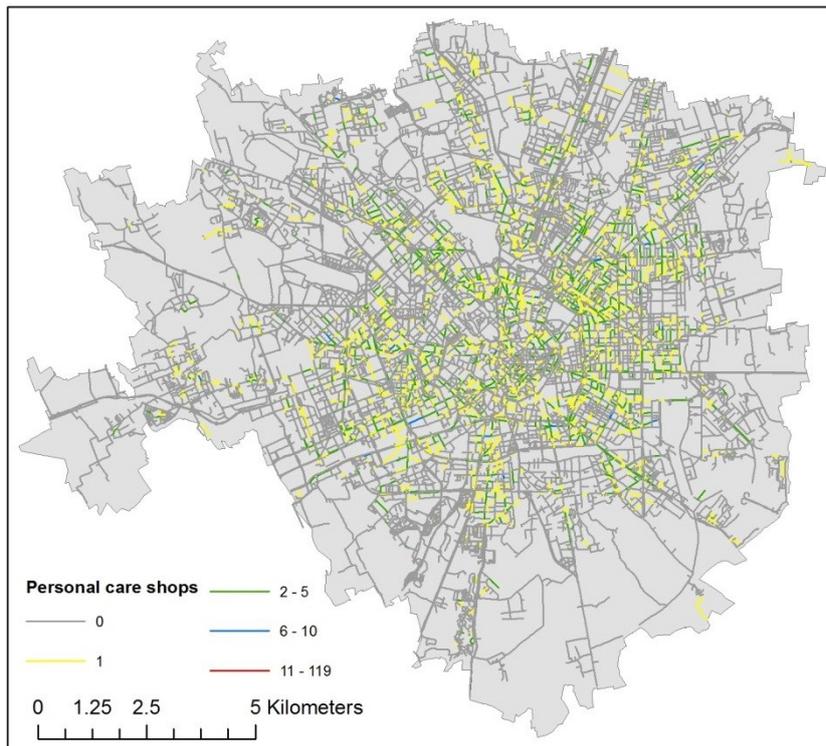
Source: author's elaboration of Municipality of Milan's data

Table 11 summaries the descriptive statistics of this variable. Data were collected through the Municipality of Milan and are referred to 2013.

Table 11. Descriptive statistics of personal care shops. Year 2013

Variable	Observations	Mean	SD	Min	Max
Personal Care Shops	18973	.2278501	1.091869	0	119

Source: author's elaboration of Municipality of Milan's data

Almost 0.3 personal care shops are present at each street segments. 86.6% of street segments do not present any of this types of shops, whereas in only a case 119 shops were found in a single segment.

4. Bank branches

The presence of bank branches has been proved to be correlated with robberies in the city of Milan (Dugato 2013; Dugato 2014). Indeed, in the city the closeness to a bank branches

increases the risk of being victim of a robbery. A total number of 1,118 bank branches were geocoded and included also in this analysis (Figure 26).

Figure 26. Distribution of bank branches in Milan. Year 2011
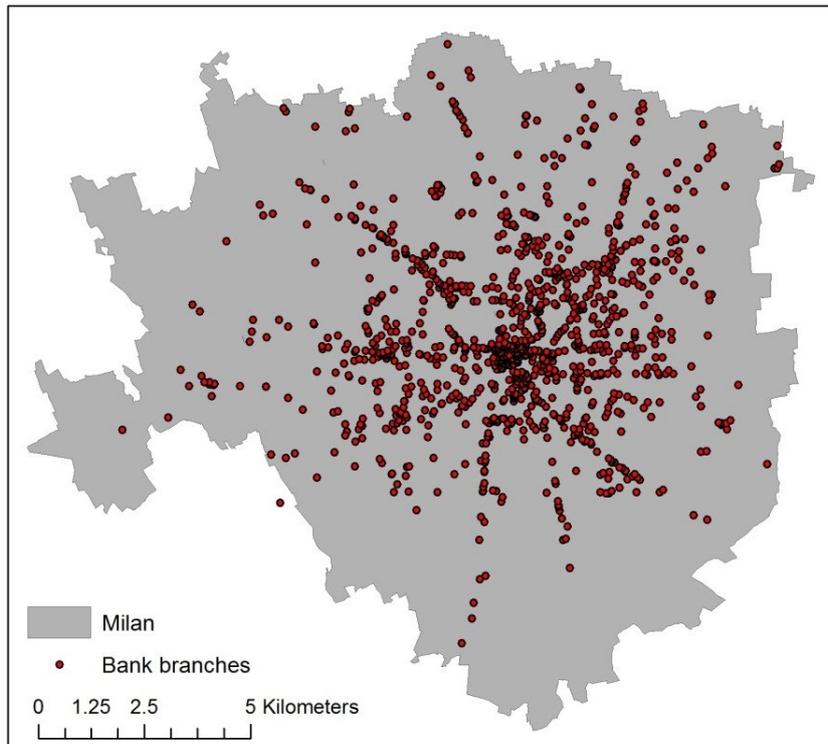
Source: author's elaboration of ABI's data

The information on the locations of the branches were collected through the Associazione Bancaria Italiana – ABI (Italian Banking Association). The dataset contains information on the active Italian bank branches and data on the city of Milan were collected for 2011. Table 12 shows the descriptive statistics of this variable. On average, 0.06 bank branches are distributed per street segment. The totality of the bank branches are concentrated in very few street segments.

Table 12. Descriptive statistics of bank branches. Year 2011

Variable	Observations	Mean	SD	Min	Max
Banks Branches	18973	.0589258	.2663701	0	4

Source: author's elaboration of ABI's data

Figure 27 shows the distribution of bank branches after the join with the street segment network. Bank branches are more widespread in the city center and along main arterial roads.

Figure 27. Distribution of bank branches at street segment level. Year 2011

Source: author's elaboration of ABI's data

Guardianship

1. Police stations

Police stations were took into account as a measure of guardianship also in the case of robbery. It has been assumed that the proximity with a police stations may discourage motivated offenders to commit a robbery. A buffer of 100 meters was created around each police station because of the influence of this variable is expected to impact also the vicinity of each point. For a better explanation of this variable, refer to the guardianship related with burglary section.

Accessibility

1. Bus and tram stops

Bus stops are the measure of accessibility connected with robbery. As in the case of burglary, the presence of bus and tram stops is supposed to have a positive relationship on

crime events. This measure was extensively explained in the paragraph related to accessibility and burglaries. More explanations can be found in that part.

Control Variables

Resident population and the number of schools were included in this analysis as controls. A set of variables connected with robberies were included in the models for burglaries, as well as resident population and schools, in order to address and take into consideration all possible effects on this type of crime. Residents represent potential victims, so the more people who live in a street segment, the more potential targets are available for motivated offenders. In the same sense, schools represent possible indirect targets for offenders. Parents who carry their kids to school or kids themselves can become victims of possible robbers.

In conclusion, Table 13 is a summary table of the opportunity theory factors that will be included in the models for robbery. It refers to both explanatory and control variables with indication of the name, description, source, year, proxy and type of variable per each measure.

Table 13. Summary of the explanatory variables connected with the opportunity theory used in the model for robbery

Opportunity theory - ROBBERY					
Variable	**Definition**	**Source**	**Year**	**Proxy**	**Type of variable**
Retail shops	Total number of retail shops on each street segment	Municipality of Milan	2013	Target	Explanatory
Licensed premises	Total number of licensed premises on each street segment	Municipality of Milan	2013	Target	Explanatory
Personal care shops	Total number of personal care shops on each street segment	Municipality of Milan	2013	Target	Explanatory
Bank branches	Total number of bank branches on each street segment	ABI	2011	Target	Explanatory
Police Stations	Total number of police stations with a 100mt buffer that are on or intersect street segments	Polizia di Stato	2012	Guardian	Explanatory
Bus stops	Total number of bus stops on each street segment	Municipality of Milan	2013	Accessibility	Explanatory
Residents	Resident population per street segment	ISTAT	2010	Target/ Guardian	Control
Schools	Total number of schools with a 100mt buffer that are on or intersect street segments	Municipality of Milan	2013	Target/ Guardian	Control

III.2.2.2 Variables to measure social disorganization theory

Social disorganization theory emerged in the framework of the Chicago School's ecological theories. According to this theory, crime is directly linked with the ecological characteristics of the neighbourhoods where people live and the communities of which people are part of. In this sense, the distribution of crime in space and time follows the pattern of the physical structure and the social organization of the cities. Both physical characteristics, such as urban deterioration or proximity with industrial land use, and social characteristics, such as poverty, racial heterogeneity or unemployment can influence crime occurrence in the cities. The neighbourhood, the physical and social place where people grow up, live, lead their routines influences individuals' actions and also their propensity to commit crime. In their *Juvenile Delinquency and Urban Areas* (1942, 1962), which is considered a cornerstone in the study of crime and delinquency from a sociological point of view, Shaw and McKay argued that structural factors such as economic conditions, ethnic heterogeneity, and residential mobility led to the deterioration of community social organization. The weakening of social bonds and community ties have, as a consequence, only intensified the crime problem.

With the development of the environmental criminology and a more situational approach to the crime event, theories of social disorganization have been replaced by the theories of opportunity. The explanations of crime occurrence drawn by the social disorganization theorists remain up to date, but they were often rejected by the new paradigm held by the opportunity theorists. In the attempt of combining these two approaches, in the *Criminology of Place* Weisburd, Groff and Yang rehabilitate the role of the social disorganization theory in studying crime at place. Following this intent and truly believing that social disorganization plays a fundamental role in the explanation of crime events, this paragraph introduces the variables that were chosen by this study to measure the aspects connected to the social disorganization theory.

Since traditionally social disorganization variables have been used for conducting studies at neighbourhood, community or city level, it was challenging to collect these information at micro units of geography such as street segments. The set of variables proposed by this study to measure social disorganization are to be considered as a preliminary attempt. Measuring

wealth, unemployment, truant juveniles, land use or social engagement and community ties at street segments represent the major difficulty of this study.

Since all the variables measuring social disorganization factors represent structural features of the places and specific characteristics of the communities that can affect any type of crime the same variables were took into account both for burglaries and robberies together. Opportunities are situational, are based on the here and now, so only certain types of opportunities can lead to a certain types of crimes. On the other hand, social disorganization factors are more settled in the street segments' social environment and are probably more difficult to eliminate. For this reason they tend to prepare the ground for different types of offences. The importance of studying both situational and social disorganization factors is the possibility to understand the immediate and the long-standing dimensions that can influence crime occurrence.

BURGLARY AND ROBBERY

Socio-economic factors

According to the social disorganization theory, socio-economic factors are crucial in explaining crime occurrence. Social advantages and disadvantages create the precondition for the development of strong or weak sense of community, social bonds and social organization. In this sense a large amount of studies have focused on socio-economic conditions of different neighbourhoods or different cities (Bursik 1988; Bursik and Grasmick 1993; Sampson 1986; Sampson and Groves 1989). The present analysis wants to analyse two dimensions of socio-economic factors. From one side, the values of the real estate were included in order to identify the wealth streets and test the influence of advantages streets on crime. From the other side, the presence of public housing wants to measure the influence that disadvantages and poor streets can have on crime events. As one could imagine, more valuable houses and richer residents can be the optimal target for burglaries and robberies, while the same types of crime can proliferate in streets where social control is lower such as poorer areas.

1. Values of the real estate

The values of the real estate were took into account as a proxy of the wealth of the street segments. It was assumed that the street segments that present real estate values higher than the average can be considered in a more valuable area from an economic point of view. The

values are expressed as a dummy variable to diversify the streets presenting real estate values under the average of the entire distribution and the streets presenting values above the average. The dummies were created on the average economic values of apartments, houses and villas expressed in euros per square meter. These values were collected for the second half of 2011 from the Italian Real Estate and Land Registry Agency (Agenzia del Territorio). They were originally aggregated in 55 areas of the city and only consequently disaggregated at street segment level. The average value of an area were applied to a street segment when the segment falls completely inside the area or falls inside for most of its length. As it is shown in Table 14, 60% of the street segments present values under the average, whereas 40% values above the average. The spatial distribution of the real estate values shows that segments with values above the mean are concentrated in the city centre and in two areas of the North-East and the South-East of the Milanese territory (Figure 28).

Street segments presenting values above the average are assumed to be more prone to experience burglaries since in those streets, apartments, houses and villas are supposed to me more prestigious and valuable compared to others. For what it is concerning robberies, more valuable streets can be positive correlated also with this type of crime because the residents of the richest streets are possible suitable targets.

Figure 28. Distribution of real estate values at street segment level. Year 2011
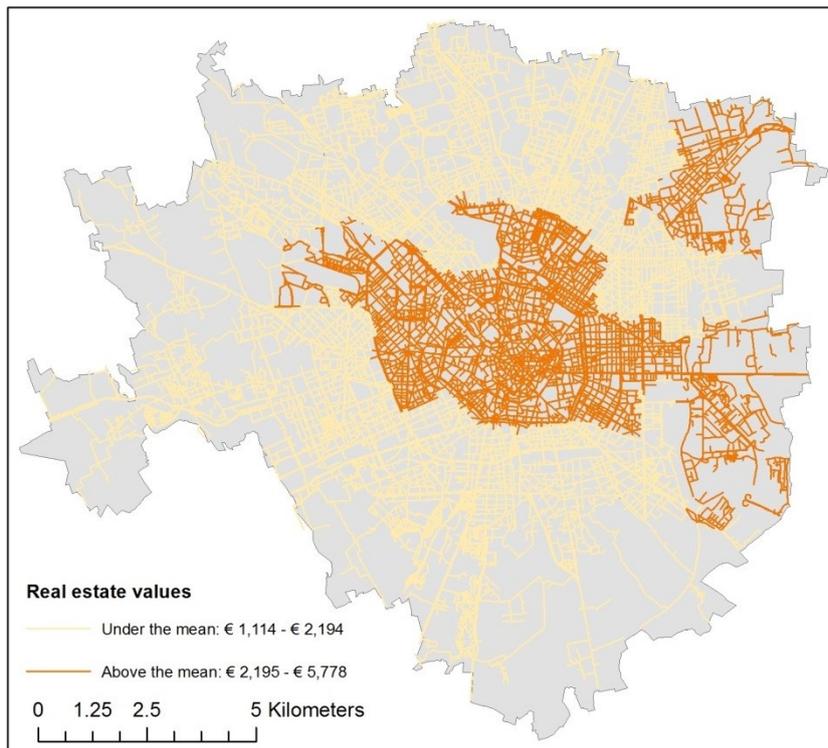
Source: author's elaboration of Real Estate and Land Registry Agency's data

Table 14. Descriptive statistics of real estate values. Year 2011

Variable	Observations	Under the average	Above the average	Under the average (%)	Above the average (%)
Real estate values	18973	11,391	7,582	60.0%	40.0%

Source: author's elaboration of Real Estate and Land Registry Agency's data

2. Presence of public housing

As values of the real estate were took into account as proxy for the wealth of the street segments, the presence of public housing represent an indicator of the socio-economic disadvantages which may be related with high level of crime. It is well-known that crime is often associated with poor and deteriorated neighbourhoods because these areas suffer from the lack of social ties and as a consequence of the lack of social control (Sampson and Groves 1989; W. R. Smith, Frazee, and Davison 2000). In addition, these areas are often characterized by social and physical disorder which is related to the lack of control and the lack of interest in the public spaces from the community itself. Poor areas usually present poorly designed environment that can increase crime opportunities (Newman 1972). All these

factors were operationalized in the city of Milan by Dugato (2013), who introduced in his analysis the number of public housing as a "proxy indicator of concentrations of both socio-economic disadvantages and poorly designed environments" (Dugato 2013, 71). In addition, concentrations of public housing have long been connected with social disorganization (Kubrin and Weitzer 2003). Weisburd, Groff and Yang (2012) introduced a combined measure of public housing and housing vouchers in their analysis on Seattle.

In this study, the presence of public housing is also supposed to be positively correlated with both burglaries and robberies in the city of Milan. This measure represents the buildings owned and managed by the public housing's company of the municipality of Milan (ALER). Figure 29 shows the distribution of public housing in the Milanese territory. It is quite clear how public housing are distributed in the peripheral areas of the city. Especially, large areas of public housing, marked in the maps with blue and red colours, are concentrated at the borders of the city. The descriptive statistics of this variable explains how the mean of this distribution is equal to 0.1 houses per street segment since the majority of the segments do not present any public house. 45 is the maximum number of public houses concentrated in a single segment (Figure 15).

Figure 29. Distribution of public housing at street segment level. Year 2011

114
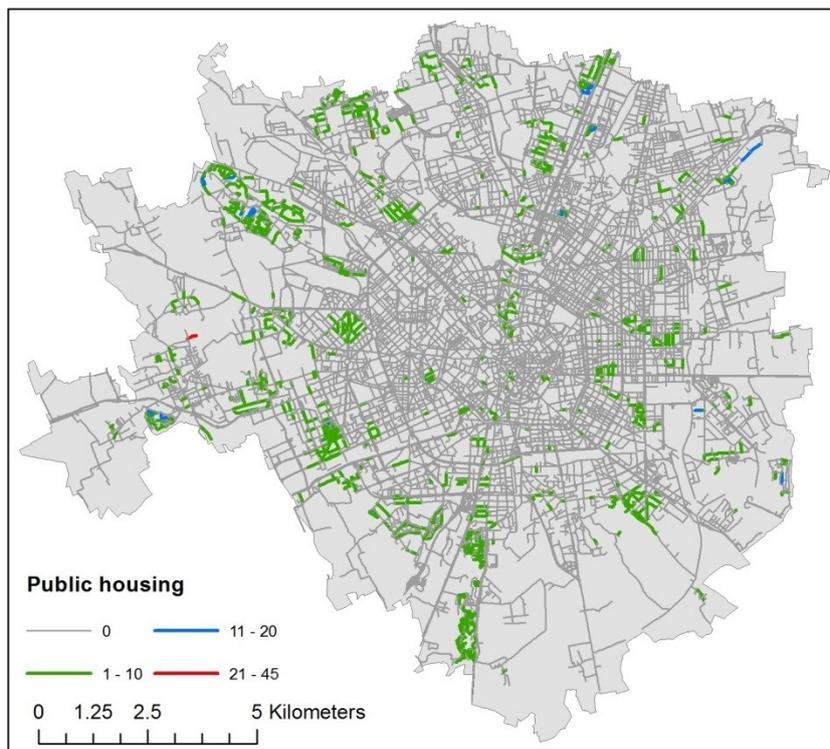
Source: author's elaboration Municipality of Milan (ALER)'s data.

Table 15. Descriptive statistics of public housing. Year 2011

Variable	Observations	Mean	SD	Min	Max
Public housing	18973	.1293944	.8463355	0	45

Source: author's elaboration Municipality of Milan (ALER)'s data.

Type of land use

Another aspect that can be directly related to the social disorganization theory is the type of land use (see Sampson and Groves 1989). There are controversial points of view in taking into account land use in relation to crime occurrence. Several studies have proved how mixed land uses are more likely to experience higher crime rates because of the weaker ties that are present among residents of such types of land (Roncek 2000; Groff and McCord 2011; Weisburd, Groff, and Yang 2012). Indeed, land use seems to be connected with the strength of social control (Taylor 1997; Wilcox et al. 2004). Mixed lands may present a higher level of anonymity compared to residential lands and influence crime rates. In the same vain, also public spaces are supposed to generate crime because they are owned by everybody and nobody in the same time (Groff and McCord 2011). They do not usually have managers who are responsible for them, because the entire community should take care and monitor common spaces. On the other hand, mixed lands and public places may also be characterized by a high level of informal control because they are always crowded places with a lot of people that can exercise control on other's people routines.

The presence of bars, theatres, cinemas or other places related to the entertainment can enhance the vitality of a commercial area which is usually empty during the evening/night or increase the perceived security in a residential area. Indeed, according to Jacobs (1961), places with mixed land use tend to draw more 'eyes on the street' because they draw a combination of visitors and residents who are at the street at different time of the day". In this sense, measuring and interpreting the effects of land use on crime can be controversial. This study includes in the present analysis both residential and mixed use in order to understand which are the influences of these measures on burglary and robbery. The first hypothesis is that residential land use is positive correlated with both burglary and robbery. Mixed land use may be positive correlated with crime because community ties can be weaker in this type of

land, or it may be negative correlated because informal control tends to be higher in mixed lands compared to other type of lands.

1. Residential and mixed land use

In 2009, the Region of Lombardy through the data DUSAF (Uso del Suolo) divided the areas of the city of Milan in different categories depending on the different land usage. These different areas were joined with each street segment in order to give to the segments the attributes of the area in which they fall inside. Residential and mixed land use were operationalized as dummy variables, so a street segment can be non-residential/residential or non-mixed/mixed.

Table 16. Descriptive statistics of residential land use. Year 2009

Variable	Observations	Non-residential (n)	Residential (n)	Non-residential (%)	Residential (%)
Residential use	18973	8,617	10,356	45.4%	54.6%

Source: author's elaboration of DUSAF's data

The variable residential land use includes the category "dense residential urban fabric", whereas the variable mixed land use comprises territories of "irregular, sparse, discontinuous residential urban fabric". The former variable present 45.4% of non-residential street segments, whereas 54.6% of residential portions of the street (Table 16). In Milan, the residential land use seems to be much more developed than the non-residential. This is quite linear considering the high population density registered by the city. Figure 30 shows spatial distribution of the residential street segments within the city.

Figure 30. Distribution of residential land use at street segment level. Year 2009
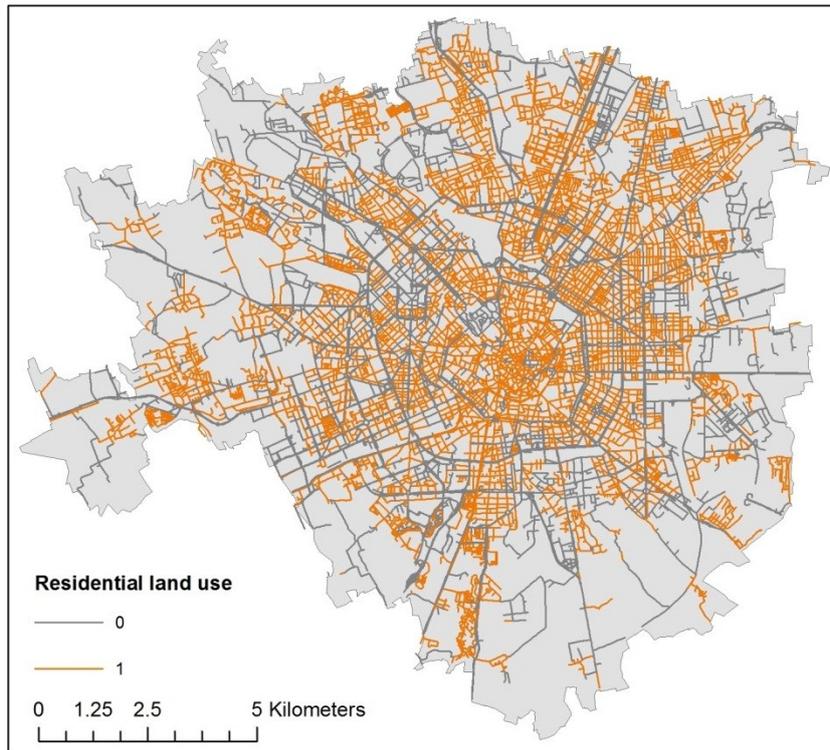
Source: author's elaboration of DUSAF's data

Regarding the latter variable, 80.5% of street segments present a non-mixed land use, whereas 19.5% a mixed land use (Table 17). In proportion, in the city of Milan, mixed land use is less widespread than residential land use (Figure 31).

Table 17. Descriptive statistics of mixed land use. Year 2009

Variable	Observations	Non-mixed	Mixed	Non-mixed (%)	Mixed (%)
Mixed use	18973	15,276	3,697	80.5%	19.5%

Source: author's elaboration of DUSAF's data

Figure 31. Distribution of mixed land use at street segment level. Year 2009
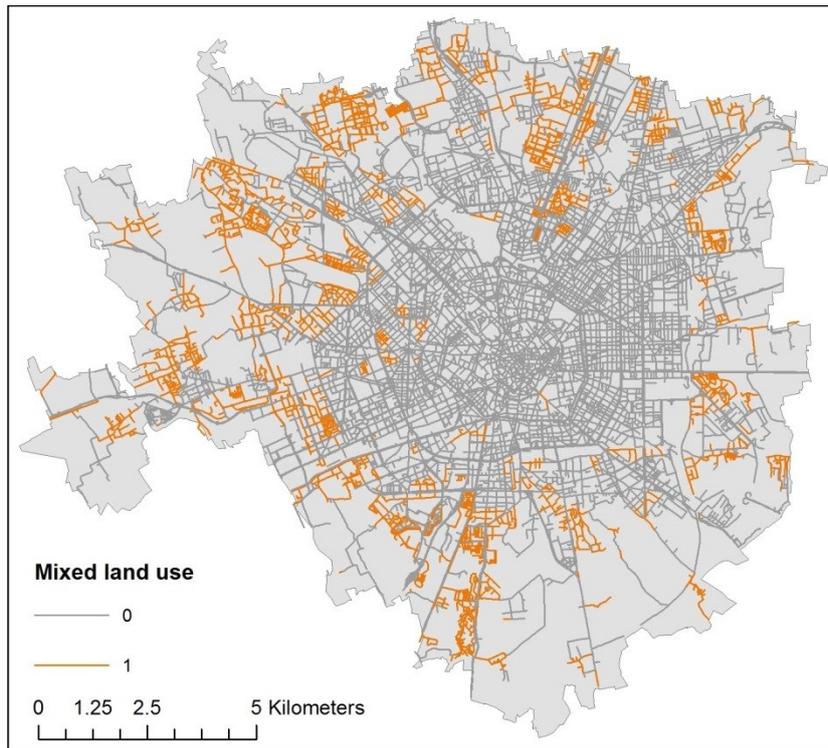
Source: author's elaboration of DUSAF's data

Disorder

The idea that physical and social disorder could create opportunities for crime in urban areas goes back to the Broken Windows Theory, first elaborated by the psychologist Zimbardo in 1969, which was then better explored by Kelling and Wilson in 1982. Disorder is described as a violation of the social rules in the use of public spaces that can lead to the development of a condition of decay of the public areas helping the proliferation of crime and antisocial behaviour caused by the lack of formal and informal control. The same concept was also key in the research of Skogan, who has studied how disorder can influence crime occurrence deteriorating informal social control and creating fear of crime (Skogan 1986; Skogan 1990). The real estate industry and the values of the real estate in those types of neighbourhoods tend to easily depreciate putting the neighbourhoods in a condition of even more insecurity and decline. In those places high level of mobility is registered which is often accompanied by a very low level of social bonds. Indeed, residents of the same building or of the same street tend to change frequently not giving the possibility to the community to get to know people who live in the area. This create the breaking up of social ties than may influence crime occurrence as theorised by the social disorganization theory.

1. Physical and social disorder

The variable measuring physical and social disorder in this study is countable and includes a number of single events of disorder reported by the Milanese Local Police between 2000 and 2010. The entire dataset of ten years was took into account in order to create a larger sample and do not incur in problems of misrepresentation of the phenomenon. 8,229 events of physical disorder and 8,151 events of social disorder were geocoded in the city of Milan (Figure 32).

Figure 32. Distribution of physical and social disorder events at street segment level. Years 2000-2010
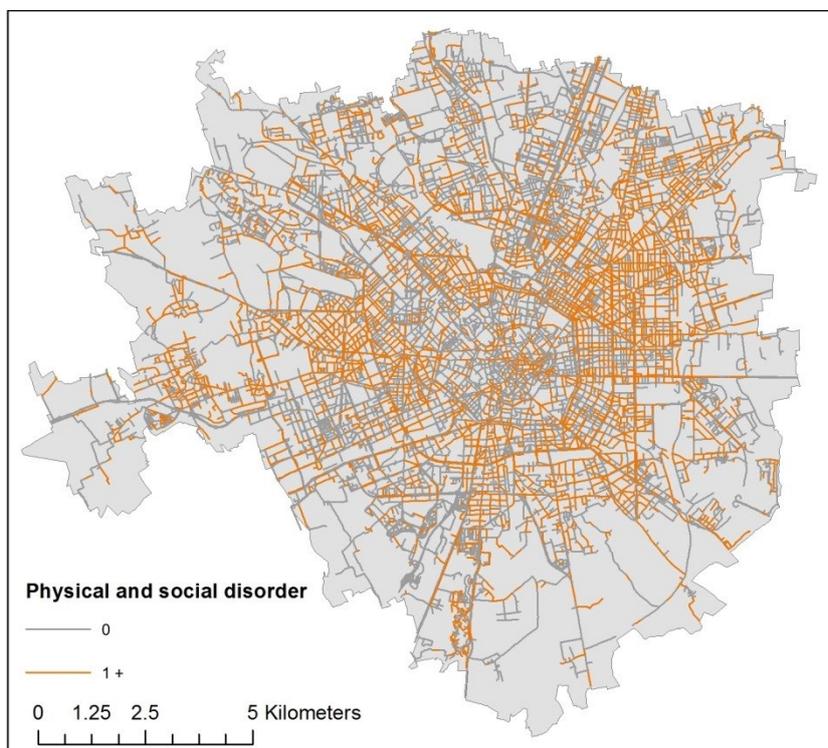
Source: author's elaboration Local Police's data

The elements connected with physical disorder included in the variable are: unauthorized encampment, abandoned area, shantytown, rough road, damage to properties/animals/lands, illegal dump, abandoned building, graffiti, noise pollution, pollution and environmental offences, squatting, missing or damaged road signs and abandoned vehicle. The episodes connected with social disorder are: begging, illegal immigration, threat, beating, street prostitution, fight, homeless people, drug dealing and illegal vendors. On average, 0.9 of these events were found at each street segment for a maximum of 110 episodes found in a single specific segment (Table 18).

Table 18. Descriptive statistics of disorder incidents. Year 2000-2011

Variable	Observations	Mean	SD	Min	Max
Disorder	18973	.8634375	3.841274	0	110

Source: author's elaboration Local Police's data

Collective efficacy

Collective efficacy reflects the willingness to residents to intervene and participate in public affairs involving the whole community. Sampson, Raudenbush, and Earls (1997) extended the concept of social disorganization including also social control as understood as the capacity of a community to realize common values and regulate behaviour through mechanisms of mutual trust. This conceptualization goes beyond the structural factors and the aspects of advantages and disadvantages, but it touches the relational aspects among individuals and the sense of belonging to a bigger community. These aspects are fundamental to the elaboration of a more comprehensive theory of social disorganization based on the social informal control. Weisburd, Groff and Yang (2012) operationalized the concept of collective efficacy including in the analysis the percentage of active voters represented on each street segment. This measure was strongly criticised by Braga and Clarke (2014) who citing Sampson (2012) stated that "levels of individual voting, while obviously civic, do not seem to define the collective civic engagement character of a neighbourhood. Individual voters may or may not be engaged in the social fabric of a neighbourhood in a way that leads to more effective monitoring of youth behaviour, intervening in acts of truancy, or doing something about people who disturb public spaces" (Braga and Clarke 2014, 488).

In an answer to this critique, Weisburd, Groff, and Yang (2014) explained how their measure was substantially different from the one used by Sampson in his piece. "Sampson examined the proportion of residents in the neighbourhood who reported voting in the last mayoral election. We measure the proportion of active voters on a street, defined by voting patterns over two years" (Weisburd, Groff, and Yang 2014, 502). According to the authors, voting once in a while does not necessarily mean strong involvement in the public life of a community, but voting constantly over time is a sign of a more strong civic engagement. Since it was not possible to measure the voting involvement over time in the city of Milan

because this study is not a longitudinal analysis, the number of associations were used to measure collective efficacy in the present work.

1. Associations

The number of associations present in the Milanese territory were geocoded through data of the Municipality of Milan. The presence of associations in a street segment can be a good predictor of the strengthening of a community. Being part of a cultural, sports or voluntary, association is considered as a strong civil engagement that can create ties and be beneficial for the whole community. This variable is assumed to be negatively associated with the presence of crime at street segment level. According to Figure 33, associations are quite widespread in the Milanese territory.

Figure 33. Distribution of associations in at street segment level. Year 2013
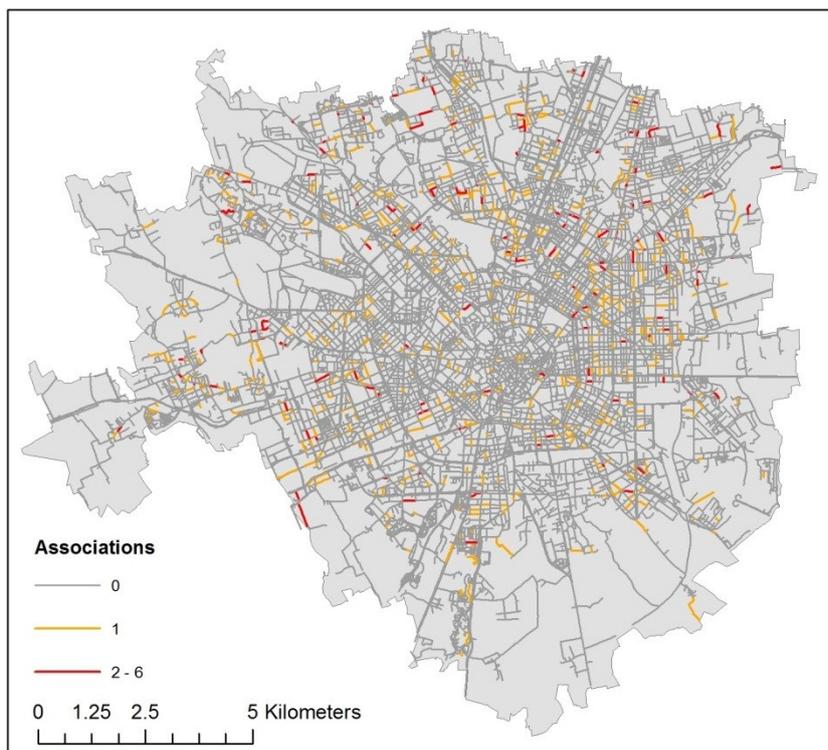
Source: author's elaboration of Municipality of Milan's data

On average, 0.03 associations are present at each segment and a maximum of 6 associations are located in a single segment (Table 19).

Table 19. Descriptive statistics of the number of associations. Year 2013

Variable	Observations	Mean	SD	Min	Max

| Associations | 18973 | .04849 | .2604944 | 0 | 6 |

Source: author's elaboration

Vicinity to the city centre

The centrality or the peripheral location of a street segment can play a central role in analysing its crime rate. Starting from the first theorization of Burgess's concentric zone model (Burgess 1925) several authors have identified the importance of measures of urbanization or position of the neighbourhoods in the urban setting. Central and peripheral areas of the city can experience different patterns in the distribution of socioeconomic conditions.

1. Circle 1 and Circle 2

Milan presents a concentric structure and a radial street network. Two circular rings cut this radial network as it is shown in Figure 34. The rings are two long circular roads called *circonvallazioni* (bypasses) which connect the North, the South, the West and the East parts of the city.

Figure 34. Map of the concentric zones of the city of Milan
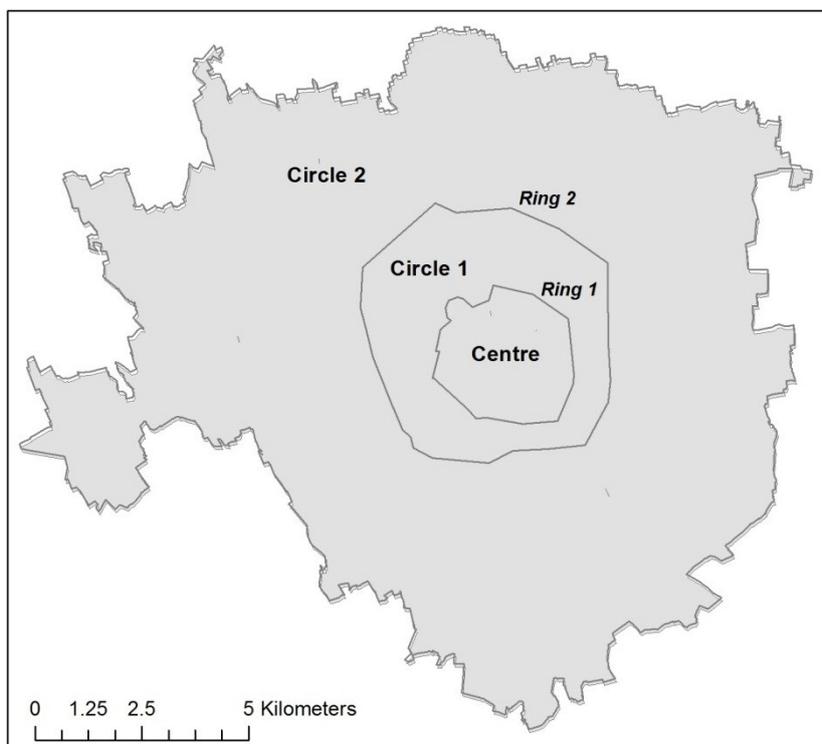
Source: author's elaboration

The first ring delimits the city centre area, whereas the second ring marks the end of the Circle 1 which goes from the city centre to the second ring, concluding that Circle 2 is the most peripheral. This is the area going from the second ring to the border of the city itself. The Circle 1, the biggest one, absorbs the largest part of the street segments compared to the Circle 1 and the city centre. The Circle 2 includes 12,835 segments, which are 67.6% of the total, whereas the Circle 2 only 21.4%. The smaller area is represented by the centre has 2,079 segments equal to 11.0% of the total (Table 20). The more peripheral areas are supposed to present higher level of burglaries and robberies compared to the city centre. Despite the city centre for most of its part is a residential area and presents a very high population density with a great number of apartments, it is also a very important commercial and business area of the city. In addition, the access to the historical centre of Milan is limited by the Congestion Charge area (Area C) on Monday, Tuesday, Wednesday and Friday from 7.30 am to 19.30 pm, and Thursday from 7.30 am to 18.00 pm. To get into "Area C" people must activate an entrance ticket of 5 euro and this can influence the accessibility in the area and discourage motivated offenders. So, Circle 1 and Circle 2 are supposed to be positive related with crime occurrence in Milan compared to the city centre.

Table 20. Descriptive statistics of the vicinity to the city centre in Milan. Year 2013

Variable	Observations	Centre	First zone	Second zone
Vicinity to the city centre	18973	2,079 (11.0%)	4,059 (21.4%)	12,835 (67.6%)

Source: author's elaboration

Control Variables

The length of the street segments were kept under control in the models for burglary and robbery. It is possible that longer segments can experience more crime compared to shorter segments. To avoid these problems, in all the models the length in meters of each segment was included in the analysis as a control. In addition, it was introduced as a control also the variable spatial lag computed with GeoDa to account for spatial autocorrelations.

In conclusion, Table 21 summaries the variables connected with social disorganization theories took into account in the analysis of burglary and robbery.

Table 21. Summary of the explanatory variables connected with social disorganization theory used for both models

Social disorganization theory- BURGLARY and ROBBERY					
Variable	**Definition**	**Source**	**Year**	**Proxy**	**Type of variable**
Real estate value	Dummy variable (under/above the average) created on the average values of apartments/houses/villas expressed euro/m^2	Real Estate and Land Registry Agency	2011	Socio-economic factor	Explanatory
Public housing	Total number of public housing on each street segment	Public housing's Company of the Municipality of Milan (ALER)	2011	Socio-economic factor	Explanatory
Residential use	Total number of segments that present a "dense residential urban fabric"	DUSAF	2009	Land use	Explanatory
Mixed use	Total number of segments that present a "irregular, sparse, discontinuous residential urban fabric"	DUSAF	2009	Land use	Explanatory
Physical and social disorder	Total number of physical and social events happened at each street segment	Local Police	2000-2010	Disorder	Explanatory
Associations	Total number of associations at each street segment	Municipality of Milan	2013	Collective efficacy	Explanatory
Concentric Zone	Number of street segments belonging to the first and the second zone	Municipality of Milan	2013	Urbanization	Explanatory
Length	Length of each street segment in meters	Authors' elaboration	2014	Type of street	Control
Spatial lag	Measures of spatial autocorrelation	Authors'elaboration	2014	Type of street	Control

III.3 Conclusions

To test the presence of crime concentrations outside the U.S. and the stability of these concentrations over time, a street segment analysis was conducted in the city of Milan. The city was chosen because of data availability and because it represents a reliable example of European city. Indeed, Europe presents a lack of knowledge on the topic and few studies have been conducted at street segment level. The street network of the city of Milan was re-adapted and divided in 18,973 street segments. The average length of these street segments is 106 meters, very similar to the average length of the street segments grid used in the prior study in Seattle (118 meters). A total number of 43,615 crime incidents between 2007 and 2013 were joined to the street segment network. 32,477 burglaries and 11,138 robberies were geocoded in the city representing, respectively, a proxy for property crime and a proxy for violent crime. The percentage of geocoding is around 70% for the former and 50% for the latter.

The second challenge of this study is understanding what the determinants influencing crime concentrations in the city of Milan were. Therefore, a set of negative binomial regressions models were conducted. This method was chosen because of the over-dispersed nature of the count variables identified by the analysis. The dependent variables included in the models are the total number of burglaries and the total number or robberies experienced by each street segment from 2009 to 2013. The explanatory variables included in the analysis are a set of measures of opportunity and social disorganization factors collected in a fixed year for each street segment. As mentioned before, the models do not include the entire period under study (2007-2013), but only the last five years (2009-2013). This is mainly because it has been assumed that the explanatory variables have remained quite stable over the last five years, but this cannot be assumed for the entire period under study.

Because of the economic crisis that substantially hit the southern part of Europe in 2008, it is particularly risky to assume stability before and after this year. As a consequence, the statistical analysis was conducted only in the last five years and data on opportunity and social disorganization factors were collected for the last available year (2013), when possible, and not going back before 2009. Two different set of models were computed depending on which crime type was took into account. Different opportunity measures were connected with burglary and robbery since only certain types of situational factors can lead to certain types of

crime. On the other hand, the same social disorganization measures were included in the different set of models because these determinants represent structural features of the places and specific characteristics of the communities that should affect any type of crime.

CHAPTER IV. Presentation of the results

This chapter illustrates the results of this study answering the two main questions held in the second chapter:

Question 1: Is the presence of crime concentrations confirmed outside the U.S.? If yes, are crime concentrations stable over time?
Question 2: Do opportunity theory and social disorganization theory play a central role in explaining crime concentrations outside the U.S.?

These research questions were translated in two main objectives, which aim at testing the presence of crime concentrations and their potential stability in a European city and testing the effect of opportunity and social disorganization factors explaining crime concentrations. The city of Milan was chosen as reliable example of European city. This choice was driven by data availability, but also because the city presented a unique opportunity to test the law of crime concentrations outside the United States. The urban centre presents the distinctiveness of the European circular urban model in contrast with the grid model structure typical of the US cities.

IV.1 Objective 1: crime concentrations and their stability in the city of Milan

IV.1.1 Crime concentrations

To test crime concentrations in the city of Milan, 11,138 robberies and 32,477 burglaries were geocoded between 2007 and 2013 to conduct a street segments analysis. Robberies represent a proxy for violent crime, whereas burglaries for property crimes. A total of 43,615 crime incidents were joined to 18,973 street segments.

Looking at the frequency distribution of robberies and burglaries among the street segments it is quite noticeable that the majority of the segments do not present any crime incidents (Table 22 and Table 23). Each year the segments that present 0 crimes are on average around 85% in the case of burglary and around 94% in the case of robbery. This means that almost all crime incidents are concentrated, respectively, in the remaining 15% and 6% of the street segments. The crime concentrations, in the case of Milan, seem to be even tighter if compared to any other U.S. and Israeli city. On average, 9.7% street segments present 1 incident of burglary, whereas 3.1% register 2 of these property offences. For

robbery, on average 4.4% street segments register 1 incident, whereas only 0.9% 2 offences. For both types of crime, more than 2 incidents are registered in a residual group of street segments. The only exception may be represented by burglaries in 2012 and 2013. Indeed, in these years, respectively, 1.8% and 2.1% of street segments experienced 3 incidents of burglary which is a quite high number compared to the other years.

Table 22. Frequency distribution of burglaries. Numbers and percentages per year

	BURGLARIES					
	0	**1**	**2**	**3**	**4**	**from 5 to 25**
2007	16,463 (86.8%)	1,760 (9.3%)	483 (2.5%)	156 (0.8%)	57 (0.3%)	54 (0.3%)
2008	16,586 (87.4%)	1,666 (8.8%)	462 (2.4%)	159 (0.8%)	50 (0.3%)	50 (0.3%)
2009	16,770 (88.4%)	1,611 (8.5%)	403 (2.1%)	110 (0.6%)	45 (0.2%)	34 (0.2%)
2010	16,426 (86.6%)	1,723 (9.1%)	505 (2.7%)	204 (1.1%)	59 (0.3%)	56 (0.3%)
2011	16,153 (85.1%)	1,866 (9.8%)	580 (3.1%)	211 (1.1%)	79 (0.4%)	84 (0.4%)
2012	15,405 (81.2%)	2,133 (11.2%)	828 (4.4%)	335 (1.8%)	133 (0.7%)	139 (0.7%)
2013	15,080 (79.5%)	2,174 (11.5%)	913 (4.8%)	398 (2.1%)	188 (1.0%)	220 (1.2%)

Source: author's elaboration of Ministry of Interior's data

Table 23. Frequency distribution of robberies. Numbers and percentages per year

	ROBBERY					
	0	**1**	**2**	**3**	**4**	**from 5 to 25**
2007	17,670 (93.1%)	1,006 (5.3%)	194 (1.0%)	56 (0.3%)	13 (0.1%)	34 (0.2%)
2008	17,694 (93.3%)	964 (5.1%)	198 (1.0%)	55 (0.3%)	31 (0.2%)	31 (0.2%)
2009	18,100 (95.4%)	672 (3.5%)	114 (0.6%)	37 (0.2%)	22 (0.1%)	28 (0.1%)
2010	18,064 (95.2%)	709 (3.7%)	135 (0.7%)	38 (0.2%)	12 (0.1%)	15 (0.1%)
2011	17,721 (93.4%)	911 (4.8%)	202 (1.1%)	71 (0.4%)	27 (0.1%)	41 (0.2%)
2012	17,928 (94.5%)	803 (4.2%)	163 (0.9%)	44 (0.2%)	19 (0.1%)	16 (0.1%)
2013	17,966 (94.7%)	803 (4.2%)	139 (0.7%)	39 (0.2%)	16 (0.1%)	10 (0.1%)

Source: author's elaboration of Ministry of Interior's data

Taking into account the percentage of street segments that accounts for 50% and 100% of burglaries and robberies, on average, 4.0% of street segments concentrate 50% of burglaries and 1.6% of segments the 50% of robberies. The law of crime concentrations in Milan is largely confirmed as it can be deduced looking at Figure 35 and Figure 36. Between the years of 2007 to 2013, burglaries and robberies were concentrated in very few street segments. The crime concentrations of robbery are very high compared to burglaries, as well as their relation to the crime concentrations recorded in the U.S. cities and in Israel.

The higher level of concentration for burglary was registered in 2009 when 3.3% of segments experienced 50% of crime events and 11.6% of segments register 100% of offences (Figure 35). Burglaries tend to be less concentrated in 2012 and 2013 when, respectively, 50% of the offences happened in 5.1% of street segments. In these years the totality of the crime events occurred, respectively, in 18.8% and 20.5% of segments.

Figure 35. Percentage of street segments that accounts for 50% and 100% of burglaries
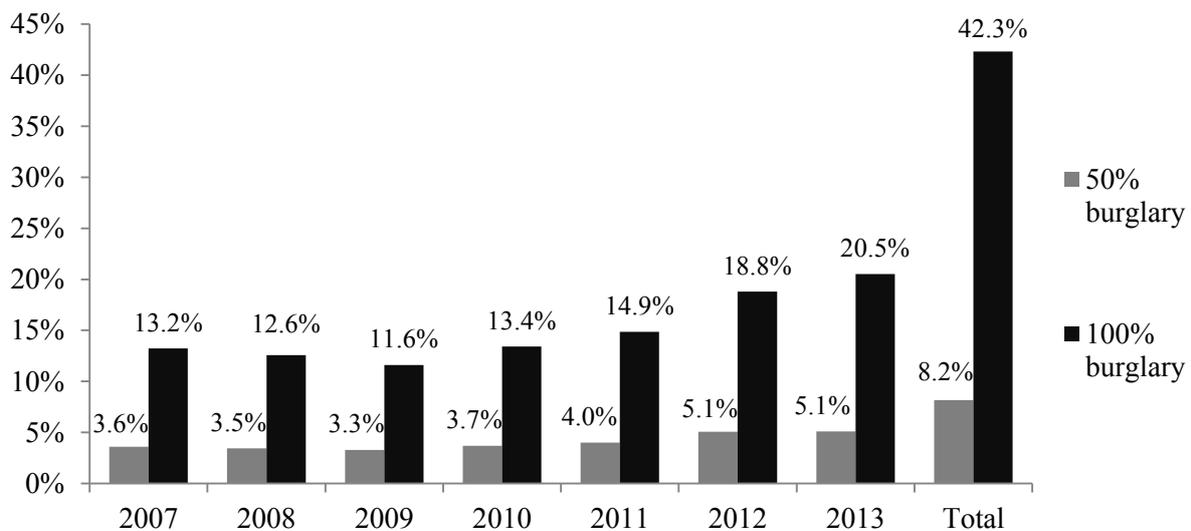
Source: author's elaboration of Ministry of Interior's data

Also in the case of robbery, the year with the highest crime concentration occurred in 2009 (Figure 36). In this year, 1.3% of segments experienced 50% of crime events, whereas 4.5% of segments the totality of crime occurred in the year. Except for 2009, 50% of robberies tend to concentrate always around 1.6% of street segments. Only in 2013, this percentage reaches 1.8%. Regarding the totality of robberies, 100% of crime events are less concentrated in 2007,

2008 and 2011. In these years, the percentage of street segments is around 6.7% which is quite high compared to the other years.

Figure 36. Percentage of street segments that accounts for 50% and 100% of robberis
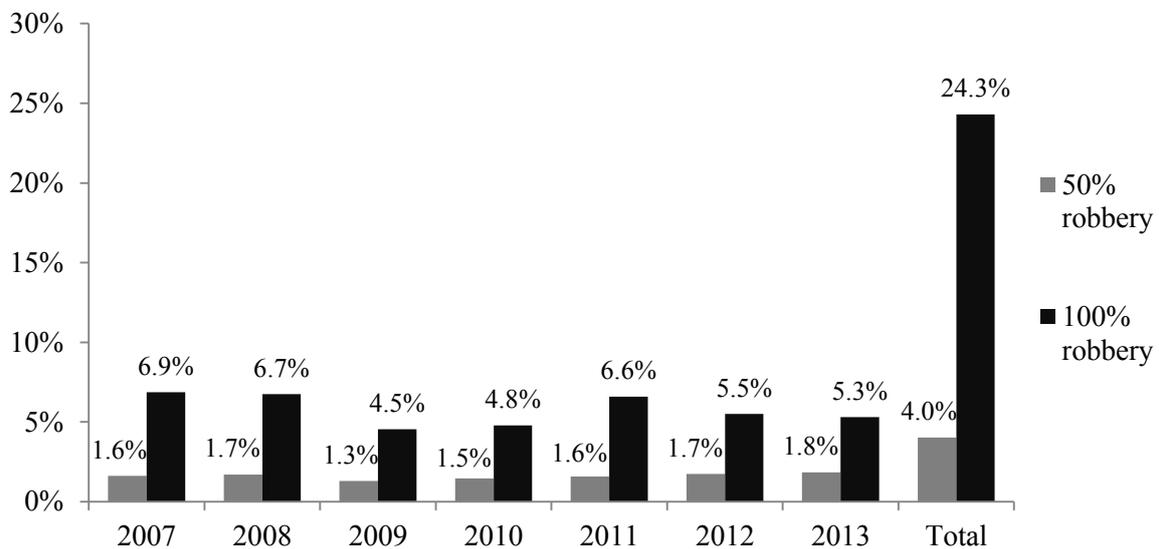
Source: author's elaboration of Ministry of Interior's data

It is worth mentioning that, due to the problems related to the geocoding rates, the results have to be carefully taken into account, especially in the case of robbery in 2012 and 2013. Indeed, these years present a lower geocoding percentages and this could have in impact in the results. Anyway, the findings seem quite strong if looking at the entire data time series and both Figure 35 and Figure 36 present interesting results on how crime concentrations are different if comparing the two crime types. Despite possible differences in the geocoding rates year by year, the same percentages of robberies tend to concentrate in a much smaller number of street segments compared to burglaries. Robberies may concentrate where people usually concentrate, whereas targets of burglaries may be more widespread in the entire territory of the city.

Usually, the majority of the streets present concentrations of apartments and houses, whereas crowded places which attract a large number of people are concentrated in fewer streets. As well as targets of robberies can be more concentrated in the space, also facilitators of this type of crime may be more concentrated in specific places. The visual representations of the distribution of burglaries and robberies presented in Figure 37 and Figure 38 confirm

these differences. The maps show the number of burglaries and robberies per each street segment per each year. For a visual purpose and to focus the attention of the reader only on the street segments where actually occurred something, the maps do not show the segments that do not record any crime event. Segments where occurred only 1 incident in the entire year are marked as green lines, whereas segments experienced from 2 to 5 offences with the blue line. Orange lines represent segments that registered from 6 to 10 crimes per year and red lines segments with more than 11 offences. For both types of crime, concentrations change in intensity and they sometimes change location year by year. A number of street segments present a high crime level for the entire period under study, this is the case of the Stazione Centrale – Central Station, but other segments present high level one year and no crime events the year after and vice versa.

This results support the idea of tailoring specific preventive actions on different types of crime and producing better analysis on the stability of the street segments. As conceptualized by Clarke and the situational crime prevention framework, it is important to make distinctions between the different types of offence and do not treat crime as a macro category per se. Indeed, targeting is the first step to create effective preventive measures able to impact the opportunity structure of each type of crime. In this vein, different preventive measures can be identified for burglaries and robberies in the city of Milan only if these offences are analysed as separated. For these reasons, in the next paragraph, different negative binomial models will be conducted depending on which type of crime will be took into account in the analysis. Specific situational variables were identified for burglary and for robbery in order to understand the determinants of the concentrations of these two offences in the city (see III.2 Objective 2: testing the effect of opportunity and social disorganization theories).

Prior studies on crime concentrations, such as the ones conducted in Seattle, Tel Aviv-Jaffa and New York did not differentiate the analysis depending on different types of crime (Weisburd et al. 2004; Weisburd, Groff, and Yang 2012; Weisburd, Telep, and Lawton 2013; Weisburd, Groff, and Yang 2014). They draw conclusions on the general level of crime across street segments over time without targeting specific measures to specific crime types. On the contrary, this study presents a first attempt to identify similarities and dissimilarities among different offences. This is just a first steps and many other crime types need to be

taken into account in order to have a better picture of the crime situation at small unit of geography in Milan.

The concentration of the total number of burglaries and robberies occurred from 2007 to 2013 is less tight compared to the crime concentrations experienced every year. Summing all the burglaries happened between 2007 and 2013, 8.2% of street segments account for 50% of events and 42.3% of the street segments experience 100% offences. Summing all the robberies, 4.0% and 24.3% of the street segments experienced, respectively, 50% and 100% of crime events. These represent quite high percentages if compared with the crime concentrations experienced each single year. This may be due to the fact that burglaries and robberies are not experienced by the same street segments each year. There are a number of segments that experience crimes one year and are free from offences the next year and vice versa. This may induce to better analyse crime concentrations among the years and their stability.

The presence of crime concentrations in the city of Milan is confirmed also in this urban context. However, the stability of these crime concentrations across the years need to be further explored. Indeed, the descriptive and visual representations can only shine a light in the understanding of the dynamics of stability or instability of the crime concentrations in the city. This issue will be better explored in the next paragraph (see IV.1.2. Stability of the crime concetrations).

Figure 37. Distribution of burglaries among the street segments. Years 2007-2013
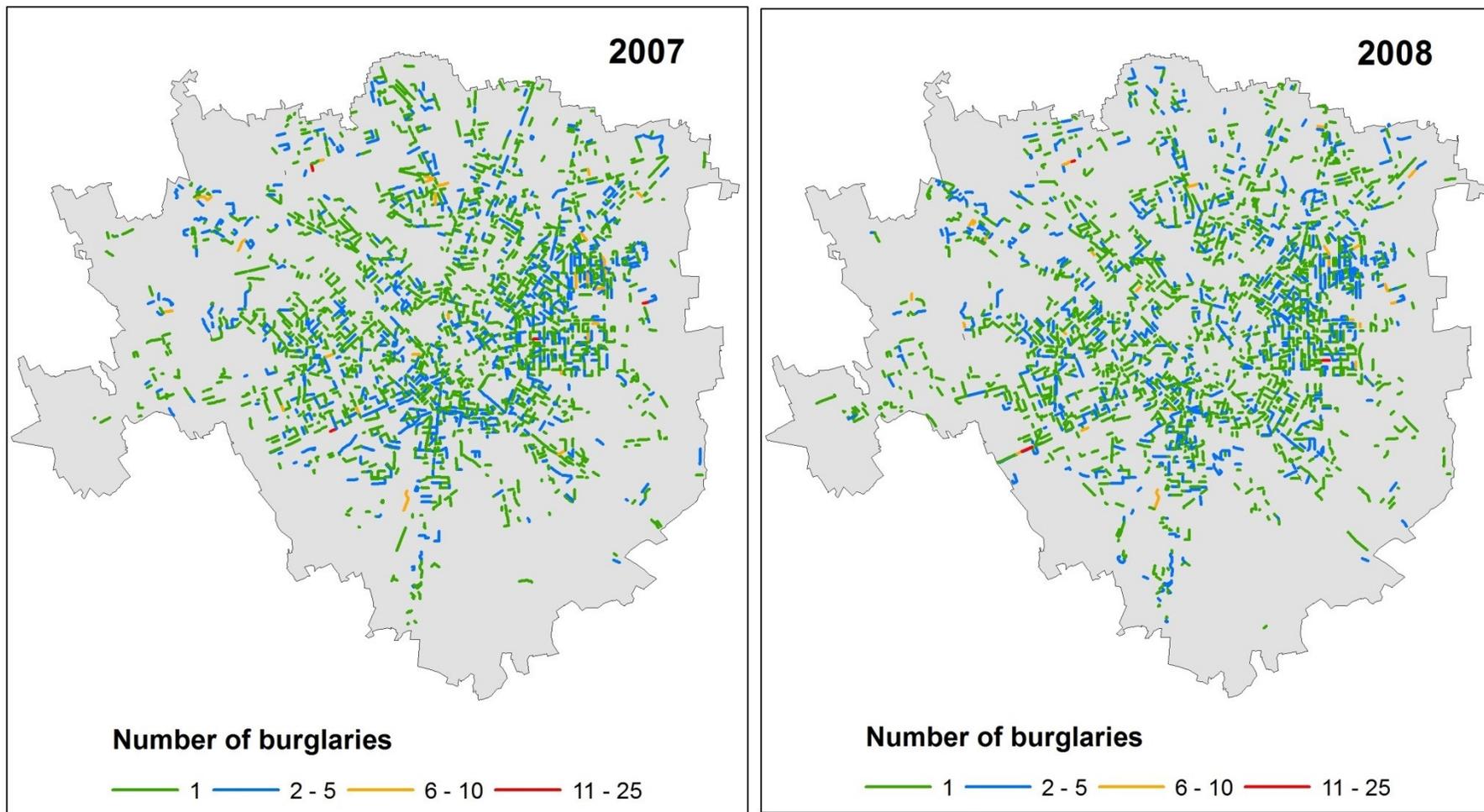
Source: author's elaboration of Ministry of Interior's data
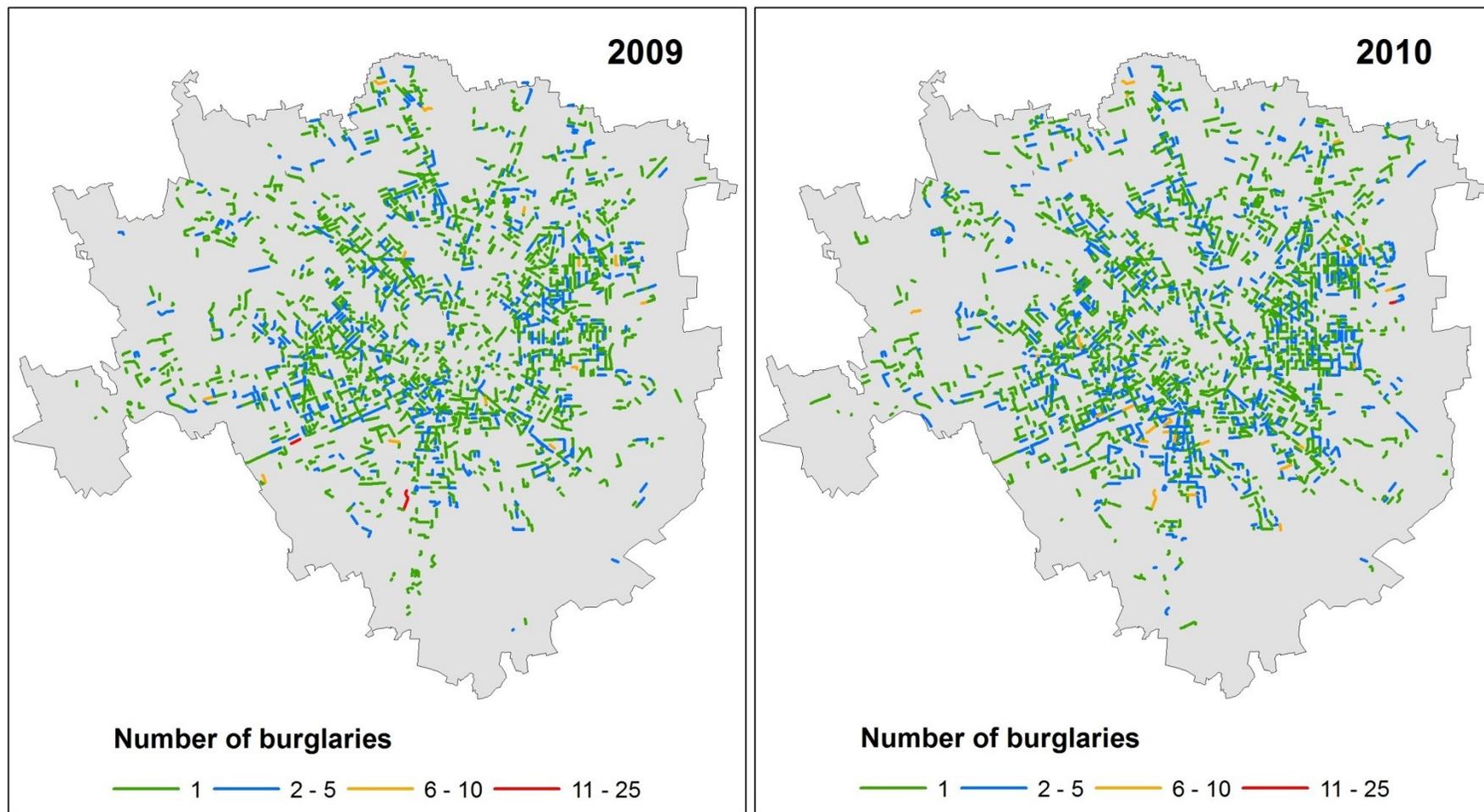
Source: author's elaboration of Ministry of Interior's data
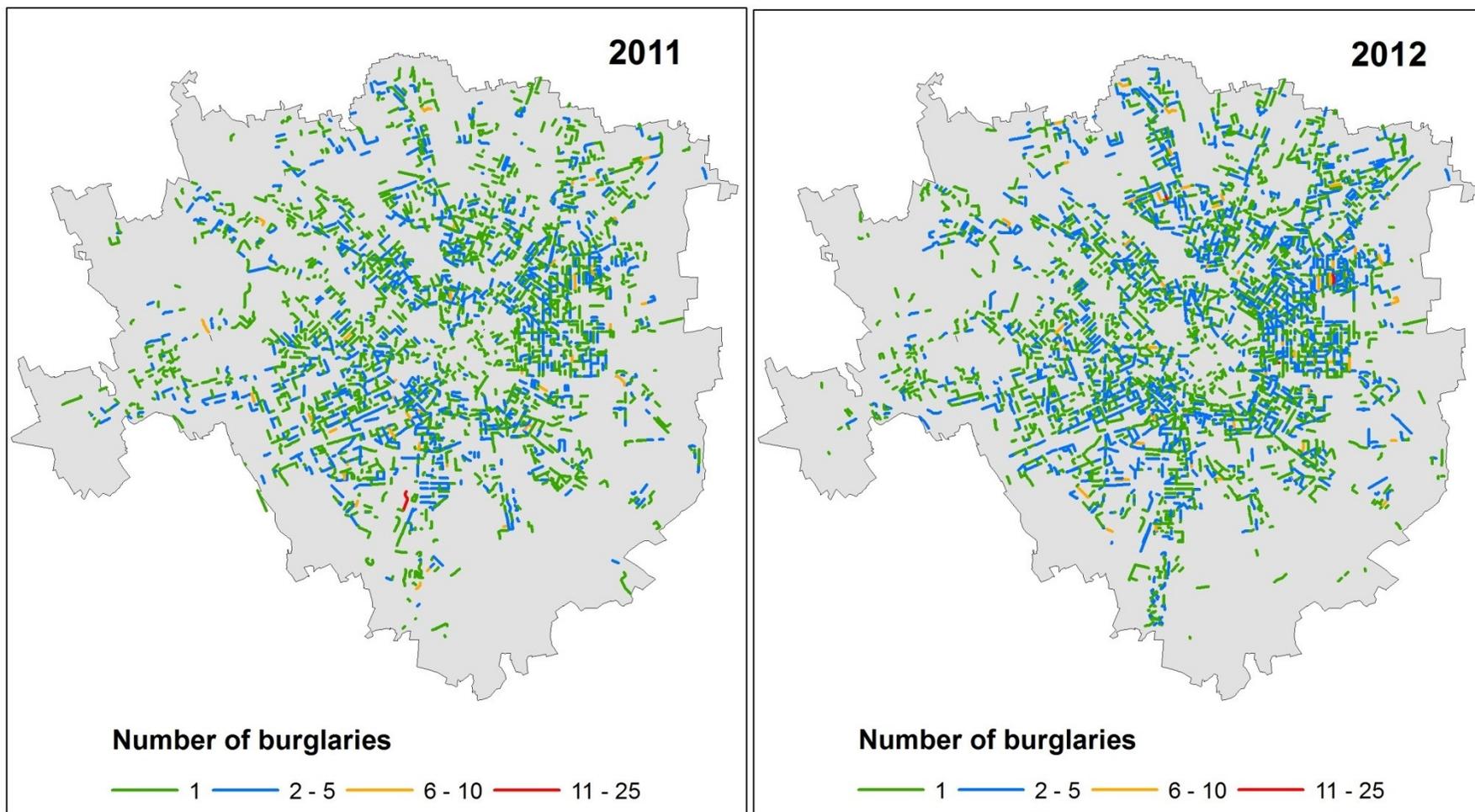
Source: author's elaboration of Ministry of Interior's data
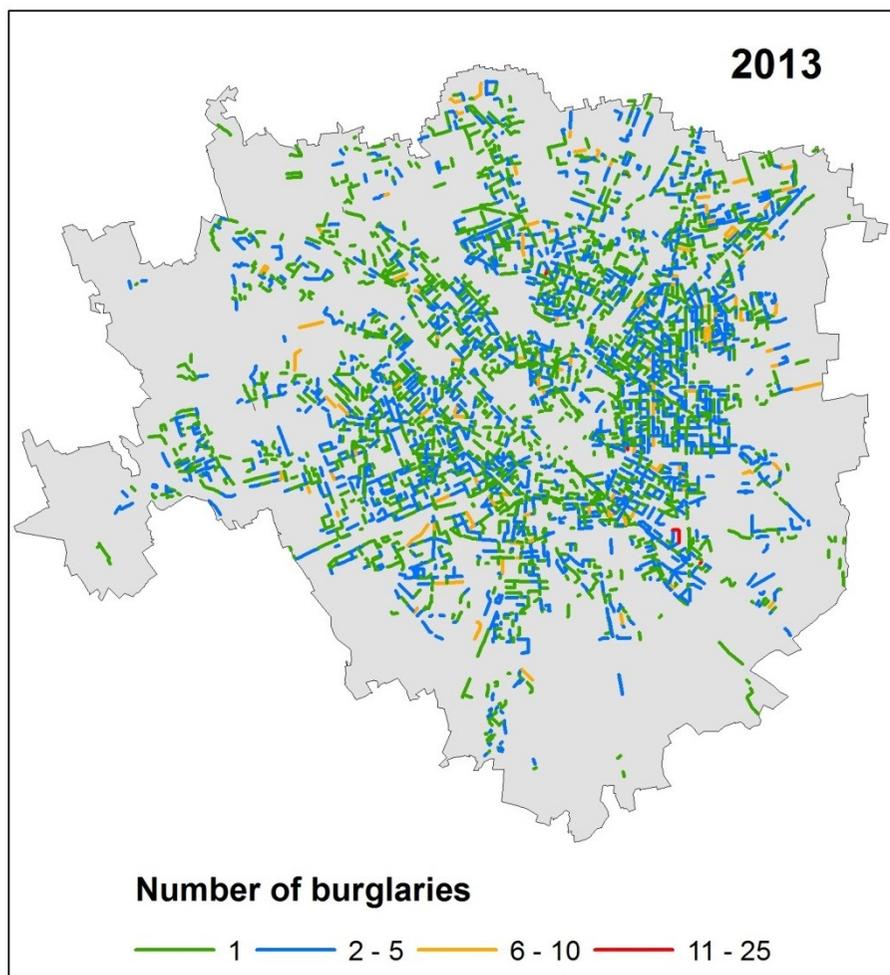
Source: author's elaboration of Ministry of Interior's data

Figure 38. Distribution of robberies among the street segments. Years 2007-2013
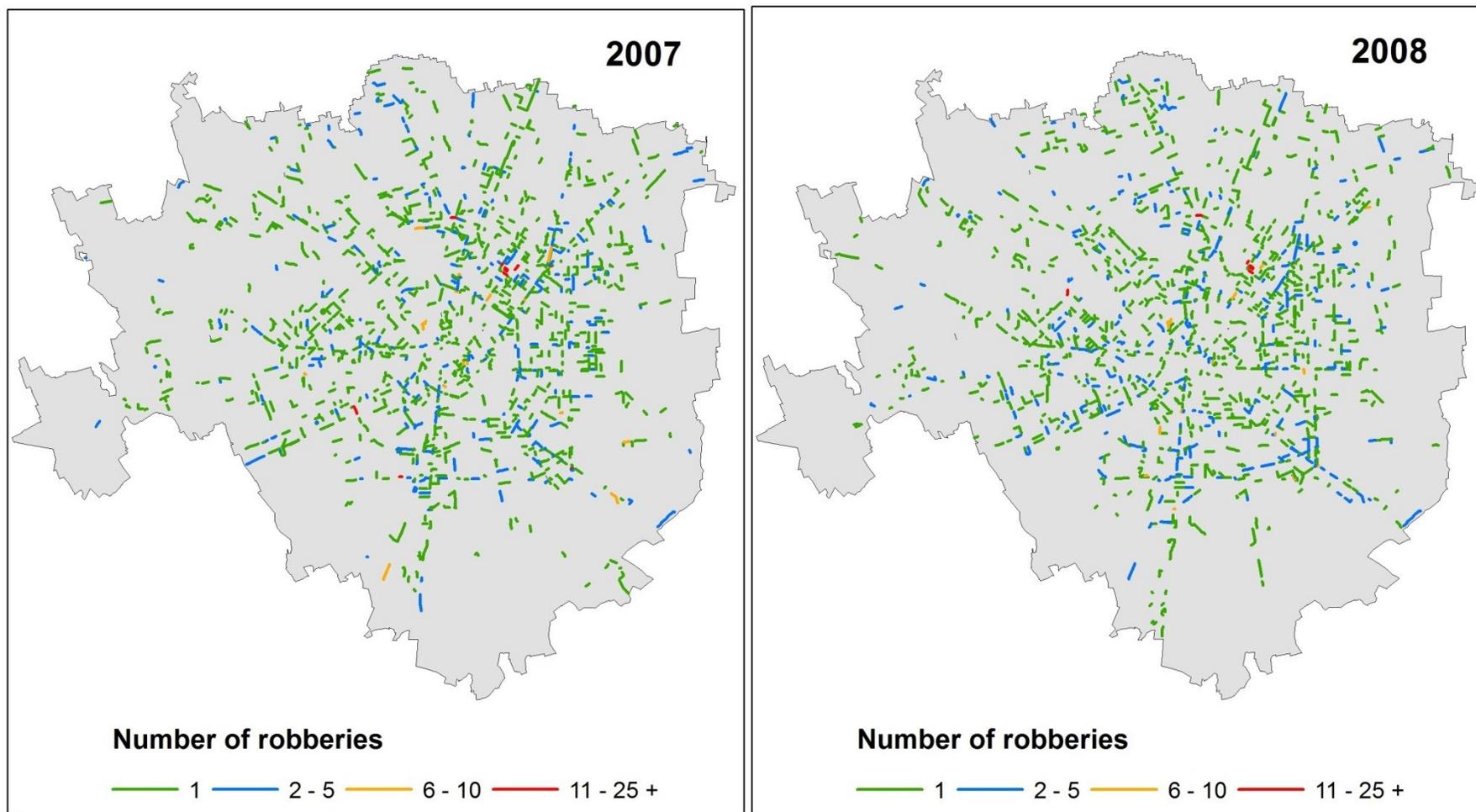
Source: author's elaboration of Ministry of Interior's data
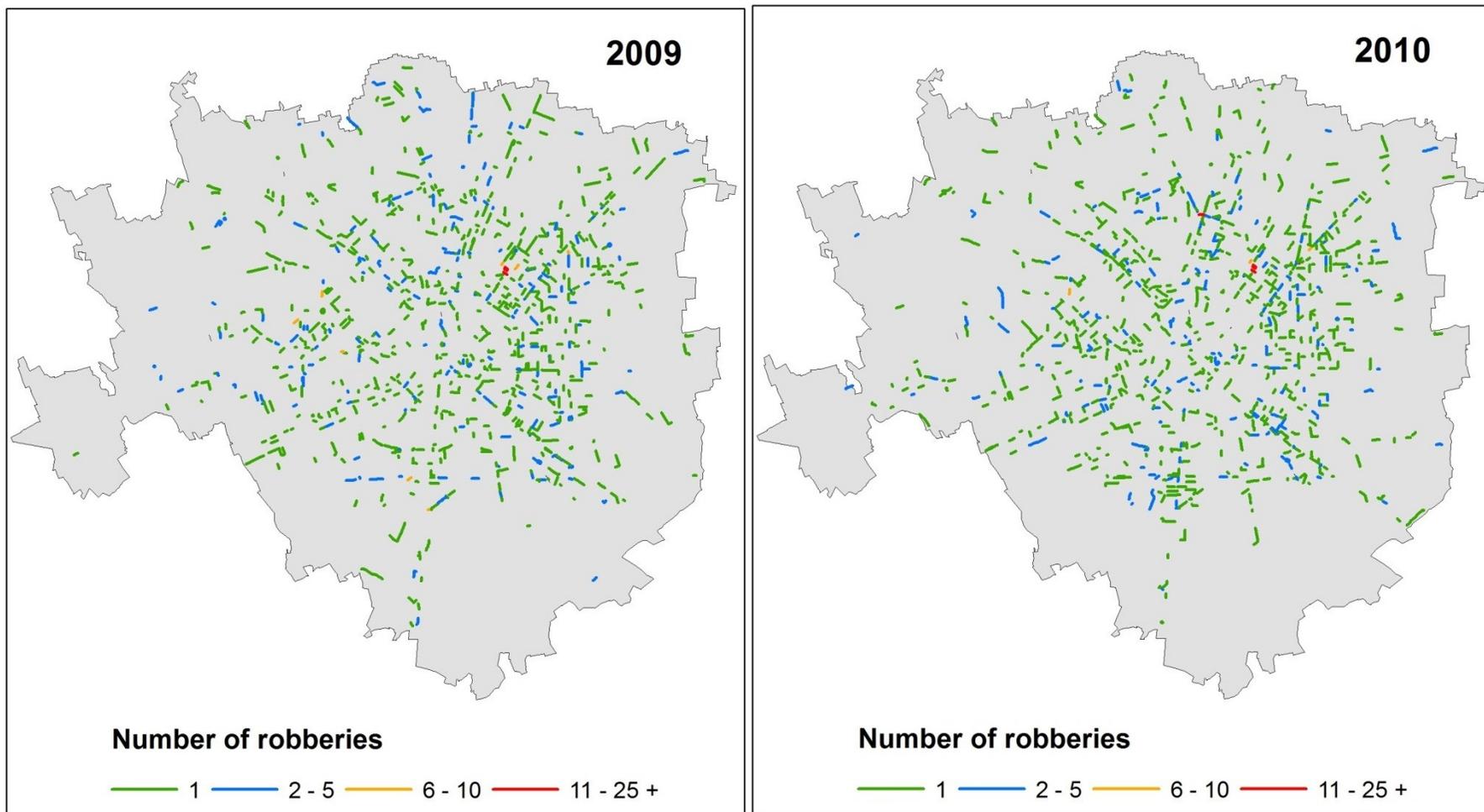
Source: author's elaboration of Ministry of Interior's data
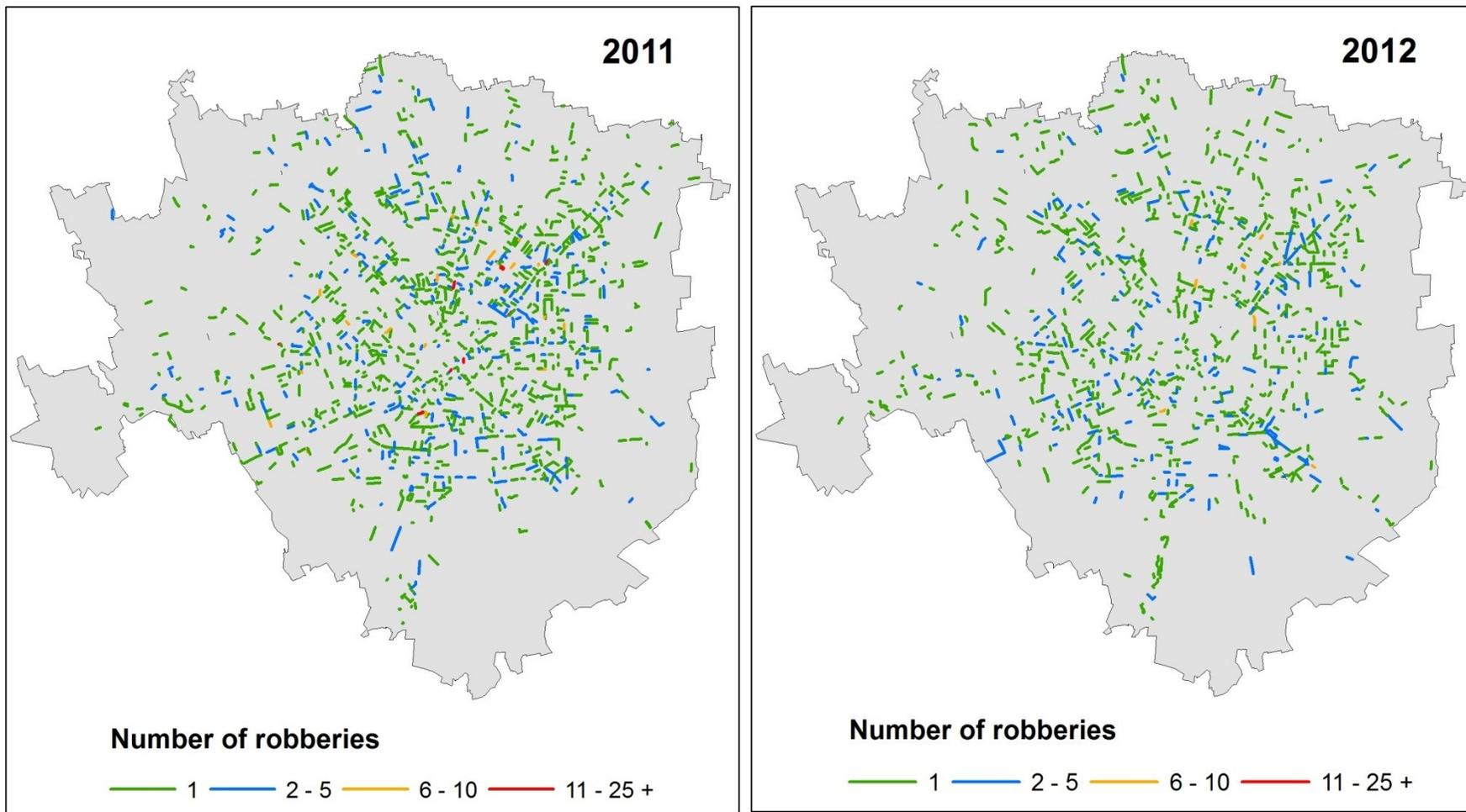
Source: author's elaboration of Ministry of Interior's data
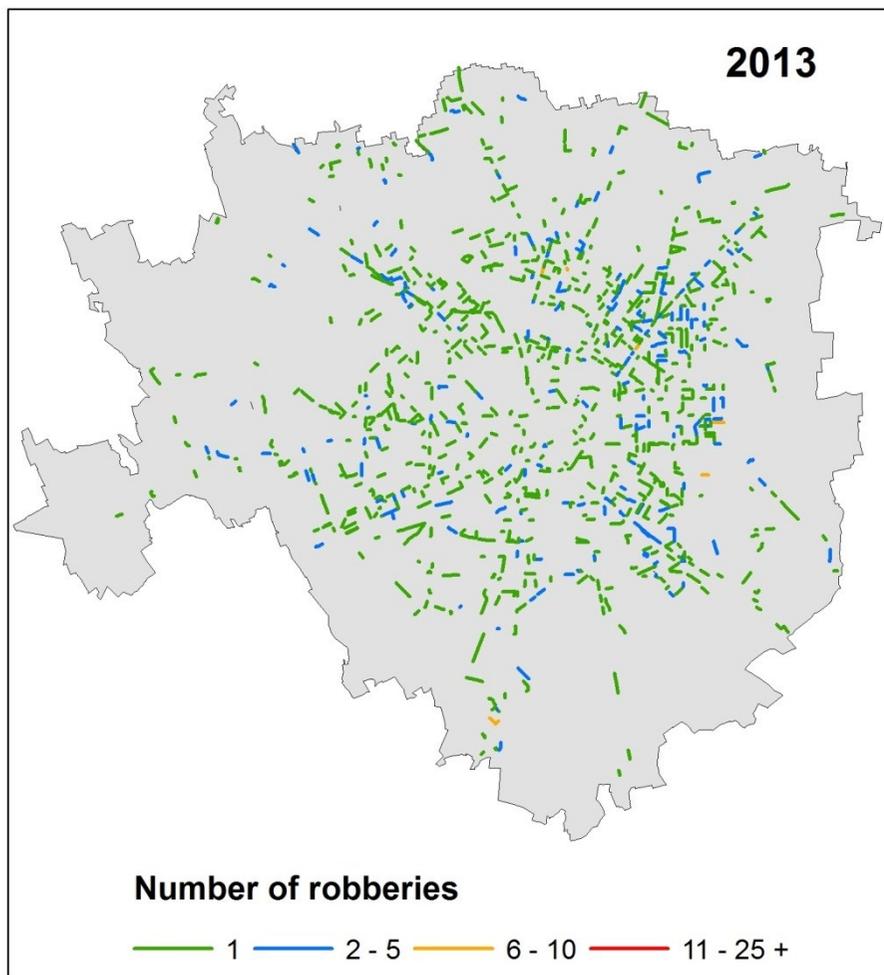
Source: author's elaboration of Ministry of Interior's data

IV.1.2. Stability of the crime concetrations

Weisburd, Groff and Yang (2012), after having found crime concentrations in the city of Seattle over a 16-year period, tested the stability of these concentrations using group-based trajectory analysis. Daniel Nagin applied this method to the social sciences and to criminology in order to understand if micro-places have generally stable concentrations of crime over time (Nagin and Land 1993; Nagin 1999). According to the scholar, "developmental trajectory is used to describe the progression of any phenomenon, whether behavioural, biological, or physical" (Nagin 2010, 53). The longitudinal analysis of crime trajectories in the city of Seattle found eight main crime patterns characterizing the crime distribution across the years. These patterns (crime free; low stable; low decreasing; low increasing; moderate stable; high decreasing; high increasing; high chronic) are proved to be stable over time. This means there are street segments which do not present any crime events for the entire period, segments which have always low, moderate or high levels of crime and segments which present high chronic level of crime.

For this study it was not possible to conduct a group-based trajectory analysis since data were originally insufficient to carry out a longitudinal analysis. The Ministry of the Interior has originally provided data on reported crime events between 2007 and 2010. An integration of this data was recently provided in March 2014, allowing for the possibility to include the most updated data between the years of 2011 to 2013. The dataset comprises seven years which are still a small sample in order to conduct a group-based trajectory analysis if compared to the 16-year period used by Weisburd, Groff and Yang (2012). In addition, problems of timing and scheduling made not possible the formulation of any type of longitudinal analysis on crime patterns. Nevertheless, to understand the stability a set of dummy variables were created in order to explore if the same number of street segments present high numbers of burglaries and robberies among the years. For each year and each type of crime, a dummy variable (0; 1) was created to measure weather the street segments that account for 50% of crime remain stable over time.

If a segment registers 1 in a specific year it means it belongs to the group of street segments that account for 50% of crime in that specific year. If a segment registers 0 it means

that it do not belong to the segments accounting for 50% of crime. Following this method, the dummy variables were created for each year per each type of crime. Table 24 and Table 25 show that only 10 segments for burglary and 5 segments for robbery belong to the group accounting for 50% of crime for the seven years under analysis. These segments can be considered as high-risk streets, even though they represent, respectively, 0.05% and 0.03% of the total street segments of Milan. Indeed, the majority of the segments registered 0, so they are not part of the group accounting for 50% of crime, for the entire period under analysis. In the case of burglary, 84.53% of the segments registered 0 for all the seven years and in the case of robbery, 93.39%. Therefore, it seems that very few street segments account for 50% of crime over the years, whereas a large amount of them are not part of this group. In this way, this study was able to understand year to year stability across the seven available years, even though it is something quite different from assessing stable patterns of crime over time as other studies did.

Table 24. Distribution of street segments among the years, 2007-2013. Burglary

	Number of segments belonging to the group accounting for 50% of burglaries	Percentage of the segments belonging to the group accounting for 50% of burglaries
7 years	10	0.05%
6 years	35	0.18%
5 years	74	0.39%
4 years	173	0.91%
3 years	334	1.76%
2 years	704	3.71%
1 year	1605	8.46%
0 year	16038	84.53%

Source: author's elaboration of Ministry of Interior's data

It is worth mentioning that this simple and descriptive method gives an overall magnitude of the stability of crime concentration out of the total data and it permits to take into account the intermittency. Even the most active criminals or places could stop committing crime for one year because of several different reasons. To tally how often each segment shows up in the high crime group help to take under control this important variations. Further analysis is

needed to better address this issue such as the development of a group-based trajectories analysis.

Table 25. Distribution of street segments among the years, 2007-2013. Robbery

	Number of segments belonging to the group accounting for 50% of robberies	Percentage of the segments belonging to the group accounting for 50% of robberies
7 years	5	0.03%
6 years	12	0.06%
5 years	18	0.09%
4 years	68	0.36%
3 years	121	0.64%
2 years	268	1.41%
1 year	763	4.02%
0 year	17718	93.39%

Source: author's elaboration of Ministry of Interior's data

IV.2 Objective 2: effects of opportunity and social disorganization factors on crime at street segments

At this point, the study has tested the first hypothesis and confirmed the presence of crime concentrations among the street segments in the city of Milan (see IV.1.1 Crime concentrations). In the meantime, the analysis has also explored the stability of these concentrations both for burglary and robbery. Indeed, descriptive evidences and the analysis of crime distributions over the years confirmed the hypothesis of stability for each type of crime (see IV.1.2. Stability of the crime concetrations).

To test the effects of opportunity and social disorganization factors on burglary and robbery at street segment level in the city of Milan a set of negative binomial regression models were conducted. The dependent variables of this analysis are the number of robberies and burglaries at each street segment registered each year between 2009 and 2013, whereas the independent variables are a set of variables able to measure opportunities coming from the environment and social disorganization factors. Since robbery and burglary present peculiar

characteristics, the choice of situational variables were differentiated depending on which crime type will be took into account. The negative binomial models do not include the entire period under study (2007-2013), but only the last five years (2009-2013). It has been assumed that the explanatory variables have remained quite stable over the last five years. This cannot be assumed for the entire period under study. Since the big economic crisis that hit in 2008, which significantly impacted a number of Southern European countries in a negative way, it is particularly risky to assume stability before and after 2008. For these reasons, opportunity and social disorganization variables were collected for the last available year, but not going back to the years before 2009. The only exception of this rule is represented by the variable disorder, which includes a number of single events reported by the Milanese Local Police between 2000 and 2010. The entire dataset of ten years was took into account in order to create a larger sample and do not incur in problems of misrepresentation of the phenomenon.

IV.2.1 Results of the negative binomial regression models for burglary

Table 26 summarises the final results of the five models for burglary. Each model was run taking into account burglaries happened in different years, so the table reports a model for each year from 2009 to 2013. In 2013, the outputs of the model indicate that all the variables are significantly correlated with the presence of burglaries, even though the level of significance is different (p<0.01, p<0.05, p<0.1). Generally speaking, in the previous years, some factors remain strongly correlated to the presence of burglaries in the city, whereas some others lose their significance and become uninfluential as explanations for burglary. For the opportunity factors, this is the case of schools in 2009 and 2011, police stations in 2010, 2011, 2012, bus and tram stops in all the other years. Schools do not represent a direct measure of opportunity for burglary. They are supposed to indicate residential areas and nodes of the routine activities of people. Maybe they do not represent a correct measure of these factors, indeed, more direct indicators such as residents and residential land use have significant positive influences on burglaries in the city of Milan.

Concerning the presence of police stations, they have provided a negative correlatation with burglaries in 2009 and 2013. This is perfectly in line with what it was hypnotized. The Incidence Rate Ratio (IRR) suggests that in 2009 and 2013 the number burglaries in a street segment decreases, respectively, by approximately 30.1% (IRR = 0.699) and 21.5% (IRR =

0.785) with every one unit increase of police stations at each street segment. Nevertheless, in the remaining years the variable becomes not significant and the measure does not represent a valuable explanation of burglary occurrence in the city. Also Dugato (2013) did not find significant correlation between police stations and robberies in the city of Milan. He concludes that "although the formal guardianship is probably a relevant factor for determining the crime risk in an area, the used indicator is simply not appropriate for measuring the law enforcement activities, and, therefore, for obtaining reliable results" (Dugato 2013, 74). He continues stating that it is a problem hardly solvable since Italian law enforcement agencies do not make available the information on their activities such as patrolling routes, number of officers and usable resources.

Since the variable used in this study is very similar to the one used by Dugato in his analysis, it is possible that it does not represent a good measure also for the present analysis. For what it is concerning bus and tram stops, this variables has been associated with clustering of crime events among the city in many different studies (Levine, Wachs, and Shirazi 1986; Loukaitou-Sideris 1999; Newton 2008; Yu 2011). According to the outputs of this study the presence of a bus or tram stop in a street segment seems not to have a great and constant impact on burglary and robbery concentrations in the city of Milan. This factor is significantly and positively correlated with the presence of burglaries in 2013 and with the presence of robberies in 2009 and 2010 (0; 0). In the latter years, the number robberies in a street segment increases, respectively, by approximately 23.5% (IRR = 1.235) and 23.1% (IRR= 1.231) if the segment present at least a bus or a tram stop on it. This relationship seems robust and highly significant, even though for the remaining years the relationship is not significant anymore.

Among the other situational variables, the negative relationship between street with limited access and burglary seems robust and highly significant for the entire period under study. Indeed, if a street segments is at limited access the number of burglaries in that street segment decreases by approximately 34.4% (IRR = 0.656) in 2009, 33.0% (IRR = 0.670) in 2011 and 51.1% (IRR = 0.489) in 2013. Also the number of residents appears positively and significantly associated with burglaries, even though the effects of this variable are not very high. On average in the period under study, the IRR suggests that the number of burglaries at

each street segment increases by approximately 0.3% with every one unit increase in the number of residents.

Social disorganization factors seem to play an important role in explaining concentrations of burglary in the city of Milan. These variables are almost always robust and highly significant for the entire period under study. The only exceptions are real estate values in 2009 and 2011, and Circle 2 in 2009 and 2010. In 2013, the factors that exercise a major effect on burglaries' distribution at street segment level are Circle 1, residential land use and Circle 2. Being inside the Circle 1 increases the number of burglaries in a street segment by approximately 121% (IRR = 2.210) compared to street segments that are outside Circle 1. On the other hand, being inside the Circle 2 by about 82.6% (IRR = 1.826) compared to segments that are outside Circle 2. Generally speaking, both the two peripheral areas seem to be more affected by burglary compared to the city centre, especially in the case of Circle 1 which presents very high values for the entire period. This is in line with the previous hypothesis. Indeed, the access to the historical centre of Milan is limited by the Congestion Charge area (Area C).

To get into "Area C" people must activate an entrance ticket of 5 euro and this influences the accessibility in the area and discourage motivated offenders. So, the city centre could be less affected by burglary occurrence because of the limited accessibility of this area. In addition, the city centre is a business area characterized by the presence of shops and offices which are not targets for burglary. Also the relationship between residential land use and burglaries is robust and highly significant for the whole period. In 2013, being a street segment located in a residential area may increase the number of burglaries by 116% (IRR = 2.159). On the contrary, being in a street segment located in a mixed land may decrease the number of burglaries of approximately 26.8% (IRR = 0.732). Mix land use presents a robust and significant effect for the whole period demonstrating how the coexistence of residential and commercial premises in a street segment can discourage possible offenders. Indeed, this coexistence can create informal control by people who spend time in the commercial premises during the day and people who live in the street segment during the night. On the contrary, the presence of associations which was supposed to be negatively correlated with the presence of burglary it is positively and significantly associated with burglary at street segment level for

the whole period. It was hypothesised that the presence of associations would have been connected with the presence of high level of collective efficacy, civic engagement and consequently with a high level of informal social control. The IRR value in 2013 (IRR = 1.428) indicates that a one unit increase of associations is connected with an increase of about 42.8% in the counts of burglaries at street segments.

Also in 2013, real estate values and public housing are positively and significantly correlated with burglary. The IRR suggests that the number of burglaries at each street segment increases approximately by 20.2% (IRR = 1.202) with every one unit increase of the real estate values and by 15.3% (IRR = 1.153) with every one unit increase in the number of public housing. The presence of public housing at street segments is always significantly correlated with burglaries, whereas real estate values lose their significance in 2009 and 2011. In addition, events of physical and social disorder are always positively and significantly correlated with burglaries for the whole period. The effect of this variable is lower if compared to other factors, but its IRR in 2013 suggests that the number of burglaries increases by approximately 2.1% with every one unit increase in the number of disorder events. The introduction of a spatial lag control variables permits to take into account spatial autocorrelations between street segments. This variable is always negatively and almost always significantly correlated with burglaries confirming how the presence of a street segment with a burglary does not influence the surrounding street segments which could also be crime-free.

In conclusion, social disorganization factors seem to affect more burglaries' concentrations at street segment level compared to opportunity factors. In 2013, only police stations and street with limited access seem to have a strong and significant effect on burglaries, even though police stations are not significant in the majority of the other years. The same pattern is also valid for schools and bus/ tram stops. Indeed, these variables are positively and significantly correlated with burglaries in 2013, but not in most of the previous years. On the contrary, resident population is always significantly correlated with the presence of burglaries, but its effect on burglary is weak.

Table 26. Negative binomial regression models for burglary. Years 2009-2013

	2009		2010		2011		2012		2013	
	β	IRR	β	IRR	β	IRR	β	IRR	β	IRR
Opportunity theory										
Residents	0.00277***	1.003	0.00276***	1.003	0.00243***	1.002	0.00246***	1.002	0.00248***	1.002
Schools	0.0131	1.013	0.0378*	1.039	0.0506***	1.052	0.0138	1.014	0.0713***	1.074
Police stations	-0.358***	0.699	-0.065	0.937	-0.0318	0.969	-0.0539	0.947	-0.242***	0.785
Bus and tram stops	-0.0265	0.974	-0.0425	0.958	-0.0624*	0.940	-0.0455	0.956	0.0551*	1.057
Streets limited access	-0.532***	0.588	-0.422***	0.656	-0.400***	0.670	-0.715***	0.489	-0.715***	0.489
Social disorganization										
Real estate values	-0.0655	0.937	-0.152***	0.859	-0.00796	0.992	0.143***	1.154	0.184***	1.202
Public housing	0.122***	1.130	0.0860***	1.090	0.103***	1.108	0.146***	1.157	0.142***	1.153
Disorder	0.0179***	1.018	0.0153***	1.015	0.0241***	1.024	0.0234***	1.024	0.0210***	1.021
Residential land use	0.800***	2.226	0.750***	2.117	0.752***	2.121	0.827***	2.285	0.770***	2.159
Mixed land use	-0.453***	0.636	-0.307***	0.735	-0.252***	0.777	-0.303***	0.739	-0.312***	0.732
Associations	0.309***	1.362	0.243***	1.275	0.395***	1.484	0.289***	1.335	0.357***	1.428
Circle 1	0.348***	1.416	0.542***	1.720	0.640***	1.897	0.504***	1.655	0.793***	2.210
Circle 2	0.0436	1.045	0.148	1.160	0.355***	1.427	0.367***	1.444	0.602***	1.826
Controls										
Retail shops	0.0328***	1.033	0.0437***	1.045	0.0538***	1.055	0.0448***	1.046	0.0556***	1.057
Licensed premises	0.130***	1.139	0.112***	1.119	0.198***	1.219	0.170***	1.185	0.139***	1.149
Personal care shops	0.129***	1.138	0.153***	1.166	0.126***	1.134	0.176***	1.192	0.146***	1.157
Length	0.00304***	1.003	0.00314***	1.003	0.00293***	1.003	0.00298***	1.003	0.00327***	1.003
Spatial lag	-1.51e-05***	1.000	-2.77e-05***	1.000	-2.79e-05***	1.000	-0.00000395	1.000	-1.41e-05***	0.999
Constant	-3.105***	0.045	-2.886***	0.056	-3.040***	0.048	-2.956***	0.052	-2.957***	0.048
Pseudo R^2 (*McFadden's R^2*)	0.1005		0.0974		0.1107		0.1028		0.0987	

*** p<0.01, ** p<0.05, * p<0.1

IV.2.2 Results of the negative binomial regression models for robbery

Table 27 reports the outputs of the five negative binomial regression models for robbery. The table shows a model for each year from 2009 to 2013. Each model was run taking into account robberies happened in five different years and a set of explanatory variables registered at a fixed point in time. In 2013, the outputs of the model indicate that all the variables are significantly correlated with the presence of robberies, except for police stations, bus/ tram stops and real estate values. Police stations are negatively and significantly correlated with the presence of robbery only in 2012. In this year the IRR value (IRR = 0.699) indicates that a one unit increase of police stations is connected with a decrease of about 30.1% in the counts of robberies at street segments. Nevertheless, as supported also by Dugato (2013), this indicator may be not appropriate for measuring law enforcement activities. Indeed, both for robberies and burglaries, this factor is not always significant and if it is significant it can be positive associated with robberies as in the case of 2009.

The variable bus and tram stops is another measure that is not always robustly and significantly correlated with the presence of robberies. It presents significant effects only in 2009 and 2010. Also streets with limited access present negative and significant values only in 2010 and 2013, whereas the factor loses its significance in the other years. However, it is possible to assume that segments with limited access are less influential in the case of robberies compared to burglaries. Indeed, robberies, and especially street robberies, are usually carried out without the use of any vehicles, so segments which present limited access to vehicles are not influential in explaining robbery occurrence. On the contrary, bank branches and retail shops are always positively and significantly correlated with the presence of robberies in Milan. In 2013, the number of robberies at each street segment increases by approximately by 53.3% (IRR = 1.533) with every one unit increase of bank branches and by 11.7% (IRR = 1.117) with every one unit increase in the number of retail shops. In the same year, the number of robberies increases by approximately by 17.0% (IRR = 1.170) with every one unit increase of personal care shops and by 15.0% (IRR = 1.150) with every one unit increase of licenced premises. According to these results, this study strengths the positive and significant relationship between banks, licensed premises and robberies. The link between these factors in the city of Milan was already proved by Dugato (2013).

Regarding social disorganization factors, real estate values are significantly correlated with robberies only in 2012. In this year, they register a negative correlation with robberies demonstrating how advantaged segments seem to be correlated with less robberies, whereas disadvantaged segments with an increasing level of this type of crime. This is exactly the opposite correlation if compared to burglaries where the confirmed hypothesis was that segments with higher real estate values will be more prone to experience burglaries compared to segments with lower real estate values. In addition, it is important to stress that real estate values possibly serve as a proxy of advantaged and disadvantaged segments are a more appropriate measure for burglaries rather than for robberies. Indeed, the real estate values are a direct indicator of how valuable houses, apartments and villas can be in a certain street segment. With higher values of real estate, along with the growing value of property, a criminal has more to gain from a burglary in that area.

In the case of robbery, this link is not direct but indirect, and for this reason the real estate values may not be the fitting measure of the wealth of a street segment. On the contrary, Circle 1, Residential and Mixed land uses and disorder are always significantly correlated with robberies for the whole period. Also public housing and Circle 2 are almost always significantly correlated with the presence of robberies in the city of Milan. In 2013, in the segments in Circle 1 the number of robberies increases by approximately 147% (IRR = 2.475) compared to the segments outside Circle 1, whereas in the segments in Circle 2 by around 131% (IRR = 2.312) compared to the ones outside Circle 2. In the same year, being a street segment located in a residential area may increase the number of robberies by 26.8% (IRR = 1.268). Being in a street segment located in a mixed land may decrease the number of robberies of approximately 37.6% (IRR = 0.624) compared to street segments that are not considered in a mixed land.

Also in the case of robbery, residential lands have a criminogenic effect, whereas mixed lands a mitigating effect. Disorder also plays a constant role in explaining robberies' concentrations at street segment level in the city of Milan. The relationship between disorder and robberies is not particularly strong, but it is always positive and significant. In 2013, the IRR suggests that the number of robberies at each street segment increases by approximately by 2.5% (IRR = 1.025) with every one unit increase of disorder events. Almost the same

percentages are registered in 2011 and 2012, whereas the percentages are lower in 2009 and 2010. The measure for public housing was not significantly correlated with robberies in 2009, but it became significantly correlated from 2010. In the most recent year, the IRR value (IRR = 1.129) indicates that a one unit increase of public housing is connected with an increase of about 12.9% in the counts of robberies at street segments. Associations, as it was in the case of burglaries, are positive correlated with the presence of robberies. This correlation is not always statistically significant for the whole period under study. In 2013, the IRR (IRR = 1.263) indicates that a one unit increase of associations is connected with an increase of about 26.3% in the counts of robberies at street segments.

In conclusion, the factors that seem to have stronger effects in the explanation of robberies' concentrations at street segment level in the city of Milan are Circle 1, bank branches and residential and mixed land uses. In 2009, 2012 and 2013 also Circle 2 exercises a strong effect on robberies, but in the other years this variable loses its significance. On the contrary, retail shops, licenced premises and personal care shops are almost always positively and significantly correlated with robberies, but their influence is lower if compared with other indicators. Social disorganization factors seem to be better measures of robbery concentrations in the city of Milan. Excluding bank branches, opportunity factors, even though they are often significantly correlated with robberies, represent weaker measures compared to social disorganization factors.

Table 27. Negative binomial regression models for robbery. Years 2009-2013

	2009		2010		2011		2012		2013	
	β	IRR	β	IRR	β	IRR	β	IRR	β	IRR
Opportunity theory										
Retail shops	0.0931***	1.098	0.0681***	1.070	0.0763***	1.079	0.0990***	1.104	0.111***	1.117
Licensed premises	-0.00604	0.994	0.0788*	1.082	0.186***	1.204	0.176***	1.193	0.140***	1.150
Personal care shops	0.107*	1.113	0.141***	1.151	0.0941**	1.099	0.0676	1.070	0.157***	1.170
Bank branches	0.772***	2.165	0.802***	2.230	0.249**	1.283	0.546***	1.727	0.427***	1.533
Police stations	0.260*	1.296	-0.0146	0.986	0.00767	1.008	-0.359**	0.699	0.127	1.135
Bus and tram stops	0.211***	1.235	0.207***	1.230	0.0175	1.018	0.0134	1.014	0.022	1.022
Streets limited access	0.247	1.280	0.387**	1.473	-0.125	0.882	-0.18	0.835	-0.388*	0.678
Social disorganization										
Real estate values	-0.047	0.954	-0.0876	0.927	-0.00907	1.009	-0.227**	0.797	-0.0245	0.976
Public housing	0.0503	1.052	0.0722*	1.075	0.0687*	1.071	0.119***	1.126	0.121***	1.129
Disorder	0.0373***	1.038	0.0308***	1.031	0.104***	1.110	0.0615***	1.063	0.0245***	1.025
Residential land use	-0.310***	0.734	-0.226***	0.798	0.182**	1.199	0.204**	1.226	0.237***	1.268
Mixed land use	-0.515***	0.598	-0.371***	0.690	-0.488***	0.614	-0.490***	0.612	-0.472***	0.624
Associations	0.0397	1.041	0.0366	1.037	0.173*	1.189	0.133	1.143	0.233**	1.263
Circle 1	0.552***	1.737	0.668***	1.949	0.370***	1.448	0.430***	1.537	0.906***	2.475
Circle 2	0.283*	1.327	0.258	1.294	0.0398	1.041	0.369**	1.447	0.838***	2.312
Controls										
Residents	0.00130***	1.001	0.00134***	1.001	0.00108***	1.001	0.00152***	1.002	0.00138***	1.001
Length	0.00157***	1.002	0.00133**	1.001	0.00230***	1.002	0.00219***	1.002	0.00172***	1.002
Spatial lag	-5.53e-07	1.000	-7.32e-06	1.000	-1.20e-05*	1.000	-1.39e-05**	1.000	-6.71e-06	1.000
Constant	-3.601***	0.027	-3.558***	0.028	-3.328***	0.036	-3.780***	0.023	-4.375***	0.013
Pseudo R^2 (*McFadden's R^2*)	0.0601		0.0656		0.0942		0.1022		0.1000	

*** p<0.01, ** p<0.05, * p<0.1

IV.3 Conclusions

Chapter IV presents the results of this study organised by the main objectives. According to the results of the street segment analysis conducted in the city of Milan the law of crime concentrations is confirmed also in the European context. Other cities may be tested to corroborate this analysis, but according to this first attempt, the presence of crime concentrations at street segment level is largely confirmed. It is interesting to notice how these concentrations tend to be quite stable over time. This result is not different compared to the results of the Seattle study which finds stable patterns of crime concentrations over a 16-year period. Also in this case, a longitudinal analysis such as a group-based trajectory analysis would corroborate these preliminary findings and give better insights on this phenomenon.

In the second part of this analysis, a set of negative binomial regression models were conducted in order to understand the determinants of the crime concentrations. The results of these models are divided by crime types because different models were run for burglary and for robbery. To summary the main findings, social disorganization factors seem to play an important role in explaining crime concentration at street segment level both for burglary and for robbery. Nevertheless, some opportunity measures such as bank branches and streets with limited access have a strong and significant effect on crime concentrations.

The next chapter will better analyse the results that were only presented in this chapter. The discussion will provide new insights, possible explanations, the advantages and the limitations of this study.

CHAPTER V. Discussion

The results presented in Chapter IV answer to the two main questions established by this study and, consequently investigate the two main objectives proposed in Chapter II. Here, the study returns to the working hypotheses developed in Chapter II to see whether they have been confirmed by the results.

V.1 Confirming or discarding the working hypothesis

The hypotheses proposed by this study in Chapter II (see II.5 Conclusions and research problem) stated that:

> **Hypothesis 1:** **Crime concentrations are supposed to be identified at street segment level also outside the U.S. and this concentrations are supposed to be stable over time**

> **Hypothesis 2:** **Both opportunity and social disorganization theories are supposed to play a central role in explaining crime concentrations outside the U.S.**

The first hypothesis is based on U.S. literature (Sherman, Gartin, and Buerger 1989; Weisburd et al. 2004; Braga, Papachristos, and Hureau 2010; Weisburd, Groff, and Yang 2012; Weisburd, Telep, and Lawton 2013) and on a few other pieces investigating general spatial patterns of crime in some European cities (Ceccato, Haining, and Signoretta 2002; Ceccato and Oberwittler 2008; Ceccato 2009; Uittenbogaard and Ceccato 2012; Dugato 2013). This collective data affirms that the concentrations of crime are believed to be present at micro level in Europe and proposes these concentrations are stable. Moving from the Milanese case-study, this first hypothesis is confirmed.

Undoubtedly, the presence of crime concentrations is largely confirmed in the European context. Indeed, on average, the results show how in Milan 50% of burglaries are concentrated in about 4.0% of the street segments and 50% of robberies in about 1.6%. There is an incredible difference between the degree of concentrations of burglary and robbery in the city. This can be due to the different distribution of the targets among the street segment network in Milan. Houses and apartments, both being targets of burglary, are more widespread within the territory of the city since the majority of the street segments present residential buildings. However, i.e. bank branches, which are highly correlated with robbery

and represent possible targets, are less widespread around the city. They mainly concentrate in the city centre and along the main roads (Figure 27).

In the same vein, residential land has a stronger tendency of being burglarized rather than robbed, whereas mixed land has a stronger impact in decreasing robberies rather than burglaries. In total, 10,356 street segments have a residential use, whereas only 3,697 have a mixed use. Again the distribution of burglary seems to be correlated with a more widespread variable, whereas robbery with a more tight measure. Unfortunately, prior studies do not differentiate between crime types, so comparisons cannot be made. Indeed, prior research usually considers the crime events in the cities as a sum of different offences, whereas this study decides to separate crime types. The decision to differentiate crimes represents one of the main strength of this analysis.

Undoubtedly, other crime types should be included in the analysis in order to have a better understanding of the crime concentrations in the city. This attempt represents a good starting point that was able to develop a strong methodological structure, which can be further apply to other offences. The importance of targeting and shaping crime prevention measures on different crime types is clearly addressed by Clarke (1992; 2008) and his situational crime prevention. In line with these considerations, for orienting future analysis, this study supports the idea of differentiate preventive efforts depending on which crime types will be taken into account. The hope is to be able to geocode new data and new crime types in order to expand the results of this analysis. In addition, it should be interesting also to compare the results of this study with the results of other studies to test if the differences between crime types are present also in other contexts.

Milan shares a normal level of crime at a street segment level with the metropolises like Boston, Minneapolis, Seattle, New York and Tel Aviv-Jaffa. The consistency of crime concentrations in these cities underlines the presence of a certain social process pushing crime to a stable level of concentration in urban centres. Despite the crime trends of burglaries and robberies having decreased from 2007 to 2009 and then increased again, respectively, from 2010 and 2011 to 2013, their crime concentrations seem to remain quite stable over this period. They slightly increased in 2012 and 2013 in the case of burglary and in 2013 in the

case of robberies, but they do not overcome a one point percentage of increase. This is particularly significant and it confirms the results of prior studies. Despite the general crime trend increases and decreases, each year the same percentage of street segments accounts for 50% of crime events. Durkheim's original proposition claims the level of crime is stable in societies, and may be applied to the concentrations of crime in several places. As already addressed in the theories presented by Weisburd, Groff and Yang (2012), Weisburd and Amram (2014), it is possible to think that crime concentrations would help in defining normative boundaries in the society. According to Durkheim, there is a normal level of crime in healthy societies, which supports the drawing the boundaries between acceptable and unacceptable behaviours by defining those who operate outside of the social boundaries of the law.

The criminal behaviour is the result of a normative process that defines the deviant behaviours to be condemned. In this way, people can know which are the acceptable moral behaviours in contrast with people that are labelled as deviant and sanctioned because of their deplorable conducts (Becker 1963; Erikson 1966). In this sense, Weisburd and Amram (2014) argue that a certain number of places in a city with crime problems may serve as a lesson for the city more generally. "Bad street" in the city should define the moral boundaries of a place and teach to the residents which are the acceptable and non-acceptable streets for a peaceful common coexistence.

The analysis confirms the stability of crime concentrations among the street segment network in Milan. This represents a very interesting result, though further research is needed to better address the stability issue. From a qualitative analysis conducted on the twenty street segments with the highest number of crimes emerges that Via Donna Prassede has experienced a high number of burglaries in 2007, 2008 and 2009. The same is for a segment of Via Alessandro Bisnati and a segment of via Teano. These segments have experienced a high number of burglaries, respectively, in 2009, 2011, 2012 and 2009, 2010, 2012 and 2013. Chronic patterns can be also described for robbery. Different segments of Piazzale Duca D'Aosta, which is the square in front of the Central Station, have experienced crime robberies for the entire period under study. A segment of Piazzale Abbiategrasso present a very high number of robberies in 2008 and 2009, whereas a segment of Piazzale Corvetto between 2007

and 2010. For the same twenty street segments, it is interesting to notice how the year 2013 presents a very different street segments in comparison to other years. From 2007 to 2012 it is possible to find some similarities and many street segments are present in two, three or four years. However, in 2013, the twenty street segments with the highest number of crimes, both for burglaries and robberies, are very different for the ones registered from 2009 to 2012. This may be due to a different distribution of crime events or to problems related with the low number of offences that were geocoded for this year. A more in-depth longitudinal analysis should help to explore the evolution of these concentrations over the years.

Different patterns can be delineated conducting a group-based trajectory analysis. One hypothesis can be that crime concentrations are generally stable, but only few chronic street segments present very high levels of crime during the entire period. A second hypothesis may suggest there is a general stability, but a quite big number of segments presenting a medium level of crime. Many assumptions can be made and a group-based trajectory analysis could be a helpful tool to better explore spatial and temporal dynamics of burglaries and robberies. Unfortunately, it was not possible to conduct such analysis in Milan, but this aspect should be deepened because it can point out valuable results. If concentrations would prove to be unstable over time and no clear patterns would be identified then it is necessary to think about preventive measures that would take into account this issue. On the other hand, if concentrations would be stable over time, then crime at street segments is highly predictable. One of the main findings of Weisburd, Groff and Yang (2012) was the predictability of crime in Seattle. Indeed, crime coupled to place because places evidence specific characteristics that inhibit or encourage crime. Differences of crime opportunities across street segments are related to differences in crime patterns, and differences in social disorganization across the micro communities of street segments are also related to the crime patterns. Since this analysis underlined a certain stability in the segments involved in crime occurrence, further research should investigate which are the chronic-crime patterns in the city of Milan and understand which are their determinants.

The second hypothesis of this study stated that both opportunity and social disorganization factors play a central role in explaining crime concentrations at street segment level outside the U.S.. Recently, studies have tried to combine opportunity and social disorganization

theories in a perspective of theoretical integration (W. R. Smith, Frazee, and Davison 2000; Rice and Smith 2002; Weisburd, Groff, and Yang 2012; Weisburd, Groff, and Yang 2014). A few of them have also involved European cities (Ceccato and Oberwittler 2008; Uittenbogaard and Ceccato 2012; Dugato 2014). Both opportunity and social determinants have been found relevant to explain crime at micro places. From one side, social disorganization factors such as socio-economic conditions, racial heterogeneity, residential mobility, informal social control and civic engagement have been considered too broad and difficult to measure. These variables have been traditionally tested on communities or neighborhoods and the results have been generalized for the entire community or the entire neighborhood. This led not to take into account to the dissimilarities that exist within the same community/neighbourhood and to miss important information about the place under study. On the other side, opportunity measures are able to explore the degree of spatial heterogeneity of crime of larger areas, but they have been usually criticised to be too much oriented on the micro level and to propose short-sighted preventive policies.

Event-prevention strategies seemed to have a dramatic and immediate impact on specific crime problems the short-term period, but not to solve the crime problem in the long-term period. In addition, some scholars support the idea that the approach is not effective because it displaces crime to other places. Many other scholars have discarded the hypothesis of displacement and have supported the diffusion of the benefits that these measures can create. Since the debate on the effectiveness of situational prevention measures over the more traditional socio-economic measures is still wide open, this study integrates opportunity and social disorganization dynamics in the explanation of crime at small urban places. Results show how social disorganization measures such as type of land use and distance from the city centre present strong and almost always significant correlation with both burglaries and robberies for the entire period under study (2009-2013). A street segment which is in a residential area present more possibility of being victim of burglary, whereas a street segment which is in a mixed land use decrease this possibility of being victim of both of these offences.

In general, a street segment located in Circle 1 presented a higher number of burglaries and robberies compared to street segments, which are not in Circle 1. Circle 2 also draws a

positive correlated with both crime types, but these correlation are less strong than the ones of Circle 1. Generally speaking, it can be deduced that being a street segment in the peripheral Circle 1 and Circle 2 increases the possible risk of being victim of a crime compared to the city centre, but being in the first peripheral area Circle 1 is riskier. Indeed, this area is immediately outside the city centre and represents most of its wealthy areas, which are full of people that transit from the more peripheral area to the city centre. Both burglaries and robberies are strongly and positively correlated with Circle 1. As it might be expected, the values of the real estate are positively correlated with burglary, even though the variable is significant only in 2010, 2012 and 2013. This measure is not significant for robbery despite for 2012 when it registers a strong negative effect. This variable was introduced as a determinant of the wealth of a street segment, but it is maybe more connected with burglary rather than robbery and possibly not the best tool to measure wealth of a segment.

Public housing and disorder are almost always significant and positive related with both crime types, but their influence is not very strong. The former variable increases the number of burglaries at street segments by approximately 15% or less (depending on the year) every one unit increase in the number of public housing, whereas the number of robberies of approximately 13% or less. The latter variables increases the number of burglaries of about 2% or less (depending on the year) every one unit increase in the number of disorder events and the number of robberies of about 2.5% or less (depending on the year). Despite these two variables having less of an effect when compared with others, it is important to underline that they exercise a positive, constant and almost always significant effect on both burglaries and robberies. In the case of burglaries, associations play quite a strong and significant effect on the entire study, though according to the previous hypothesis this measure should negatively influence crime at street segments. The variable was introduced as a measure of collective efficacy assuming that the presence of associations in a street segment may be a reliable proxy of civic engagement and involvement in the life of the street.

However, this has turned into a proxy of suitable targets because they are always associated with positive correlations, especially with burglaries, including robberies in 2011 and 2013. As Braga and Clarke (2014) stressed in their recent piece, which was largely supported by Weisburd, Groff and Yang (2014), it is difficult to measure collective efficacy

and it is even more difficult to find proxies of collective efficacy at street segment level. More in general these authors focus on the idea that it is necessary to better improve data collection at very small units of geography in order to better shape the analysis and to have better results. The collective efficacy measure uses in this study was not able to catch such a complex phenomenon. It would be better to use more than a variable to express and measure the concept in order to get different aspects of collective efficacy in Milan. In conclusion, social disorganization factors seem to have a stronger and more stable effect on both burglaries and robberies, even though also some measures of opportunity theory play key roles in explaining crime concentrations especially in the case of robberies.

For what concerns the situational factors, bank branches have a strong, constant and always positive effect on robberies. This variable was strongly correlated with Milanese robberies also in Dugato (2013) and this analysis corroborates this result. In the case of this crime type also retail shops, licensed premises and personal care shops have a positive and almost always significant effect, even though the impact is not particularly strong. Dugato (2013) stressed the strong relationship between licenced premises and robberies in Milan and the same connection is also supported by this study. Nevertheless, at street segment level the same relationship is less stronger than the one found by Dugato (2013) at neighbourhood level. Police stations seem to have a strong, negative and significant effect only in 2012 for robbery and in 2009 and 2013 for burglary. According the assumption posed by this study, police stations should exercise a decreases of the number of crime in the street segments that present police stations for the effect of their guardianship. This variable, as it was in Dugato (2013), it is not significant for most of the years in the period under study and it may not represent a good measure of guardianship.

It can also be assumed that informal control plays a more important role than formal control in explaining guardianship at crime concentrations. Indeed, mixed land use, which is strongly and negatively correlated with both crimes, represents a measure of the presence of informal social control in the streets. Places with mixed land use tend to draw more 'eyes on the street' because they draw a combination of visitors and residents who are at the street at different time of the day. To test this hypothesis, other measures of formal and informal control should be added at the analysis in order to see if other variables may produce the same

effects. In any case, the results of the correlation between mix land use and different crime types are always very strong, negative and always significant, whereas results for police stations are not. In line with these considerations, also bus and tram stops are significantly and positive correlated with robberies in 2009 and 2010, and with burglaries in 2013. This represents a contrasting result if compared to previous literature.

Many studies have investigated and found positive relationship between bus and tram stops and crime (Levine, Wachs, and Shirazi 1986; Loukaitou-Sideris 1999; Groff and McCord 2011; Yu 2011). Indeed, they always represent an easy transport to get to the destination and to escape from the location. A possible explanation of this result is that bus and tram stops are capillary distributed across the street segment network, so they do not make any difference in explaining crime distribution. In Milan, they do not represent a valuable discriminant and a particular characteristic because they are quite widespread in the entire territory. This assumption has to be carefully taken and further research should be addressed in understanding spatial dynamics of crime and public transportation in Milan.

The second measure of accessibility, streets with limited access, presents negative, strong and always significant effect for burglaries, whereas significant correlations only for 2010 and 2013 for robberies. This variable has a particular strong and negative effect on burglaries and it is possible to think that it is because burglars are more affected by the impossibility to use a car or a motorcycle. Burglars often use cars or vehicles to move and to transport stolen goods (Krohn, Lizotte, and Hall 2010). Finally, the relationship between burglaries and residents is positive, always significant but very weak, as well as schools do not always show a significant effect in the 5-year period and when the impact is significant the correlation is very weak. These two variables seem not to be good measures of suitable targets for burglaries and their weak relationship may confirm this idea.

Generally speaking, it is important to stress the fact that sometimes there are certain overlapping areas between the two theories because some variables could be seen as crucial concepts of each theory. In addition, the same variables could sometimes be seen as guardianship and some others as a target of crime. Griffiths, Grosholz, and Watson (2011) pointed out how the victim/target could have a capacity for self-guardianship that triggers a

sort of role reversal. This could lead to some misleading results or difficulties in interpreting the findings. The importance of including new variables and to measure the two theories with more fitting proxies could help also in better reshape the concepts belonging to one and to the other theory.

In conclusion, as it was already mentioned, social disorganization factors seem to play a more central role in explaining crime concentrations in Milan, even though bank branches and streets with limited access show a strong relationship, respectively, with robbery and burglaries. Also retail shops, licensed premises and personal care shops have a quite strong impact on robberies. Nevertheless, it is crucial to stress that since opportunity and social disorganization measures were collected in a fixed point at time and then used to explain crime dynamics taking into account crime in different years, it is possible that this may have had an impact on the results. Indeed, social disorganization factors are supposed to be more stable over time, whereas situational measures depend by definition on specific spatio-temporal dynamics. The data collection and the method used to run the models could have affected the results of this analysis. In any case, the findings on social disorganization measures are strong, constant and very significant over time. The efforts for a future implementation of this work could be oriented in findings new opportunity variables able to take into account the longitudinal variations of crime trends over the years.

The U.S. studies usually find positive and strong relationships between situational factors and crime. Weisburd, Groff and Yang (2012) in their longitudinal study on Seattle find that the measures connected with suitable targets and motivated offenders represent important explanations of crime concentrations. The authors mainly confirm the importance of situational characteristics in explaining the crime problem, but they also point out extremely important findings on social disorganization determinants. Characteristics of social disorganization across places present a tremendous concentration and variation in all the variables that they took into account. While there are clusters of street segments with the same traits, there are also significant street by street variability in these concentrations. According to the authors "this is an extremely important finding, since it suggests that a perspective that has generally been seen as relevant at higher levels of geography shows concentrations and variability at the street segment level" (Weisburd, Groff, and Yang 2012, 179). In line with

this statement, this study supports the importance of social disorganization determinants in understanding burglary and robbery concentrations in the city of Milan.

It is interesting to notice how social disorganization factors usually represent the long-standing characteristics of an area and consequently of a street segment. These features represent socio-economic conditions or cultural behaviours that are usually very difficult to change and to impact with crime prevention measures. Hence, the importance of an integrative approach in the development of crime prevention measures is here strengthen. Moving from these findings, it is clear how a connection between these two approaches is needed in order to, from one side, focus on the micro dynamics and find short-term solutions, and on the other side, improve on socio-economic conditions, education of the citizens and sense of community in urban centres.

V.2 Advantages and limitations of the study

One of the most important achievement of this study is the confirmation of the presence of crime concentrations at street segment level also in Milan and consequently in Europe. Moving from these findings, Durkheim's original preposition which claims that the level of crime is stable in societies may be transposed to concentrations of crime at street segments. Nevertheless, many other cities must be tested to theorise the presence of a normal level of crime at micro units of geography. In this vein, this study represents one of the first attempts to test the presence of crime concentrations outside the United States trying to find a sort of common pattern among different urban centres. Maintaining a comparative approach, this analysis places itself in the group of studies that contribute to the development of the cross-national research on urban crime. Previous literature on crime in urban environments show that Anglo-American research heavily dominate the field (Wikström 1982; Wikström 1987). As it was reported by Wikström (1991), "much of the experience we have on urban crime is based on the North American and British research and theory". This is why it is so important to test the Anglo-American theories and findings in other contexts such as the European one. There is a great lack on cross-national comparative studies in criminology, although there is a great need of such research in order to understand crime and its causes (Wikström 1991, 1–2). Adopting a comparative approach exporting theories beyond the origin territories mainly attend to understand criminal and deviant behaviour as it is manifested globally and inevitably

yield useful insights about the control of deviant behaviours (Howard, Newman, and Pridemore 2000). Cross-national studies underline common and unique features of crime in different countries for evaluating the generalizability of theories or for generating new ones (R. Bennett 1980).

Despite the differences between U.S. and European cities, many similarities can be found in the distribution of crimes at street segment level. This represents an important insight from a comparative point of view. This is why, the present analysis builds another step in the knowledge of micro dynamics of crime occurrence in urban centres. Moreover, this step is a fundamental one because, it permits to conduct for the first time a quantitative analysis at street segment level in Europe. It also explores the micro dynamics of crime in Italy where crime at place has not yet been developed with the only exception represented by Dugato (2013; 2014).

This analysis does not draw conclusions on the general level of crime, but it differentiates between burglary and robbery, identifying them as different patterns of crime concentrations for each type of offence. Prior studies on the topic such as the ones conducted in Seattle, Tel Aviv-Jaffa and New York did not differentiate the analysis depending on different types of crime, but treated crime as a unique category. The diversification conducted by this study represents a major strength, even though it is just a first step and many other crime types need to be included in order to have a better picture of the crime situation at small unit of geography in the city.

The present study was able to find geocode and analyse a series of opportunity and social disorganization variables at a very small unit of geography. Especially in the case of social disorganization, it is quite unusual to be able to find fitting measures for these determinants at punctual level. The micro analysis of crime was born connected with the opportunity theories and the situational crime prevention approach. In this theoretical and practical framework, scholars started to geocode at punctual level not only crime events, but also situational variables that could influence crime occurrence (i.e. schools, bus stops, main roads, shopping malls, bars, bank branches, police stations). Nevertheless, this approach has been criticized because of its exasperation of the micro over the macro in the explanations of the crime

problem. This is why an integrative approach which conjugates opportunity and social disorganization factors was chose over the mere analysis of opportunities. A theoretical integration approach will help in understanding the micro dynamics, but also analyse the surrounding context in which this micro factors are located.

Beside all the advantages, the study presents several limitations that in part were already discussed throughout these chapters. First of all, it was not possible to geocode a wide range of types of offence. As already mentioned, Italian law enforcement agencies record information on crime events with a very low level of precision compared to the United States. On average, the geocoding percentages are around 70% for burglary and around 50% for robbery, but it was not possible to include in the analysis thefts, drug related crimes and other types of offence. To have a better understanding of the crime problem in a city, it is necessary to identify patterns among different typologies of crime. The present study includes only burglary and robbery in its analysis, but it only represents a first attempt. Indeed, an enlargement to other types of offence is needed to have a more comprehensive investigation of the crime distribution across the city of Milan.

Second of all, it was not possible to collect more data on the determinants of crime concentrations in Milan at punctual level. Form the point of view of the opportunity theory, it was not possible to geocode any data measuring the presence of juveniles and street lighting at street segments. From the point of view of the social disorganization theory, it was not possible to disaggregate at micro level any data on unemployment and racial heterogeneity. In addition, key aspects such as informal social control and collective efficacy need to be reshaped finding more variables able to express the complexity of these concepts. Two recent pieces by Braga and Clarke (2014) and Weisburd, Groff and Yang (2014) calls for the necessity of an appropriate data collection systems and measurements able to capture the characteristics of small areas such as street segments.

An improvement in the collection of punctual data could help in adding new variables to the analysis and in collecting more years in order to conduct longitudinal analysis of crime trends at the micro level. Indeed, the third limitation of this study is the impossibility to conduct a longitudinal analysis because of the lack of information on the explanatory

variables over time. For most of the variables, it was only possible to collect information on the last available year forcing the author to conduct a non-longitudinal analysis taking into account explanatory variables as fixed in a certain point in time. Fortunately, all the variables are not supposed to vary or register big changes in the five years took into account by the statistical analysis. Nevertheless, a longitudinal approach could have led to a more precise analysis and to a better interpretation of the results of the crime distribution in Milan over the years.

According to the opportunity theories, it is fair to conclude that time plays an important role when looking at crime at place dynamics. Time is meant as time of the day, time in a month or time in a year underling the importance of the seasonality in crime and space analysis. This study do not explore different time patterns in the distribution of burglaries and robberies. Further research should address also this issue in order to find similarities in time patterns and drew conclusions on the distribution of crime during the day or during the night, in different months or in different part of the year.

V.3 The present study and its main contributions to the criminological research

First of all, the present study pointed out that crime concentrations are present at a street segment level in different cities around the world. Despite their dimension, structure, street network, socio-economic composition and wealth, all these cities share the same concentration of crime. From a comparative point of view, the generalization of these findings are an important step in the development of common knowledge and in the implementation of common preventive strategies. If it is a fact that crime concentrates at street segments in urban environments, a direct consequence for the criminological theories is to conduct even more specific analysis at micro places. The main goal of further research should be the identification of the different chronic-crime patterns present among the street network in order to implement targeted preventive measures. This approach should lead to a better understanding of crime dynamics at urban level and to the maximization of the available resources. In addition, if crime concentrations result stable over time, as it was suggested also by this analysis, they become even more predictable. The predictability of crime distribution is another important finding of this study because it is directly connected with the policy relevance the criminology of place could assume in the future.

Nevertheless, if from one hand this study largely supports the development of a micro approach to the crime problem in urban areas and intends to direct the future research to embrace an even more targeted method, on the other hand, it gives also aid to the importance of an integration between situational and social factors in the analysis of crime at place. Since traditionally the micro studies of crime at place have developed from the opportunity theory framework, they tend to take into account only situational variables as determinants of the criminal behaviour. The results of this analysis gives great support to the social disorganization factors in explaining crime concentrations in the city of Milan. The same findings are shared by the Seattle study, where both opportunity and social disorganization perspectives have considerable salience in understanding crime at place.

"Person-oriented and environment-oriented approaches are potentially helpful for identifying important explanatory factors but, taken separately, do not provide fully developed explanations of crime as an action. […] Typically, neither explains the actual causal process that directly links a person (crime propensity) and a setting (criminogenic exposure) to an act of crime" (Wikström et al. 2012, 5). Recently, several pieces have followed the statement of Wikström and its colleagues advocating for a theoretical integration of the criminological theories (Bernard and Snipes 1996; Bernard 2001; W. R. Smith, Frazee, and Davison 2000; Weisburd, Groff, and Yang 2012; Weisburd, Groff, and Yang 2014; Braga and Clarke 2014). This study recommends the future research to take into account the interaction between personal and environmental factors in explaining crime dynamics. Social disorganization factors still play a central role as determinants of criminal behaviours, also at micro level. For this reason, much more research outside the United States is needed to assess the universal validity of social disorganization (Bruinsma et al. 2013), also at a street segment level (Weisburd, Groff, and Yang 2014).

Conclusions

Testing the presence of crime concentrations outside the U.S. may aid the understanding of how spatial dynamics of crime develop at micro units of geography in the cities. It may also help confirm the presence of a normal level of crime at micro places. Many studies have demonstrated how crime clusters at places, but most recently, scholars have proved how crime can have a strong street by street variability in its distribution. These findings are crucial in increasing the knowledge related to the crime problems and targeting preventive measures able to offer cost-effective alternatives. If crime has a strong variability at the street segment level, it means that some segments can have a high chronic level of crime, whereas some other neighbour segments can be crime free. Hence, preventive measures cannot be only oriented at neighbourhoods or community level because they could be ineffective or could be a waste of money.

The present study is a first attempt to test the presence of crime concentrations in Italy and more in general in Europe. Crime concentrations have already been tested in different US cities and in Tel Aviv-Jaffa. In these cities, the same proportion of crime events concentrates in the same percentage of street segments. The case-study of Milan is used to test the presence of crime concentrations in Europe, where crime distributions at street segment level have not been yet tested. This presents a unique opportunity to compare the U.S. and Israeli findings with a European city. In addition, to understand the main determinants of crime concentrations in Milan, opportunity and social disorganization factors have been collected and geocoded at street segment level. In Europe, this is one of the first attempts to combine situational and social disorganization measures at such a small unit of geography.

The results confirm the presence of crime concentrations in the city of Milan from 2007 to 2013 and, consequently, further applications of these analysis at European level would deepen the analysis and be able to generalize some findings. From a first analysis, these concentrations seem to be quite unstable over time, but the implementation of a further longitudinal analysis may help to corroborate this result. In conclusion, social disorganisation factors seem to have a stronger influence on crime at street segment level, compared to opportunity factors. Nevertheless, other variables should be included in the analysis to better

strength this statement and the implementation of a longitudinal analysis can have an effect on better explore the determinants of crime concentrations.

According to the present study, future research should focus on the micro analysis of crime dynamics which seemed to be promising in understanding where and how crime occurs in urban areas. A micro approach appears an efficient way to narrow down the problems and to better target preventive measures. On the other hand, it is necessary to take into account not only situational factors as possible explanations of the criminal behaviour at micro places, but also social disorganization factors which seem to play a central role in explaining crime concentrations in Milan.

Appendix I

A) Correlation Matrix of the exploratory and control variables of the models for burglary

	Residents	Schools	Police stations	Bus/tram stops	Streets limited access	Real estate values	Housing	Disorder	Residential land use	Mixed land use	Associations	Circle 1	Circle 2	Retail shops	Licensed premises	Personal care shops	Length
Residents	1																
Schools	0.05***	1															
Police stations	0.00	0.04***	1														
Bus and tram stops	0.19***	0.01	0.01*	1													
Streets limited access	-0.05***	0.01	0.01	-0.01	1												
Real estate values	-0.07***	0.07***	0.06***	-0.01	0.18***	1											
Housing	0.13***	0.01	0.00	0.02**	-0.02**	-0.08***	1										
Disorder	0.11***	0.03***	0.02*	0.04***	0.02*	-0.01	0.04***	1									
Residential land use	0.22***	0.06***	0.01	0.00	0.04***	0.03***	0.10***	-0.02*	1								
Mixed land use	0.06***	-0.02**	-0.01*	0.01	-0.08***	-0.20***	0.18***	-0.03***	0.45***	1							
Associations	0.14***	0.05***	0.01	0.04***	-0.01	-0.04***	0.07***	0.07***	0.06***	0.02*	1						
Circle 1	0.00	0.00	0.05***	-0.02**	0.06***	0.37***	-0.07***	0.02*	-0.05***	-0.20***	-0.01	1					
Circle 2	0.06***	-0.07***	-0.09***	0.04***	-0.24***	-0.61***	0.09***	0.00	-0.03***	0.29***	0.03***	-0.75***	1				
Retail shops	0.23***	0.02**	0.02*	0.10***	0.09***	0.11***	-0.02*	0.15***	0.10***	-0.13***	0.10***	0.11***	-0.18***	1			
Licensed premises	0.22***	0.03***	0.02**	0.09***	0.08***	0.09***	-0.01	0.15***	0.10***	-0.11***	0.11***	0.13***	-0.17***	0.67***	1		
Personal care shops	0.13***	0.01	0.01	0.05***	0.01	0.04***	0.00	0.08***	0.06***	-0.06***	0.06***	0.06***	-0.07***	0.35***	0.30***	1	
Length	0.37***	0.05***	0.00	0.23***	-0.03***	-0.10***	0.07***	0.10***	-0.03***	0.03***	0.11***	-0.08***	0.14***	0.12***	0.12***	0.06***	1

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

B) Correlation matrix of the exploratory and control variables of the models for robbery

	Retail shops	Licensed premises	Personal care shops	Bank branches	Police stations	Bus/Tram stops	Streets limited access	Real estate values	Housing	Disorder	Residential land use	Mixed land use	Associations	Circle 1	Circle 2	Residents	Length
Retail shops	1																
Licensed premises	0.67***	1															
Personal care shops	0.35***	0.30***	1														
Bank branches	0.25***	0.21***	0.11***	1													
Police stations	0.02*	0.02**	0.01	0.03***	1												
Bus and tram stops	0.10***	0.09***	0.05***	0.05***	0.01*	1											
Streets limited access	0.09***	0.08***	0.01	0.04***	0.01	-0.01	1										
Real estate values	0.11***	0.09***	0.04***	0.10***	0.06***	-0.01	0.18***	1									
Housing	-0.02*	-0.01	0.00	-0.02**	0.00	0.02**	-0.02**	-0.08***	1								
Disorder	0.15***	0.15***	0.08***	0.05***	0.02*	0.04***	0.02*	-0.01	0.04***	1							
Residential land use	0.10***	0.10***	0.06***	0.02*	0.01	0.00	0.04***	0.03***	0.10***	-0.02*	1						
Mixed land use	-0.13***	-0.11***	-0.06***	-0.08***	-0.01*	0.01	-0.08***	-0.20***	0.18***	-0.03***	0.45***	1					
Associations	0.10***	0.11***	0.06***	0.04***	0.01	0.04***	-0.01	-0.04***	0.07***	0.07***	0.06***	0.02*	1				
Circle 1	0.11***	0.13***	0.06***	0.05***	0.05***	-0.02**	0.06***	0.37***	-0.07***	0.02**	-0.05***	-0.20***	-0.01	1			
Circle 2	-0.18***	-0.17***	-0.07***	-0.13***	-0.09***	0.04***	-0.24***	-0.61***	0.09***	0.00	-0.03***	0.29***	0.03***	-0.75***	1		
Residents	0.23***	0.22***	0.13***	0.08***	0.00	0.19***	-0.05***	-0.07***	0.13***	0.11***	0.22***	0.06***	0.14***	0.00	0.06***	1	
Length	0.12***	0.12***	0.06***	0.05***	0.00	0.23***	-0.03***	-0.10***	0.07***	0.10***	-0.03***	0.03***	0.11***	-0.08***	0.14***	0.37***	1

*** p<0.01, ** p<0.05, * p<0.1

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