Қылмыс болған жерді өзгертуге болмайды ма? Астана және Алматы қалаларындағы ауыр емес ұрлық пен зорлық-зомбылық қылмыстарының кеңістікте таралуын кешенді талдау

Дмитрий Серебренников, Әсем Құсманова

Бұл мақала Қазақстанның екі ірі мегаполисінде, Астана мен Алматыда, ауыр емес ұрлықтар мен күш көрсетіп жасалған қылмыстардың бөлінуін кешенді зерттеуді ұсынады. Біз қылмыс феноменін әртүрлі аспектілерде қарастырамыз: қылмыстардың кеңістіктік паттерндерін, қалалардың «ыстық нүктелерін», олардың соңғы 5 жылдағы динамикасын, әртүрлі қылмыстардың сипаттамаларын ескере отырып, олардың әдеттегіден көп қылмыс болатын кеңістіктің сипаттамаларымен (тұрғындар саны, жылжымайтын мүліктің орташа құны және т.б.) және аумақпен байланысын талдаймыз. Талдау нәтижелері полицияның профилактикалық жұмысын жоспарлау кезінде, сондай-ақ Астана мен Алматы аумағындағы қылмыстық жағдайды және оның динамикасын жалпы түсіну үшін пайдалы болуы мүмкін.

Түйінді сөздер: *криминология, кеңістіктегі қылмыс үлгілері, дәлелді саясат, зорлық-зомбылық қылмысы, мүліктік қылмыс, ыстық нүктелер.*

Біз Айгүл Жанәділоваға, Аягөз Әубәкіроваға, Валерия Теге, Дәулет Бийназаровқа, Әйгерім Жиенғалиеваға мәтіннің алғашқы нұсқаларына қосқан үлестері үшін алғысымызды білдіреміз. Сонымен бірге Назгүл Ерғалиеваға жұмысты жақсарту жөніндегі құнды пікірлер мен кеңестер бергені үшін ризашылығымызды білдіргіміз келеді.

Место преступления изменить нельзя? Комплексный анализ пространственного распределения нетяжких краж и насильственных преступлений в г. Астана и Алматы

Дмитрий Серебренников, Асем Кусманова

Данная статья представляет комплексное исследование распределения нетяжких краж и насильственных преступлений в двух крупнейших мегаполисах Казахстана: Астане и Алматы. Мы рассматриваем феномен преступности с разных аспектов: пространственных паттернов преступлений, «горячих точек» городов, их динамики за последние 5 лет, связь разных видов преступлений с характеристиками пространства (количество жителей, средняя стоимость недвижимости и т.д.) и территории, в которых происходит нетипично много преступлений при учёте их характеристик. Результаты анализа могут быть полезны при планировании профилактической работы полиции, а также для общего понимания криминальной обстановки и её динамики на территории Астаны и Алматы.

Ключевые слова: *криминология, пространственные паттерны преступлений, доказательная политика, насильственные преступления, имущественные преступления, «горячие точки».*

Мы выражаем благодарность Айгуль Жанадиловой, Аягоз Аубакировой, Валерии Те, Даулету Бийназарову, Айгерим Жиенгалиевой за их вклад в работу над ранними версиями текста. Мы также хотим выразить признательность Назгуль Ергалиевой за ценные комментарии и советы по улучшению работы.

The place of crime cannot be changed? Comprehensive analysis of the spatial distribution of thefts and violent crimes in Almaty and Astana

Dmitry Serebrennikov[1], *Asem Kusmanova*[2]

Abstract: This article presents a comprehensive study of the distribution of non-serious thefts and violent crimes in the two largest metropolitan areas of Kazakhstan: Astana and Almaty. We examine the phenomenon of crime from different aspects: spatial patterns of crimes, "hot spots" of cities, their dynamics over the last 5 years, the connection of different types of crimes with the characteristics of space (number of residents, average value of real estate, etc.) and territories, which have abnormally large number of crimes, given their characteristics. The results of the analysis can be useful in planning preventive police work, as well as for a general understanding of the criminal situation and its dynamics in Astana and Almaty.

Key words: *criminology, spatial distribution of crime, evidence–based policy, violent crimes, property crimes, "hot spots"*

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Introduction

According to the statistics of the United Nations Office on Drugs and Crime in 2020. In Kazakhstan, there were 3.2 intentional homicides per 100,000 people *(United Nations Office on Drugs and Crime)*. Is this a lot or a little? On one hand, the number of crimes at this value in the Republic is twice as low as in Russia, where the corresponding figure is 6.8, but on the other hand, the country significantly lags behind Uzbekistan (1.4), China (0.5), and especially the leaders of the ranking — Japan (0.2) or Singapore (0.1). Crime in these countries is several times lower in relative terms than in Kazakhstan. According to less official indices of the total number of crimes, Kazakhstan is also in the middle of the global ranking *(World Population Review 2023)*.

Thus, the problem of crime in the country is not critical (as, for example, in the case of Jamaica, where the discussed criterion is equal to 53), but it requires significant efforts to reduce this important indicator for the comfortable life of citizens. A special place in this process is occupied by the organization of police work, which is noted on official platforms. Thus, President Kassym-Zhomart Tokayev noted in his speech the high significance of the digitalization of police work and the improvement of its quality in handling citizens' appeals *(Official website of the President of the Republic of Kazakhstan 2023)*.

In this case, digitalization can be understood not only as equipping the police with various new technical systems and creating alternative opportunities for reporting incidents to the police, but also as the process of implementing new analytical systems in police work to identify current and potential crime hotspots.

However, new analytical systems and principles of work organization do not automatically lead to the achievement of the stated goals if research work was not conducted before their implementation, and effectiveness was not assessed afterwards. This complexity leads us to the question that changes in the police and the specifics of its work with crime should be based on data, i.e., to the approach of evidence-based policy *(EBP)*. Currently, this approach is actively applied in the leading police forces of the world *(Titaev et al. 2018)*. Attention to EBP has practical arguments behind it. De-

spite relatively stable budgets *(Wuschke et al. 2018)* in many police forces around the world, there is a trend towards a gradual reduction in the number of personnel and a more rational use of budgetary resources *(Mawby & Wright 2012)*.

This, in turn, requires an increase in analytical capacity and the conduct of numerous criminological studies using a variety of quantitative and qualitative analysis methods. At the same time, large criminological studies based on data in Kazakhstan are more often associated with projects from international organizations, such as UNODC reports *(Sandip 2011)* or victimization surveys *(van Deyk et al. 2018)*, and, to a lesser extent, with local developments.

The presented study is positioned as one of the first criminological comparisons in Kazakhstan of the 'portraits' of two types of crimes, which have a certain spatial specificity — petty thefts and violent crimes. According to surveys, in 2018, every tenth resident of Kazakhstan has become a victim of theft, which is an extremely high figure *(van Deyk 2018)* that is important to pay attention to. Victims of violent crimes are significantly fewer (4-5%), however, such incidents are generally perceived as more serious and reduce trust both in law enforcement agencies (van Deyk 2018) as well as among residents of the city or district *(Garcia, Taylor & Lawton 2007)*. Indeed, crime not only directly affects the specific victim but also threatens to spread fear and a sense of insecurity within society *(Zhizhin et al. 2023)*, not to mention the significant economic costs for the country's economy *(Verkeyev & Serebrennikov 2023)*.

The main goal of the research is to identify the *'hot spots'* of the specified types of crime in urban space, as well as to understand the relationship between the level of crime in the area and its characteristics in megacities such as Astana and Almaty. The data for analysis consists of the locations of crimes marked on the map of the Committee for Legal Statistics and Special Accounts of the General Prosecutor's Office of the Republic of Kazakhstan ***(Official website of the Committee for Legal Statistics and Special Accounts of the General Prosecutor's Office of the Republic of Kazakhstan)*** for 2023. In addition, we use geospatial data on the population of a given area, average housing prices, levels of business activity, urban density, and the industrialization of space.

Our analysis differs from a simple description of the number of crimes in a given space, which we consider insufficient for comprehensive analytics. In our opinion, attracting additional sources and relative assessment of the number of crimes (for example, per thousand residents of the area) can provide more balanced conclusions about the distribution of crime and its dynamics over time. This, in turn, may allow for a more effective organi-

zation of police work in response to crimes and their prevention. As far as we know, this approach is being applied for the first time for a large-scale assessment of crime in major metropolitan areas not only in the Republic of Kazakhstan but also in neighboring countries of the post-Soviet space.

In the first part of the study, we will discuss the key tenets of *spatial criminology* and show how the literature approaches the study of the spatial distribution of crimes in the city. After that, we will detail the data used, its preprocessing, and the associated weaknesses of our approach. The fifth section will be dedicated to the analysis of 'hot spots' in the studied cities and their dynamics over the past five years. In the last section, we will conduct a regression analysis to illustrate the typical *'portrait'* of spaces where thefts or violent crimes occur, as well as to highlight areas where, according to the described 'portrait', there should not be many incidents, yet we observe them in reality. We call such spaces *'latent hot spots'*.

Where do crimes occur and how do criminologists study this?

Spatial criminology

In the early 1970s, the application of crime mapping was limited by technical and organizational challenges. The lack of data and technology, as well as issues with converting addresses into points on a map, created difficulties *(Ratcliffe 2010)*. However, starting from the 1990s, the situation began to change rapidly. Thus, George Tita and Steven Radil, the US researchers who specialize in Social Policy and Spatial Analysis, respectively, note that significant advancements in spatial modeling of crime have occurred over the past 25 years *(Tita & Radil 2010)*. In the realities of 2023, the fact of the widespread use of computer mapping solutions and software for spatial analysis is particularly noticeable. Therefore, there arises a need for theorizing spatial human behavior *(Hipp & Williams 2020)* that could help meaningfully apply highly detailed data that modern researchers possess for analysis.

One of the early and popular approaches to analyzing crimes in space was the concept of 'hot spots'. The origin of 'hot spots' is linked to the critique of traditional criminological theory. Instead of focusing on individuals and communities, as criminologists did before the 1980s, this method is focused on specific areas with high crime rates *(Weisburd & Braga 2006)*. 'Hot spot' in criminology refers to a place with a high intensity of crimes, such as

specific addresses, neighborhoods, or districts. Analysts study these areas to identify clusters of incidents and attempt to explain their causes. Sometimes they also pay attention to small areas with high levels of crime or disorder, even if they know that there is no specific group of criminals there.

In a general sense, a 'hot spot' is a place where crime occurs much more frequently than average. The opposite of this idea is the concept of *'cold spots'*, where the level of crime is significantly lower than average *(Eck et al. 2005)*. A neighborhood in a large city where street robberies, thefts, or violence are frequently reported may be a 'hot spot'. Single-floor houses in a small town where criminal incidents are rarely recorded are an example of 'cold spots'.

The causes of the emergence of 'hot spots' may be related to the social aspects inherent to the area. The Brantingham couple — Patricia and Paul are Canadinan scholars from the School of Criminology, Simon Fraser University — proposed a special terminology to describe the causes of the emergence of these points. Bars and nightclubs, for example, create situations in which crimes occur. They are called *'crime generators'*. Train stations and crowded places attract criminals and are referred to as *'crime attractors' (Brantingham & Brantingham 1995)*. Despite the fact that the Brantinghams' terminology is more complex, we will focus only on these two main terms.

It turns out that 'hot spots' can arise both because social interactions within them lead to crimes and because the space can act as a magnet for those who wish to commit a criminal act. In this case, the police's task becomes to concentrate resources in areas where the likelihood of crime is higher, in order to both increase the rate of solving crimes 'in hot pursuit' and achieve a preventive effect to deter crime. Research indicates that effective resource concentration in 'hot spots' can contribute to a reduction in the overall crime rate in the city ***(U.S. Department of Justice Office of Justice Programs).*** In this context, it is important to remember that everyday knowledge about dangerous places can be misleading, as individuals may perceive as safe those places that statistically may not be so, such as busy streets, university campuses, and bus stops *(Brantingham & Brantingham 1995)*.

The policy based on hot spot analysis involves identifying areas of the city that require increased visibility. In practice, this looks as follows: the police conduct regular, intensive, highly visible foot patrols in crime-prone areas. The main function is embedded in its preventive nature. The placement of police personnel in the most crime-ridden areas can serve as a deterrent for potential offenders. Examples of this tactic's application indicate a significant reduction in crime rates. For example, in Essex, this led to a decrease in the rate of violent crimes by more than 70% and street crime by 30% *(BBC 2021)*.

Moreover, 'hot spots' can change depending on the time of day and year. Thus, at night, the likelihood of committing a crime in poorly lit areas with insufficient surveillance will be higher than in those with more of these elements of urban infrastructure. Speaking of the time of year, in the summer months, more crimes are expected to occur on the street rather than inside residential premises *(Ratcliffe 2010)*.

In 2014, David Weisburd, a US scholar from the Department of Criminology, George Mason University, proposed a summary of the tradition of studying 'hot spots' that had developed by that time — *'Law of Crime Concentration at place' (Weisburd 2015)*. According to it, a small number of places in an area or city concentrate a disproportionate amount of crime. This law is supported by research from various countries that demonstrate a consistency in the concentration of crime on street segments. For example, Sherman and his colleagues argue that in Minneapolis, over 50% of crimes come from 3.3% of addresses, while in Seattle, 5.1% of street segments account for half of the crimes *(Sherman, Gartin & Buerger 1989)*.

Charlotte Gill, Alese Wooditch, and David Weisburd, US research specialists in Criminology, researched crime trends in Brooklyn Park, Minnesota, over 15 years (from 2000 to 2014) and found a high concentration of crimes in a small number of locations *(Gill, Wooditch & Weisburd 2017)*. Approximately 2% of street segments generated half of the crimes, and only 0.4% accounted for a quarter of the crimes. Thus, they confirmed the 'Law of Crime Concentration at place'. Despite the stability in crime concentration, Brooklyn Park experienced a gradual decline in crime in 'hot' places, which significantly affected the overall crime rate in the city.

As far as we know, it is currently unknown whether the discussed law applies to cities in Kazakhstan. If we receive a positive answer to this puzzle, it will theoretically allow us to use the developments of the 'hot spots' theory to enhance police effectiveness in the country.

Violent crimes and property crimes in urban space

As is known, crimes can vary in nature. Using commonly accepted classifications, we distinguish two types of criminal incidents that may have a pronounced spatial specificity:

- Against the person (with or without the use or threat of violence);
- Against property (property crime)

According to statistics, the combined percentage of violent crimes significantly lags behind the share of property crimes, with a ratio that varies approximately as 20:80. However, it is worth noting that in a number of European countries in recent years there has been a trend towards a decrease in the number and a gradual equalization of the proportions between these

crimes *(Nelson 2015)*. Despite the global trend towards a decline in crime (the so-called the great crime decline *(Farrel, Tilley & Tseloni 2014; van Dijk, Nieuwbeerta & Larsen 2021)*, where greater emphasis is placed on reducing the rates of violent crimes, it is precisely violent types of crime that always attract public attention. This is explained by the relative clarity and high level of their latency in the case of minor or sensitive (for example, against sexual integrity) crimes. Moreover, the effectiveness of law enforcement is assessed in terms of the dynamics of crimes involving or threatening the use of violence.

Based on this, a decision was made to compare the spatial specificity of these two types of crime in the two largest cities of Kazakhstan — Astana and Almaty.

From the perspective of research on the spatial distribution of property crimes and space, we can only rely on studies predominantly conducted on Anglo-American material. Martin Andresen and Jordan Wong, Canadian scholars whose research fields are Spatial Analysis *(Geostatistics)* and Criminology, respectively, in their study *(Andresen & Wong 2023)* expected that schools, parks, and non-profit housing, by attracting youth, would increase the number of motivated criminals and, consequently, the likelihood of theft would rise. However, the results showed the opposite, indicating that the chances of theft decrease for these areas.

Crimes such as thefts, robberies, and car thefts can occur with varying intensity within neighborhoods and districts. For example, homes in Salt Lake City with well-maintained hedges are less susceptible to theft compared to other homes in the same area. In addition, apartments in Tallahassee that are close to the entrance of the complex and do not have a view of other buildings are more susceptible to theft than apartments within the building that face other buildings. Micro spatial variations also show that stores located near uninhabited areas or away from other commercial points are more likely to be robbed compared to those situated in densely populated commercial districts *(Sherman, Gartin & Buerger 1989)*.

Marcus Felson, Yanqing Xu and Shanhe Jiang, research specialists in Criminal Justice and Information Engineering from the US and China, in turn, analyzed the specialization of property crimes in Detroit and found that only 22 groups of neighborhoods were hot spots for all five types of property crimes. At the same time, 167 groups of neighborhoods were considered hot spots for only one type of crime *(Felson, Xu & Jiang 2022)*. This indicates that the distribution of crimes is uneven and can vary significantly depending on the area. Kate Bowers, a research scholar from Department of Security and Crime Science, University College London, analyzing burglaries in non-residential premises, shows that bars are the main generators

of such crimes, accounting for a third of all incidents. Together with cafes and restaurants, they are the site of half of all burglaries. At the same time, incidents occur in more bustling areas in terms of business activity *(Bowers 2014)*.

Thus, crime hot spots represent diverse and dynamic phenomena, the specifics of which can vary greatly from city to city. In the case of Kazakh cities, we can only roughly say that they tend to occur in lively and densely populated places and have a tendency to 'gravitate' towards leisure activity locations.

Data

Several data sources were used for the research. The key one is the information from the *'Crime Map'* of the Committee for Legal Statistics and Special Accounts of the General Prosecutor's Office of the Republic of Kazakhstan ***(Official website of the Committee for Legal Statistics and Special Accounts of the General Prosecutor's Office of the Republic of Kazakhstan)*** (hereinafter referred to as CLSA GPO RK). The map displays points of each crime in the Republic with basic information about the incident: article, severity, time of commission, time of registration, type of location (for example, private house, shopping center, or entrance). The map reflects information from the Unified Register of Pre-Trial Investigations *(Agybayeva 2023)* from the first half of the 2010s and is updated daily. This imposes certain limitations on our analysis, as the register contains only initiated criminal cases, which, for various reasons, may not comprehensively describe the criminal situation in the area. More complete data could come from geolocated reports of incidents from emergency service numbers, however, we do not have such data.

We used information about all crimes that occurred in 2019-2023. At the same time, most of the analysis was conducted only on data from 2023. This period was chosen due to the absence of external and internal shocks occurring in 2020 and 2022 and, possibly, affecting the specifics of crime distribution in urban space.

In the dataset used for 2023, there are 152,296 criminal incidents. For accurate description, based on the literature, we identified three groups of crimes that are expected to have a special spatial specification.

The first of them is theft *(Articles 187, 188 of the Criminal Code of the Republic of Kazakhstan)*. In the overall array, we find that 66,076 crimes and offenses

were attributed to theft of varying degrees of severity (i.e., 43%)[1]. In Astana, there are 9,057 thefts (14% of all such cases in the country), in Almaty 14,007 (21% respectively). Theft is by far the most common crime in the country. However, since we are more focused on mass crimes, we exclude serious offenses from this number, as we assume that planned thefts with significant damage should be studied as cases, rather than through statistical analysis. As a result, we will refer to thefts as crimes under Articles 187 and 188, parts 1 and 2 of the Criminal Code of the Republic of Kazakhstan.

The second and third groups of interest to us are robberies and assaults on one side and violent crimes on the other. However, we encountered the problem that the number of crimes in each of these groups is insufficient for statistical analysis. For this reason, we decided to combine these categories for research purposes. Understanding that robberies and assaults are conventionally considered crimes against property, we emphasize the violent aspect of these crimes and interpret it in a broad sense (i.e., not always expressed physically). Thus, we refer to violent crimes as incidents classified under Articles: 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, and 192 of the Criminal Code of the Republic of Kazakhstan. In our data, we record 9,671 crimes under these articles (6% of all incidents for 2023). In Astana, there are 880 cases (9% of all violent incidents in the country), while in Almaty there are 1,366 (14% respectively).

To conduct the analysis and compare the territories of the cities with each other, we divided the two studied cities into a grid of hexes with a diameter of 500 m. Each hex was assigned information about the total number of crimes in its territory, as well as the number of thefts according to various articles and parts of the Criminal Code of the Republic of Kazakhstan.

Conceptually, we shift the focus of analysis from the immediate points of crime commission (one can draw an analogy with pins stuck in a map) to the study of different areas of the city (analogous to a patchwork quilt). A simple count of points can only show us the variation of incidents across the territory of the city. Studying hexes will allow for a multidimensional analysis by also adding information about the population residing in the area, the type of development, housing prices, and much more. This will enable comparisons of areas based on the characteristics of different crimes as well as other properties of their socio-economic profile.

To compile this profile, we need data on the properties of each hex. To achieve this, we used three different sources through which we approxi-

[1] Due to the specifics of crime registration and their reflection on the map, this number may not coincide with the aggregated indicators of official statistics.

mated three characteristics of the area: the number of residents in the hex, its economic status, and the type of development.

In the first case, we used microdata on the population from the Kontur-Project, specifically prepared for the Republic of Kazakhstan for 2023[1] *(Humanitarian Data Exchange)*. The data also represent a grid of hexes with a diameter of 400 m, which were aligned with the hexes for crimes in the studied cities.

To assess economic characteristics, data from the *krisha.kz* website were used2. To avoid disclosing personal data, only the geolocation of the advertisement and the indicated price were used. Thus, each hex was assigned information about the average cost per square meter of residential property within it. For hexes where no listings were found, the price was generated based on the average from nearby hexes. The final values were winsorized at the 99th percentile. Another economic characteristic is the business activity in the area. To assess it, each hex was assigned the number of listings for commercial property rentals. Additionally, to approximately evaluate the level of industrialization of the space, hexes were assigned information on whether there is a presence, within them or within 300 m from them, of an announcement about the purchase or rental of production or warehouse premises.

As data on building density, we used the OpenStreetMap portal *(Official OpenStreetMap website)*. Thanks to this, we added information for each hex about the percentage of its territory that was built up with buildings, as well as the percentage occupied by park spaces and recreational areas.

In the next section, we analyze only crimes and will use socio-economic characteristics in the corresponding part later.

Analysis of 'hot spots' crime in Astana and Almaty

In the first part of the analysis, we will focus on identifying the main spatial characteristics of petty thefts and violent crimes in Astana and Almaty in the context of identifying the 'hot spots' of these crimes and assessing their dynamics.

[1] We express our gratitude to the Kontur-Project for providing special population data in the Republic at our request.

[2] To save the personal data, only information about the price and geolocation of the advertisement was collected.

Astana, the capital of Kazakhstan with a population of over one million people, ranks second in population among the cities of the country. There is a high level of crime observed here, as evidenced by data from 2023: during this period, 20,933 crimes were recorded in the city, which accounts for approximately 14% of the total number of crimes in Kazakhstan[1].

According to media reports, the capital also leads in relative indicators — 127 crimes per 10,000 people *(Urankayeva 2023)*. According to various media, the highest concentration of crimes is recorded in the old part of the city — around the central train station (primarily Goethe street), the Lesozavod area, and the central city market area *(Ualikhanov — Seifullin streets)* and in the Abylay Khan Avenue area *(Baigenews 2023)*. An unfavorable situation is noted in part of the left bank of the capital — the southeast area *(Uly-Dala and Sauran streets)*, the Zhagalau area, Kosshygululy street (Koshina, n.d.). Presumably, these conclusions are based on absolute indicators that only consider the actual number of crimes committed in different locations without taking into account the number of residents living there.

In turn, Almaty, the former capital of Kazakhstan and the largest city in the country with a population of over 2 million people, plays a key role in the economy, science, culture, and production. This leads to the fact that the city registers the most crimes among all regions of the country. According to the data used by the Criminal Procedure Code and Statistics of the Republic of Kazakhstan, 26,846 crimes were recorded in 2023, including 14,007 thefts (i.e., just over half of all incidents).

To provide some characterization of the immediate distribution of crimes in space, we must first understand how meaningful this is, i.e., do the data used satisfy the 'Law of Crime Concentration'? A positive response will allow us to investigate incidents in more detail, whereas in the negative case we will not be able to identify the 'hot spots'.

Law of Crime Concentration and the Megacities of Kazakhstan

If the *'Law of Crime Concentration'* holds true for the cities of Kazakhstan, we can expect that a small number of areas in the city account for the overwhelming majority of crimes. To illustrate this, let us refer to *Table 1*, which presents such ratios. The first numerical column indicates the percentage of urban space where all (i.e., 100%) crimes occurred. The last three

1 Let us remind you that our data may not fully coincide with the aggregated values.

columns show the percentage of crimes in the hexes that correspond to 3%, 5%, and 10% of the city's area, respectively. For example, in the first row ('Entire city area' — 'Astana' — 'Total crimes'), the value '55%' is found in the '3%' column. This means that 55% of all crimes in Astana occur in 3% of the urban territory.

Sample			Percentage of space that accounts for 100% of crimes	Percentage of crimes (by columns) and percentage of space (by rows), where they occur		
				3%	5%	10%
All territory of the city	Astana	Total crimes	29%	55%	71%	89%
		Petty thefts	20%	61%	77%	92%
		Violent crimes	10%	65%	81%	100%
	Almaty	Total crimes	44%	38%	50%	70%
		Petty thefts	35%	44%	57%	77%
		Violent crimes	18%	43%	57%	80%
Only dense urban development	Astana	Total crimes	70%	22%	29%	46%
		Petty thefts	66%	26%	35%	52%
		Violent crimes	41%	28%	39%	58%
	Almaty	Total crimes	84%	18%	25%	39%
		Petty thefts	77%	21%	30%	45%
		Violent crimes	52%	23%	32%	47%

Table 1. The ratio of the percentage of crimes to the percentage of the city area where they occur.

Thus, the highest concentration of crime is noted in Astana. Here, one-third of the urban environment becomes the site of 100% of crimes. Moreover, approximately half of all offenses are recorded in just 3% of urban space. For clarity, this area can be compared to the distance from the Central Mosque to Saraishyk street between Kabanbay Batyr and Mangilik El streets. In Almaty, criminal activity is more evenly distributed compared to Astana and covers 44% of the urban territory. However, about 70% of all crimes are concentrated in 1/10 of urban locations, which corresponds to the area of the Nauryzbay district. Accordingly, we can confidently state that the examined Law works for the megacities of Kazakhstan as well.

However, this approach has a significant weakness, as the administrative boundaries of both capitals include large uninhabited areas, which makes the ratio of crimes to urban space more pronounced. A large portion of crimes in both cities occurs in urban areas characterized by the highest population density. Often, this refers to the central part of the city, while the outskirts or suburbs have a less pronounced criminal background.

To provide a more balanced assessment, we also analyze only the territory with predominantly high-rise and dense development. Conditionally, it can be called the urban center in the broadest sense of the word. The results are presented at the bottom of *Table 1.*

If we base the analysis solely on dense urban development, the conclusions take on a more conservative character. 100% of committed crimes occur in 70% of the territory of Astana, which makes the proportions less pronounced. In the context of petty thefts and violent crimes, we observe a somewhat greater difference in the ratio (66% and 41% respectively). In Almaty, similar relationships can be recorded.

However, given that about half of crimes occur in almost all cases on 10% of urban territory, we can speak of adherence to the Law of spatial distribution of crime, but in significantly fewer situations. Thus, the subsequent analysis is intended to focus more on the spatial distribution of criminal activity of approximately half of all criminal incidents, rather than to describe them completely.

It is also worth noting that the use of a strategy based on the analysis of 'hot spots' is not a universal method applicable to all types of crime, as some of them do not have a spatial attachment (corporate crimes, cyber fraud, remote crimes) or it is not as pronounced (classic frauds).

'Hot spots' of Astana

In this section, we will analyze the spatial distribution of crimes in the city. Astana and Almaty, paying special attention to the issue of identifying 'hot spots' in urban space. It is important to note that our results will not duplicate crime distribution maps in urban space *(which you can find in the Appendix)*, as crime is a deeply social phenomenon. This means that the number of crimes in any given area often reflects not the criminality of the territory, but its population. In order to understand where the most crimes occur, we take not the absolute value (the number of crimes per hectare), but the relative value — the number of crimes per 1000 residents per hectare. Thus, we can understand which areas require more attention from law enforcement, despite a small number of criminal incidents.

In modern criminology, several approaches have been developed to identify hot spots, i.e., areas where an anomalously high number of crimes

occur. We prefer the *Getis-Ord Local Gi* (or *Gi-statistics*) *(Getis & Ord 1992; Fortin & Dale 2009)*, as it allows us to identify not individual hexes of space as 'hot' or conversely 'cold', but to construct entire problematic areas. However, this approach has a weakness, as it pays less attention to isolated hexes with a high number of crimes (for example, shopping centers).

More formally, using Gi-statistics, we compare the environment of each hex (let's call a certain hex X1) with the environments of other randomly selected hexes (for example, X2, X4, and so on) in our data. We are investigating how the environment X1 may randomly occur in our data. If X1 is non-random, we say it is a 'hot' or 'cold' spot. To understand which one it is, we assess the difference between the environments X1 and a set of randomly selected environments of other hexes (X2, X4, etc.). When comparing, the more crimes in X1, the more confidently we call it a hot spot, and the fewer crimes, the more we call it a cold spot.

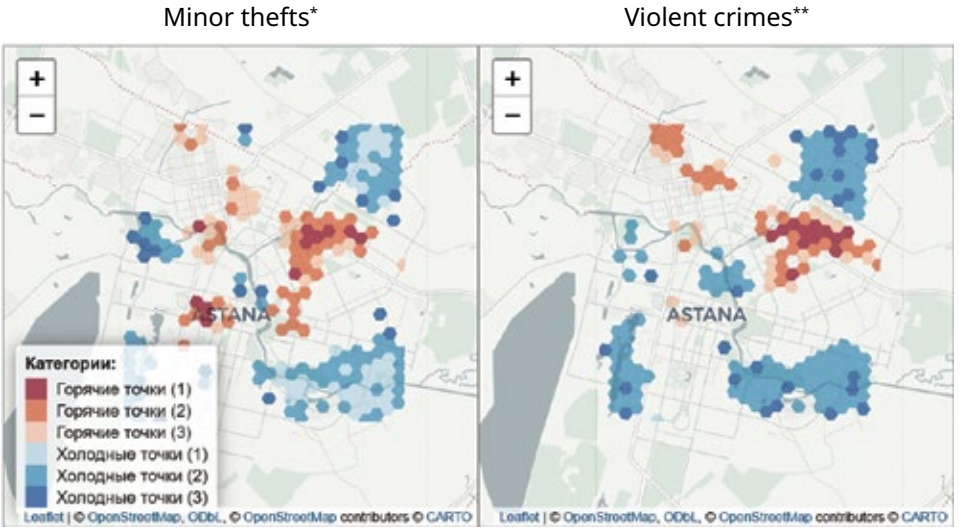

Figure 1. Gi-statistics for crimes per 1000 residents in the urban area of the City of Astana.

The graph is interactive. Hover over the area of interest to find out its value. To change the scale of the assessment, switch the tab at the top. Urban development refers to the area of the city without sparsely populated outskirts.

* Articles 187, 188 Part 1, 2 of the Criminal Code of the Republic of Kazakhstan.

** Articles 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, 192 of the Criminal Code of the Republic of Kazakhstan.

Let us remind you that we are analyzing the number of crimes (violent and minor thefts) per 1000 residents in a hex.

We will analyze the relationship between location and crime rates in Astana, considering the number of crimes committed per 1000 residents. Figure 1 presents a map of Gi-statistics, where 'hot spots' are highlighted in red spectrum, and the blue spectrum indicates 'cold spots', i.e., statistically low crime numbers. Colorless areas indicate the absence of statistical significance, i.e., neighboring areas with similar hexes could have arisen by chance due to fluctuations in various common causes of crime.

As shown in *Figure 1*, the law of crime concentration has been confirmed in relation to violent and property crimes in Astana. Thus, both petty thefts and criminal incidents involving violence in a broad sense occur more frequently in the city center, where there are large flows of people, rather than closer to the outskirts, thereby partially mirroring the population density map. It has also been found that the districts of the city located on the right bank of the capital are more susceptible to the specified types of crimes.

Now let's examine the distribution of crime across the city's territory in more detail. In urban folklore, it is traditionally believed that the most criminal areas in *Astana* are the *Saryarka* district and marginalized parts of the city such as *Lesozavod*, *Kirpichny*, the markets *Artem*, *Alem*, etc., the train station area and its adjacent territory. However, from the perspective of relative values, this is not always the case. As a result of the analysis of Gi-statistics, the most pronounced hot spot of violent crime in Astana is located in a residential area of the city characterized by uniform Khrushchyovka-style buildings. At the same time, this is the territory around the campus of ENU, gradually extending towards the area of the 7th clinic, which is notable for its dense construction and a high degree of affordable rental housing. The sharpness of criminality decreases closer to the southeast, which is also an area of rental housing, but possibly due to the differences in the type and nature of housing (the private sector area), the criminogenic effect gradually loses its strength.

To some extent, we can identify both a hot spot and the areas of the *Water-Green Boulevard*, smoothly continuing the trend towards the *Botanical Garden*. Despite its relatively prosperous reputation, this area may attract not only tourists but also criminals. It is possible that these reasons may be related.

The minimum level of violent crime is noted in the European quarter of the capital, in the residential area of the new train station, the industrial part of the city, and in the residential areas near the shopping center *Khan Shatyr* and partially in the *Kurgaldzhin* highway area. In the case of minor property crimes, similar spatial patterns have been established. Despite the

small number of crimes, the ENU area with territories within a couple of kilometers to the southeast and northwest stands out as a *'problematic'* area when considering the number of residents living there. Minor thefts are less represented on the outskirts of the city, in elite residential areas of the left and right banks, and in industrial zones.

Overall, in Astana, violent and property crime exhibit similar patterns of distribution across the city's territory. However, the scale of coverage of urban space by minor thefts is significantly greater compared to violent types of crime. While the former have distinct '*zones*' or '*belts*', the latter are more sporadically dispersed throughout the city.

'Hot spots' of Almaty

Let us consider *Figure 3* with the distribution of violent crime and minor theft per 1000 residents.

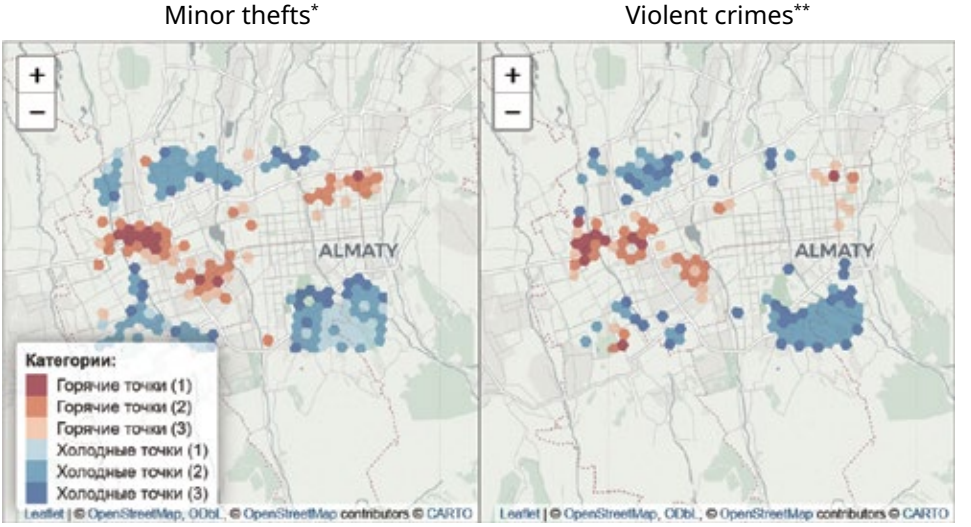

Figure 3. Gi-statistics for crimes per 1000 residents in the urban development of Almaty.

The graph is interactive. Hover over the area of interest to find out its value. To change the scale of the assessment, switch the tab at the top. Urban development refers to the area of the city without sparsely populated outskirts.

* Articles 187, 188 Part 1, 2 of the Criminal Code of the Republic of Kazakhstan.

** Articles 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, 192 of the Criminal Code of the Republic of Kazakhstan.

In Almaty, property crime is concentrated in the city center — the most criminally active areas are characteristic of the *Almalinsky*, *Bostandyk*, and *Alatau* districts. The main attractors are places of mass gathering of people — train stations, car service centers, markets; spaces intended for leisure; residential areas with uniform dense construction. At the same time, in the hexes located in the foothills of the city *(Mountain Giant),* there is a statistically small number of crimes, which may be explained by the low population density in those areas and a fairly prestigious socio-economic status. We can also observe a certain spike in crime in the Medeo complex area.

The map of violent crimes is almost identical to the distribution of property crimes in Almaty. However, violent incidents occur several times less frequently than minor thefts. From a geographical perspective, violent crimes are represented by several hotspots — *Almaly* district, *Auezov* district, *Nauryzbay* district, *Tuksib* district.

The dynamics of hot spots from 2019 to 2023

In the case of analyzing 'hot spots', researchers are often more interested in the temporal aspect of crime rather than its spatial aspect. We also could not overlook this question and studied how hot spots in the city changed from 2019 to 2023. The results for Astana is represented in *Figure 5*, while Almaty is shown in *Figure 6*. However, to understand the graph, it is necessary to provide explanations regarding the methodology of its calculations.

To assess the dynamics of crime changes in the city, we obtained Gi-statistics from the previous section for all crimes in the studied cities over the years for five years. It is worth noting that we used population data for the area only for 2023, due to the lack of similar sources for previous periods. As a result, for each hexagon in each year, we obtained two parameters: statistical significance, by which we can classify the hexagon as a point for analysis, and the value of the *Gi-statistic*, which indicates whether it will be a 'hot' or 'cold' point.

After this, based on existing classifications, we identified several groups of hexes with different temporal dynamics:

1. Territories that had statistical significance for five or four years in the studied period. For them, we conducted the *Mann-Kendall test*, which shows the monotonicity of the growth of the Gi-statistic value in the studied period. The test could show values from –1 (rapid and constant decline) to 1 (rapid and constant growth). If the test value was greater than 0.5, we marked the hex as 'Hot, Growing'; if less than –0.5 — 'Hot, Fading'; and for values between –0.5 and 0.5 — 'Hot, Uncertain Dynamics';

2. If a point had statistical significance for two or three years in the studied period, it was categorized as 'Hot, unstable';
3. If a point gained significance only in 2023 or the year before, we recorded it as 'Hot, new'.

The graphs below present the distribution of points by these types. We propose to analyze only the categories of *'growing'*, *'fading'*, and *'new'*.

Thus, in the case of Astana, we observe that petty thefts in the old part of the city are gradually declining, while the statistical values for similar crimes in the area of *Central Park*, *Nurzhol Boulevard*, *Presidential Park*, and *Mega Silk Way* are steadily increasing. As expected, we also record new hot spots in the area of new construction in the west and south of the city. A rare exception to the stable growth of statistics in the northern and eastern parts of the city is the ENU named after Gumilyov, which may be explained by the increase in the number of students at the university.

If the decline in the effect of petty thefts in the *'Tselinograd'* part of the city is characterized by a significant and related spatial area, then violent crimes exhibit the same trend only in certain *'episodic'* hexes. At the same

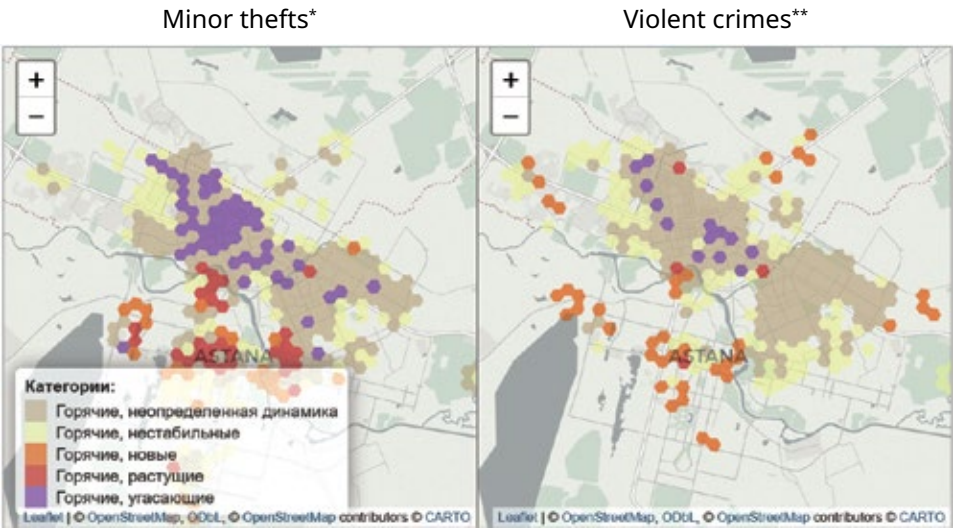

Figure 5. Dynamics of 'hot spots' for crimes per 1000 residents in the city of Astana from 2019 to 2023.

The graph is interactive. Hover over the area of interest to find out its value.

* Articles 187, 188 Part 1, 2 of the Criminal Code of the Republic of Kazakhstan.

** Articles 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, 192 of the Criminal Code of the Republic of Kazakhstan.

time, for almost the entire left bank of the capital, the relative increase in the studied indicator for violent crimes is a relatively new phenomenon.

Transitioning to the context of Almaty, we expect to see the emergence of new 'hot spots' in the areas of new residential developments in the west and north of the city. At the same time, one can observe the emergence of violent crime points in the private sector in the southwest. The distinction between the two studied types of crimes can also be seen in the patterns of fading 'hot spots'. The gradual decline of violent crimes is characteristic of the *Mega-Park* area, in the space from the *Green Bazaar* to *Raiymbek Avenue* and in the vicinity of the *PKiO Family park*. The effect of petty thefts decreases in certain hexes to the west of the lake. *Sairan*, in the territory of Medeu, while it grows in the area around the car market *Zhibek Zholy* and *Mega Center*.

In our interpretation, we wanted to note that the presented analysis speaks **not** to the dynamics of growth or decline **number of crimes**, but to the change in the *'weight'* of a particular hex in the overall picture of crime

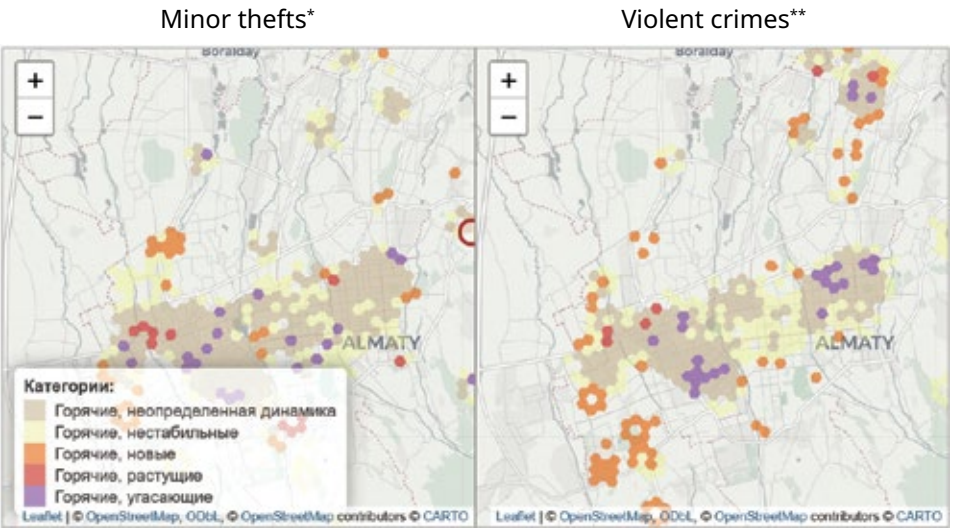

Figure 6. Dynamics of 'hot spots' for crimes per 1000 residents in the city of Astana from 2019 to 2023.

The graph is interactive. Hover over the area of interest to find out its value.

* Articles 187, 188 Part 1, 2 of the Criminal Code of the Republic of Kazakhstan.

** Articles 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, 192 of the Criminal Code of the Republic of Kazakhstan.

in the city over five years. At the same time, we analyze crime in relative terms — as the number of incidents per 1000 residents of the hex.

The relationship between crime and socio-economic characteristics

In the previous section, we provided a general description of the distribution of petty thefts and violent incidents in two megacities of Kazakhstan. However, this analysis gives us too few answers regarding the relationship between crimes and the socio-economic characteristics of the space in which they occur. Understanding such relationships will allow us to better comprehend the causes of spikes in criminal activity in a given area and more effectively develop crime prevention policies. To clarify this issue, we will use regression analysis.

Categories of crime places

To contextualize this part, we will start with a rhetorical question. From the perspective of spatial characteristics, can we compare theft in a park and theft in a shopping center? Based on the research tradition, we tend to give a negative answer, as different territories generate or attract crimes differently. For example, a shopping mall is an expected point of concentration for criminal incidents and does not require special spatial analysis (at the city level), unlike thefts on the streets. To understand the characteristics of places where crimes occur, we need to analyze only those locations that cannot generate or attract crime by themselves and are considered as cases: in private sectors, apartment buildings, and adjacent properties, in public street spaces. The data used in the *Crime and Security Analysis of the Republic of Kazakhstan* records more than fifty diverse types of crime locations. To simplify the analysis, we classified all locations into ten main groups. As shown in Table 2, in Astana, property crime is predominantly localized in commercial establishments (29%), in multi-story residential buildings and their adjacent areas (14.5%), and on the streets of the city (10.5%). In Almaty, the trend is similar; however, the list of primary locations for property crimes is supplemented by the private residential sector and transportation facilities: commercial establishments (25.7%), street public spaces (17.8%), transportation facilities (11.2%), private non-commercial property (9.9%), multi-apartment buildings and adjacent property (9.1%).

In Astana, there is a trend of violent crimes predominantly occurring in public spaces (37.7%), i.e., in higher education institutions, educational and medical facilities, and others. Next in prevalence are places such as apartment buildings (16.9%) and the private residential sector (8.5%). In Almaty, the violent nature of crimes is noted in half of the cases on the streets (50.1%). Besides street spaces, crime involving violence in a broad sense occurs more often in private residential premises (13.5%) than in multi-story buildings (5.7%).

Crime scene	Astana		Almaty	
	Minor thefts	Violent crime	Minor thefts	Violent crime
Multifamily houses and adjacent property	1112 (14.5%)	149 (16.9%)	994 (9.1%)	77 (5.7%)
Private (non-commercial) property	373 (4.8%)	75 (8.5%)	1086 (9.9%)	184 (13.5%)
Public outdoor spaces	807 (10.5%)	332 (37.7%)	1955 (17.8%)	683 (50.1%)
Cultural, educational, recreational, and GRB facilities	570 (7.4%)	68 (7.7%)	633 (5.8%)	36 (2.6%)
Public goods (indoors)	119 (1.5%)	7 (0.8%)	111 (1%)	10 (0.7%)
Industrial and warehouse premises	39 (0.5%)	0 (0%)	45 (0.4%)	2 (0.1%)
Commercial properties	2231 (29%)	57 (6.5%)	2816 (25.7%)	28 (2.1%)
Transport facilities	415 (5.4%)	9 (1%)	1231 (11.2%)	6 (0.4%)
Other facilities	1932 (25.1%)	163 (18.5%)	1949 (17.8%)	313 (23%)
Total	7694 (100%)	880 (100%)	10961 (100%)	1362 (100%)

Table 2. Number of crimes committed broken down by criminal articles against property (percentage of all crimes is in parentheses).

It is worth noting that despite the interconnection of categories, we proceed from the position of the diversity of crimes depending on socio-economic characteristics and the strategies of the criminal. For this reason, we

exclude from the analysis cultural-educational, recreational, and GRB objects, as well as commercial, transport, production, and warehouse premises. Analysis in these categories will reveal specific types of objects where crimes occur. For example, by studying thefts in places of public goods, we will create a map of schools, hospitals, and universities in the city.

For the three selected categories — private (non-commercial) property, multi-apartment buildings, and street public spaces — such complexities, in our opinion, are not so significant. We assume that crimes in these spaces are distributed throughout the city without strict ties to specific types of objects, and studying their connection with socio-economic characteristics will provide more informative results for understanding and preventing this phenomenon.

Analytical strategy

Thus, for Astana and Almaty, we will analyze changes in the number of two types of crimes (minor thefts and violent crimes) in the hex. Within each type of incident, we distinguish three samples based on their locations: in private (non-commercial) property, multi-apartment buildings, and adjacent property, as well as in public street spaces.

Since up to 80% of the values in the dependent variables are represented by zeros, the number of crimes is countable and varies from 1 to 10, there is overdispersion between the mean and standard deviation, and the distribution of zeros is non-random and related to non-zero values, we opted for negative binomial regression (negative binomial regression) as the key method for analysis.

To study the relationship between the characteristics of a place and the number of crimes, we evaluate a model of the form:

$$\text{Number of thefts}_i^S = \text{Place characteristic}_i^S + \text{Spatial lag}_i + \text{District}_i + \text{Error}_i$$

Where $\text{Number of thefts}_i^S$ is the number of thefts of type s in hex i. Place characteristics $\overset{S}{i}$ are represented by the following independent variables for each hex i:

- Number of residents in the hex (in thousands);
- Selling price of housing (in 10 thousand rubles);
- Level of business activity. An ordinal variable that we operationalize through the number of advertisements for the rental of commercial premises in the hex. For comparability of results between cities, we coded the absolute number of variables into three categories,

where the reference point is the absence of advertisements in the hex. Among the remaining observations, the lower half of the median is termed *'moderate level'*, while the upper half is termed 'high level' of business activity.

The presence of industrial premises in the hex. Dummy variable. In the presence of or at a distance of 300 m. From him, advertisements for the rental of production premises, the variable took a positive class;

Percentage of buildings in the hex from the total area (in 10%);

Percentage of parks in the hex from the total area (in 10%);

Distance from the city center (in km). This measure is used for a rough assessment of the spatial characteristics of the hex's location.

The distribution of descriptive statistics for the listed variables is presented in the Appendix in *Table A2*.

Spatial lag_i — refers to the average value of the dependent variable in the surrounding hexagon. Thus, we account for how the density of crimes in a certain space is related to the surrounding territory (i.e., the spatial effect). This will allow us to separate the effects of other variables (such as population) from what is called 'spatial diffusion of crime' — in location X, there may be many criminal incidents because crime has increased in the adjacent space.

The $district_i$ represents the fixed effect of the district for Astana and Almaty for hex i, while the $error_i$ is the error. For each of the models, robust errors are calculated with clustering by the districts of the city in the case of Astana and Almaty.

The 'portraits' of typical theft and violent crime. Results of the analysis.

What spatial characteristics are associated with the level of violent crimes or thefts? To answer this, we will refer to *Tables 3* and *4*.

Minor thefts	Violent crimes					
Multi-apartment buildings	Private houses	Street spaces	Multi-apartment buildings	Private houses	Street spaces	
Population (in thousands)	2.622***	5.040***	1.911*	1.837**	8.281*	2.307***
	(0.169)	(0.285)	(0.297)	(0.236)	(0.833)	(0.078)
Selling price per m2 (in 10 thousand tenge)	0.892	0.836	0.845*	0.893	1.060	0.915
	(0.061)	(0.110)	(0.086)	(0.277)	(0.305)	(0.093)
Level of business activity (moderate)	2.528***	1.931	2.644***	2.043	2.122***	2.439***
	(0.187)	(0.400)	(0.154)	(0.639)	(0.211)	(0.129)
Level of business activity (high)	2.096***	1.946	2.177***	2.783	1.429	2.440***
	(0.106)	(0.422)	(0.159)	(0.742)	(0.321)	(0.269)
Presence of industrial premises in/near the hex	0.911	0.961	1.156	0.864	1.440	1.069
	(0.455)	(0.404)	(0.198)	(0.464)	(0.339)	(0.265)
Percentage of buildings in the hex from the total area (in 10%)	1.255***	1.272*	1.299*	1.516***	1.127	1.361***
	(0.064)	(0.099)	(0.130)	(0.122)	(0.163)	(0.053)
Percentage of parks in the hex from the total area (in 10%)	1.066	1.162	1.142*	0.819	0.885	1.143
	(0.075)	(0.086)	(0.053)	(0.112)	(0.131)	(0.069)
Distance from the city center (in km)	0.740***	0.860***	0.764***	0.771*	0.961	0.816***
	(0.030)	(0.005)	(0.023)	(0.117)	(0.051)	(0.053)

Minor thefts	Violent crimes					
Multi-apartment buildings	Private houses	Street spaces	Multi-apartment buildings	Private houses	Street spaces	
Spatial lag	1.384***	1.329	1.482***	2.652*	1.389	1.786***
	(0.072)	(0.176)	(0.108)	(0.485)	(0.869)	(0.151)
Constant	0.755	0.130***	0.639	0.124	0.005**	0.135**
	(0.419)	(0.296)	(0.644)	(2.092)	(1.779)	(0.696)
District	Yes	Yes	Yes	Yes	Yes	Yes
Num.Obs.	3497	3497	3497	3497	3497	3497
AIC						
In parentheses are robust standard errors clustered by city districts						
The coefficients are exponentiated to obtain the incidence rate ratio						
* p < 0.05, ** p < 0.01, *** p < 0.001						

Table 3. Negative binomial regression for the city of Astana.

As shown by the analysis in *Table 3*, the strongest predictors are the population size, the level of business activity, and the density of residential buildings in relation to each other.

The largest positive effect on the number of minor thefts and violent crimes is associated with the number of residents in the hex. Especially concerning the criminal situation in the private residential sector. For example, with an increase in the total number of residents in a hex with crimes in the private sector by 1,000 people, the number of minor thefts in that area will increase by 400% and violent crime by 700%. Perhaps such a large difference is due to the lower population density in this type of housing. In this case, the effect of an additional thousand residents on crime in apartment buildings and on the streets of the city provides a more balanced picture — an increase of 80%-160% under otherwise equal conditions.

The level of business activity as a factor that can affect the dynamics of crimes also has a positive significance. If there is moderate business activity in the hex (the number of office rental advertisements is less than or equal to three), the expected number of thefts in apartment buildings and on the streets in Astana will increase by approximately 150%. A similar effect of the business activity predictor is observed in relation to violent crimes in street areas and, somewhat lower, in the private sector (110%). A high level of business activity overall shows similar effects: from 110% to 140%.

The density of urban development is also significant in the probability of committing crimes. With a 10% increase in the density of a hexagon's territory, the number of petty thefts increases by 20% in all three main crime locations, while the number of violent incidents will increase by between 10% and 50% depending on the specifics of the location.

In the regression results, there are predictors that are associated with dependent variables not only positively but also negatively. That is, with their increase, the number of crimes decreases. Such variables include the distance from the city center and real estate prices. If the hex is removed by 1 km. from the center further than another with the same other characteristics, it will have, on average, 20-25% fewer thefts and almost the same amount fewer violent crimes in high-rise buildings and in the street space of the city. This predictor has no effect on the distribution of violent crime in the private sector.

Regarding the connection with the economic characteristics of the area, it can be observed that if the price of real estate in the area of Astana increases by 10,000 tenge, the potential number of street thefts decreases by 8%. In the case of other types of spaces or violent offenses, the price of housing in the hex does not have any effect.

The predictor 'percentage of park area in the hex relative to the total area (at 10%)' has an expectedly pronounced positive correlation in the case of street thefts (15%).

The significance of the spatial effect has been identified in the case of property and violent crimes in apartment buildings and on the streets. That is, if the specified types of crimes show a positive trend in a certain hex, an increase in similar crime is expected in neighboring hexes. This effect is most pronounced (however, at the borderline significance) in the case of violent crimes in apartment buildings. That is, if an average of one incident of this type occurs in the surrounding hex, then in the hex itself, approximately 160% (or at least one and a half times) more crimes are expected, all else being equal.

At the same time, no significant relationship was found between the dependent variable and the number of industrial objects in the urban space.

The criminal profile of Almaty is largely determined by the same predictors that are significant for the space of Astana. However, some differences are recorded. Let us consider them in more detail in *Table 4*.

In Almaty, the predictor 'the number of residents living in a hex' has a strong and significant effect in the case of property crime, regardless of the location of the incident. Adding 1000 residents to the hex increases the expected number of thefts by 50%. Moreover, the effect is also observed in relation to violent crime in public spaces (about 45%).

A factor such as the area of development in the hex demonstrates a stable positive correlation in predicting both property incidents and violent crimes. With each percentage increase in development in the hex relative to the total area, the expected number of thefts and violence increases on average by 30%.

In Almaty, the factor of business activity has an abnormally high significance on the commission of crimes. Thus, the more the business sector is

Minor thefts	Violent crimes					
Multi-apartment buildings	Private houses	Street spaces	Multi-apartment buildings	Private houses	Street spaces	
Population (in thousands)	1.572***	1.524***	1.479**	1.664	1.275	1.423*
	(0.128)	(0.065)	(0.144)	(0.393)	(0.170)	(0.146)
Selling price per m2 (in 10 thousand rubles)	1.010	0.996	0.924*	0.801**	1.142*	0.963
	(0.061)	(0.070)	(0.038)	(0.077)	(0.065)	(0.050)
Level of business activity (moderate)	2.478***	1.718***	2.256***	3.960***	1.744*	2.098***
	(0.107)	(0.128)	(0.073)	(0.391)	(0.253)	(0.203)
Level of business activity (high)	3.863***	2.291***	3.160***	2.690*	2.042*	2.826***
	(0.183)	(0.157)	(0.121)	(0.499)	(0.288)	(0.240)
Presence of industrial premises in/ near the hex	0.794*	1.326**	1.079	0.760	0.953	0.939
	(0.113)	(0.106)	(0.096)	(0.336)	(0.238)	(0.224)
Percentage of buildings in the hex from the total area (in 10%)	1.379***	1.256**	1.329***	1.539***	1.311***	1.368***
	(0.066)	(0.072)	(0.057)	(0.115)	(0.050)	(0.066)
Percentage of parks in the hex from the total area (in 10%)	0.960	0.917	1.097	1.019	0.819	1.098
	(0.056)	(0.094)	(0.060)	(0.141)	(0.159)	(0.074)
Distance from the city center (in km)	0.905**	0.924*	0.891***	0.948	0.852***	0.862***
	(0.035)	(0.039)	(0.031)	(0.124)	(0.044)	(0.032)

Minor thefts	Violent crimes					
Multi-apartment buildings	Private houses	Street spaces	Multi-apartment buildings	Private houses	Street spaces	
Spatial lag	1.654***	1.747***	1.516***	5.227*	1.972	1.905***
	(0.067)	(0.044)	(0.048)	(0.832)	(0.460)	(0.116)
Constant	0.134**	0.386	0.448	0.007*	0.236	0.206**
	(0.702)	(0.639)	(0.572)	(2.352)	(0.808)	(0.527)
District	Yes	Yes	Yes	Yes	Yes	Yes
Num.Obs.	3187	3187	3187	3187	3187	3187
AIC						
In parentheses are robust standard errors clustered by city districts						
The coefficients are exponentiated to obtain the incidence rate ratio.						
* p < 0.05, ** p < 0.01, *** p < 0.001						

Table 4. Negative binomial regression for Almaty

represented in the area, the greater the number of crimes (property and violent) one should expect. The effect is particularly pronounced in the case of violent crimes in multi-apartment residential buildings and the surrounding area (about 400%).

In addition, a significant negative correlation is observed with the predictor *'distance from the city center'*. If the hexagon is removed from the center by 1 km and more, there will be 10% fewer thefts of all three types and 15% fewer violent crimes in residential areas and on the streets.

The economic factor in the distribution of crime in Almaty has an ambiguous effect. In relation to violent crime in the private sector, it has a positive effect (an increase in housing prices leads to a 15% increase in the expected number of crimes), while with the dynamics of street thefts and violent crimes in high-rise buildings, this predictor is negatively correlated (by 20% and 8% respectively).

A similar trend was identified in the analysis of the significance of such a factor as 'the presence of industrial objects in the hex'. In particular, this factor has a negative impact on property crime in apartment buildings, while it has a positive impact on thefts in the private housing sector. That is,

if there are production facilities in the hex, the potential number of thefts decreases by 20% in the first case, while it increases by 30% in the second.

The analysis did not reveal a connection between the distribution of crimes in the urban space of Almaty and the presence of a park zone in this space.

Regarding the spatial effect, a strong significant effect of mutual influence of the criminal situation in urban spaces on each other has been identified in Almaty, just as in Astana. Particularly noteworthy is the strength of the spatial effect of violent crimes in high-rise buildings (the number of crimes increases by 420%). That is, let's take, for example, a hex in an area with high-rise construction. If we can average one assault in the six surrounding hexes, the likelihood of a violent crime occurring in the discussed hex increases by 420%.

A comparative analysis of the distribution of property and violent crimes in the cities of Astana and Almaty showed that, all else being equal, the commission of these types of crimes in the city is determined by:

- A large resident population;
- High building density;
- A high level of business activity;
- Positive criminogenic dynamics in neighboring areas;
- Close proximity to the city center.

In addition to the listed predictors, an inverse relationship was identified in Astana between the socio-economic profile of the district and the likelihood of crimes occurring in it. We also found that the neighborhood's proximity to parks differently affects the dynamics of crime in Astana depending on the type of building and housing structure. The presence of industrial facilities within or near the hex reduces the number of thefts in apartment buildings in Almaty. In Almaty, the price of real estate also has a different effect for different types of spaces where the crime occurred.

'Latent hot spots'. In which spaces do more thefts occur than predicted by the model?

Above, we examined a typical minor theft and a violent crime in the two largest cities of Kazakhstan. However, due to the statistical nature of our conclusions, it is not possible to provide a comprehensive explanation of the phenomenon under study. In the statistical analysis of social phenomena, the model used can explain the presence and strength of the relationship between phenomena for most, but not all observations. It can be ex-

pected that a number of hexes in space do not conform to general patterns and should rather be considered separately. In this case, for the model, they will be a kind of 'blind spots'. For example, according to the model, hex X should have a certain number of crimes as it possesses certain characteristics. However, in real data, we observe significantly fewer or more criminal incidents.

Such exceptions to the rules require separate analysis and are subject to study using the case study method. In our work, we refer to these zones that deviate from the analysis as 'latent hot spots' and argue that latent hot spots deserve no less attention, as they can shed light on unaccounted but nonetheless important factors causing the commission of crimes. This knowledge about atypical determinants of crime rates will enhance the effectiveness of preventive work by law enforcement agencies.

Figure 7 shows the hexagons where the difference between the actual number of crimes and the expected number based on modeling results exceeds five. The color reflects the magnitude of this difference. It is presented in absolute values, which are unique to each type of territory, crime, and city, and therefore is not provided on the graph as numbers. For this reason, we will only consider hexagons of saturated color for analysis.

The study of latent hot spots in Astana demonstrates that they are primarily identified in sparsely populated areas. As shown above, the statistical model established a connection between the number of residents in an area and the frequency of crimes committed in that area. According to this logic, crimes should occur significantly less frequently on the outskirts of the city, but as the analysis shows, in some cases they are recorded anomalously more often. Such areas in Astana are:

- Private sector of the village *Talapker*;
- Private sector on *Dosmambet Zhyrau*;
- Vacant lots near *Ob'yezdnaya* street;
- The area of the cemetery near the *Karaganda* highway;
- *Koksai* street in the village of International;
- Dacha communities near the village of *Prigorodny*;
- Cottages under construction on *Uly Dala* Street.

In the specified areas, an unusually large (in the context of modeling) number of registered street violence is recorded. Property street crimes are noted in the *Koktal* microdistrict (*Tlendiyev*), on the outskirts near the street. *Northern Bypass*, on the *Kurgaldzhin* highway, and again in the territory of the suburban dacha areas.

A significant number of violent crimes are observed on *Turan* avenue near the park, on *Nurzhol Boulevard*, and in the vicinity of Sauran-Orynbor streets. Minor thefts are registered unusually often on the street. *Kaban-*

Figure 7. The difference between predicted and actual values for urban development in Astana*

The graph is interactive. Hover over the area of interest to find out its value. To switch cities, click the tab at the top. In the upper right corner, you can select the type of territory.

* Hexagons with a difference of 5 or more crimes are visualized. Color saturation indicates the difference. Values are not scaled.

** Articles 187, 188 parts 1, 2 of the Criminal Code of the Republic of Kazakhstan.

*** Articles 99, 101, 102, 104, 106, 107, 110, 111, 114, 191, 192 of the Criminal Code of the Republic of Kazakhstan.

bai Batyr area near Nazarbayev University, in the private sector along the embankment, in the 'Astana' park, and in the European quarters near the *Presidential Park*.

It is possible that the identified latent crime hotspots are due to the characteristics of the space. In almost all cases, these are uninhabited territories. The likelihood of remaining unnoticed and leaving the crime scene in such situations is high. One cannot exclude the factor of *'patrol districts'*, where law enforcement officers 'mark' all incidents with an undefined location of the crimes on certain objects.

In Almaty, the patterns of latent hot spots coincide. These are mainly areas with infrequent flows of people or private sectors closer to the outskirts of the city. Thus, violent street crimes are anomalously often recorded here:

- The cemetery *'Batys Ziraty'* (western part of the city);

- A construction site in the *Algabas* microdistrict (possibly a *'duty area'*);
- The private sector on *Akbulak Street*;
- *North Ring Highway*;
- *Medeu*.

Violent crimes in high-rise buildings are registered in the Kalakman-2 microdistrict, particularly in its upper (*Shalyapina-Ashimova*) and lower parts (*Rayimbek Avenue — Alty Alash*). Incidents also frequently occur in the industrial areas of the *Alatau* district on *Nemirovich-Danchenko* streets.

Unexpected indicators of street property crime have been identified in the Turkibsky district around Medeu and higher in areas characterized by a high socio-economic status. In the area of multi-story residential buildings, petty thefts occur in the Shugyla microdistrict at the intersection of Abay Avenue. At the same time, atypical attacks on property crimes are prevalent in the private sector of microdistricts 5 and 8 along the same *Abay* avenue and in the central part of the city along *Seifullin — Abay — Satpayev* streets.

Appendix

Aggregating category (authors' data)	**Subcategories (data from the Criminal Policy and Statistics Department of the Ministry of Internal Affairs of the Republic of Kazakhstan)**
Public outdoor spaces	park (square), street, street (square), other street areas, beach
Private (non-commercial) property	from the car salon, garage, personal transport, shed, private yard, under construction private house, private yard, including fenced, dacha, house
Multifamily houses and adjacent property	apartment, basement, dormitory, attic, entrance of a residential building, unfenced yard of the house (excluding private ones), elevator shaft
Cultural, educational, recreational, and GRB facilities	cultural center, museum, nightclub, theater/ cinema, rest house (sanatorium), hotel, gambling business facility, theater, trading house, cafe, restaurant, cloakroom

Aggregating category (authors' data)	**Subcategories (data from the Criminal Policy and Statistics Department of the Ministry of Internal Affairs of the Republic of Kazakhstan)**
Public goods (in the premises)	buffet, higher education institution, kindergarten (nursery), educational institution, medical institution, places of religious worship
Commercial properties	joint-stock company, joint-stock bank, state bank, intergovernmental bank, foreign participation bank, private bank, cash desks of enterprises and institutions, pawnshop, kiosk, private shop, office, market, pharmacy, joint-stock company, exchange point, post office
Transport facilities	bus station, parking lot, highway (route), gas station, air terminal, airport, carriage, railway station, sea (river) station, public transport, automotive transport, air transport, railway transport, sea, river, platform, passenger train compartment, other mechanized transport, metro
Industrial and warehouse premises	base, production facilities, industrial premises, warehouse, storage, utility rooms of residential buildings, utility rooms of kitchens
Other facilities	other premises, different locations, military facilities, barracks, containers, forest, forest planting, pasture, thermal tracks, water bodies, sewage wells, wasteland, ravine, cemetery, riverbank, service offices, buildings under construction or abandoned, underground communications
Not specified	–

Table A1. Categorization of spaces used in the work

For numerical variables: mean [median] (standard deviation). For textual: percentage of hexes where the category occurs

Variable	Astana	Almaty
Population (in thousands of people)	0.23 [0.01] (0.42)	0.61 [0.21] (0.74)
Price per m2 (in 10 thousand tenge)	3.95 [3.7] (1.25)	7.00 [5.76] (3.06)
Level of business activity (none)	83%	76%
Level of business activity (moderate)	9%	13%
Level of business activity (high)	7%	11%
Presence of industrial premises in/near the hex	9%	16%
Percentage of buildings in a hectare of total area	4.2% [0%] (8.3)	7.6% [1.8%] (10.0)
Percentage of parks in a hectare of total area (in 10%)	1% [0%] (6.6)	1.9% [0%] (10.2)
Distance from the city center (in km.)	10.81 [10.99] (4.36)	11.02 [11.03] (4.80)
Number of observations	3497	3187

Table A2. Descriptive statistics of independent variables in regression

Key findings

The transition to a *service-oriented police* model, as stated by the President of the Republic of Kazakhstan Kassym-Zhomart Tokayev, is largely based on the idea of increasing the effectiveness of police work. Indeed, as the text of the reform itself states, its goal is to ensure the provision of quality security services to the population and to address related issues in partnership with society.

In our view, improving the quality of police work and establishing a crime prevention policy is impossible without *evidence-based policy* and conducting extensive analytical work to understand the patterns inherent in various crimes in the Republic. *Crime is a social phenomenon.* It can be studied, as well as the connections between it and other phenomena, such

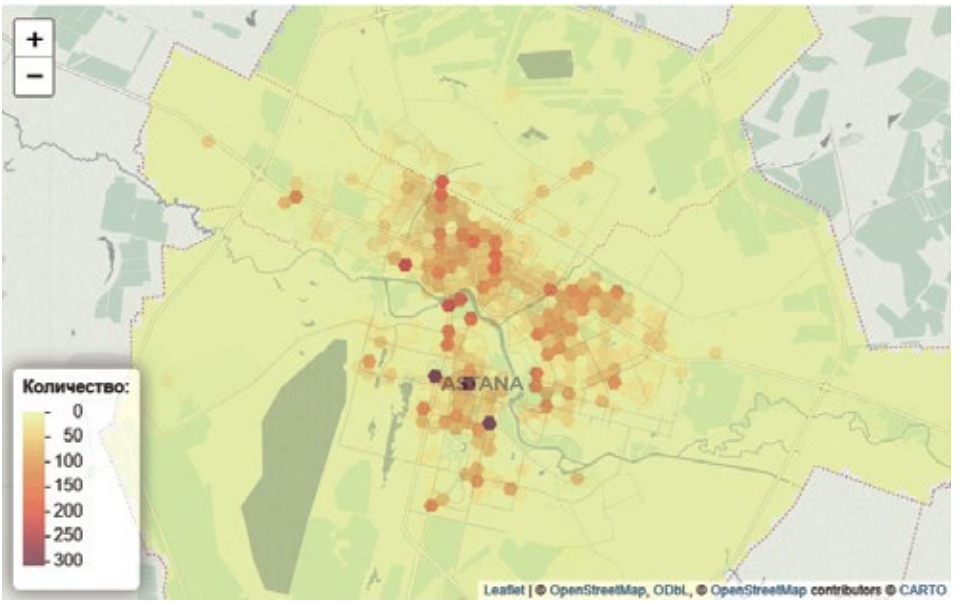

Figure A1. The absolute number of crimes in the urban space of the city of Astana

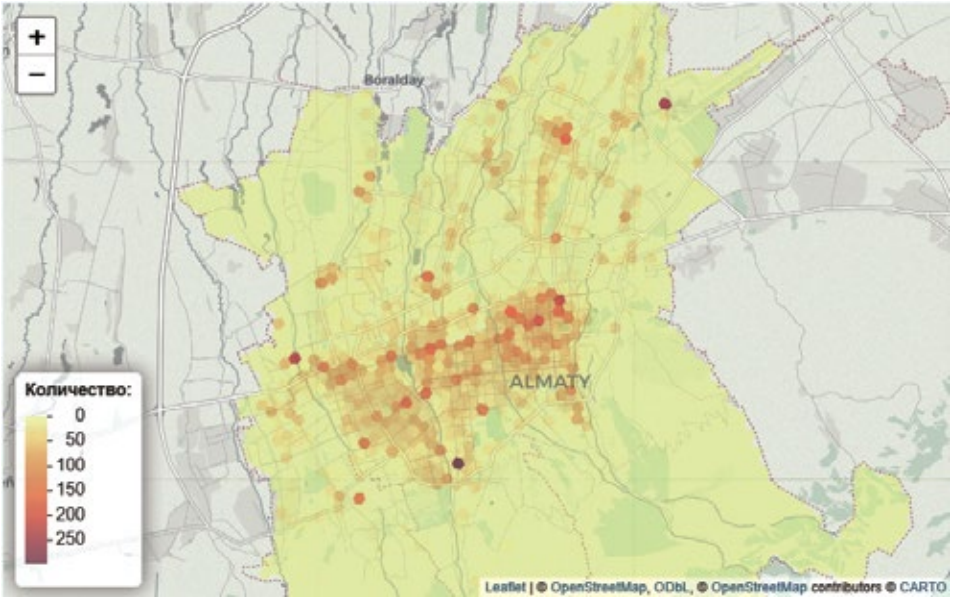

Figure A2. The absolute number of crimes in the urban space of the city of Almaty

The graph is interactive. Hover over the area of interest to find out its value. To switch the type of crime, click the tab at the top.

as income levels, population density, and more. This knowledge can ultimately be used to develop crime prevention policies in the city.

The analytical note based on data from the General Prosecutor's Office of the Republic of Kazakhstan presents a comparison of 'hot spots' for thefts and violent crimes in Astana and Almaty both in their static state as of 2023, and in dynamics over the previous five-year period. In addition, the relationship between the listed types of crimes and the socio-economic characteristics of the area where they occur has been studied, and 'portraits' of typical and atypical crimes have been compiled. Such work has been carried out for the first time using data from the Republic of Kazakhstan and neighboring countries of the post-Soviet space.

Main results:

We find confirmation of the *'law of crime concentration'* in the cities of Kazakhstan. Thus, more than 50% of crimes in Astana occur in 3% of the city's territory, while in Almaty, it is 5%. However, these results become more conservative if we analyze not the administrative boundaries of the city, but the dense development of the urban center. In this case, the ratio becomes approximately 50% of crimes to 10% of territories;

Despite the fact that the absolute number of crimes is concentrated the most in Astana in the area of the *'Astana-1'* railway station, when recalculated per thousand residents in the area, we find the center 'Hot Spots' of crime from the campus of *L.N. Gumilyov Eurasian National University* along Abylay Khan Avenue, as well as in the area of the *'Khan Shatyr'* and *'Keruen'* shopping centers. In Almaty, we can identify the areas of the western part of the city along *Raiymbek Avenue* and north of the *'Green Bazaar'*.

From 2019 to 2023, we observe a decrease in the intensity of 'hot spots' for thefts in the right bank part of the capital. At the same time, the decrease in the significance of violent crimes is expressed to a lesser extent. We expect to see the emergence of points in new residential areas in all cases, except for violent crimes in Astana. The new districts on the left bank of the city have not yet shown an increase in this type of incident;

In a typical case, both theft and violent crime do NOT occur in areas with a low population, low building density, low business activity, and characterized by remoteness from the city center. Contrary to expectations, property values in the area were not a significant variable in almost all model specifications. Moreover, we identified a number of urban areas where such a

'typical' profile does not explain the high number of thefts. We termed these spaces 'latent hot spots,' analyzing them in the text;

By comparing the patterns of property (thefts) and violent crime distribution, we highlight common properties in the context of the socio-economic characteristics of the spaces where they occur. Population, building density, business activity, and location relative to the city center are apparently similarly related to the number of both types of crimes. At the same time, thefts are more characteristic of park spaces in Astana and proximity to industrial premises in Almaty. The main difference is observed in the dynamics of 'hot spots' — property crimes in both cities form hot spots more quickly in new residential complexes. Violent crimes, on the other hand, are more rigid and concentrate in the old housing stock.

Recommendations:

More effective planning of comprehensive police forces (CPF). The analysis of hot spots and understanding that certain types of crime have stable connections between the place and time of occurrence can contribute to more effective use of vehicle and foot patrols in these locations to reduce the level of property and violent crimes. Such practices are already being implemented in a significant number of countries in Europe, Asia, and America. Our analysis can serve as the basis for developing a patrol map based on various types of 'hot spots';

More effective general prevention measures. Knowledge of hot spots can make the preventive measures of neighborhood inspectors more targeted. Collaboration with the KSK, businesses, and the akimat in specific locations to improve protection, surveillance, presence, including physical lighting, accessibility, as well as targeted information and explanatory work with law-abiding citizens will yield more significant results in reducing crime in these areas and enhancing the sense of safety in local communities. In this case, of course, it is necessary to take into account the effect of 'displacement' of crime, which can be timely registered through constant data analysis. The application of the analytical methods presented in this work will allow the police to be more *'problem-oriented'* in the field of security provision, which is one of the components of the 'service' police, as stated in the National Development Plan of the Republic of Kazakhstan until 2025. *(Decree of the President of the Republic of Kazakhstan dated February 26, 2021 No. 521: "On amendments to the Decree of the President of the Republic of Kazakhstan dated February 15, 2018 No. 636 "On the approval of the*

Strategic Development Plan of the Republic of Kazakhstan until 2025 and on the recognition of some decrees of the President of the Republic of Kazakhstan as having lost their force").

Transition to 'precision policing'. If the initial steps towards creating a 'data-driven police' are successful, they can be developed into the currently applied strategy of 'precision policing' in the UK and the USA, which is based on the idea of targeting police resources both spatially (at 'hot spots') and in relation to offenders (as research indicates that approximately 50% of crimes are committed by about 6% of individuals *(Piquero, Farrington & Blumstein 2003)*. The development of this direction will require other analytical methods, which can also be tested on extensive data from the KPSiSU of the Ministry of Internal Affairs of the Republic of Kazakhstan.

Библиография / References

Andresen, Martin, & Jordan Wong. (2023). The influence of micro-places on the spatial patterns of property crime in Vancouver, Canada. *International Journal of Comparative and Applied Criminal Justice.*

BBC. (2021). Hotspot policing cuts Southend crime by 74%, says Essex force. https://www.bbc.com/news/uk-england-essex-58591105

Bowers, Kate. (2014). Risky facilities: Crime radiators or crime absorbers? A comparison of internal and external levels of theft. *Journal of Quantitative Criminology,* 30, 389—414.

Brantingham, Patricia, & Paul Brantingham. (1995). *Criminality of place. European journal on criminal policy and research*, 3(3), 5—26.

Eck, John, Spencer Chainey, James Cameron, Michael Leitner, & Wilson Ronald. (2005). *Mapping Crime: Understanding Hot Spots.*

Farrell, Graham, Nick Tilley, & Andromachi Tseloni. (2014). Why the crime drop? *Crime and justice*, 43(1), 421—490.

Felson, Marcus, Yanqing Xu, & Shanhe Jiang. (2022). Property crime specialization in Detroit, Michigan. *Journal of Criminal Justice.*

Fortin, Marie-Josee, & Mark Dale. (2009). Spatial autocorrelation. *The SAGE handbook of spatial analysis*, 89—103.

Garcia, Marie R., Ralph B. Taylor, & Brian Lawton. (2007). Impacts of violent crime and neighborhood structure on trusting your neighbors. *Justice Quarterly*, 24(4), 679—704.

Getis, Arthur, & Keith Ord. (1992). The analysis of spatial association by use of distance statistics. *Geographical analysis*, 24(3), 189—206.

Gill, Charlotte, Alese Wooditch, & David Weisburd. (2017). Testing the "Law of Crime Concentration at Place" in a Suburban Setting: Implications for Research and Practice. *J Quant Criminol* 33, 519—545.

Hipp, John R, & Seth A. Williams. (2020). Advances in Spatial Criminology: The Spatial Scale of Crime. *Annual Review of Criminology*, 3, 75—95.

Humanitarian Data Exchange (HDX). Kazakhstan: Population Density for 400m H3 Hexagons. https://data.humdata.org/dataset/kontur-population-kazakhstan

Mawby, Rob C., & Alan Wright. (2012). The police organisation. In *Handbook of policing*, 252—280.

Nelson, Paul. (2015). Violent and property crime trends: local and international comparisons. *Bureau Brief, Issue Paper*, 109.

Piquero, Alex R., David P. Farrington, & Alfred Blumstein. (2003). The criminal career paradigm. *Crime and justice*, 30, 359—506.

Ratcliffe, Jerry. (2010). Crime mapping: spatial and temporal challenges. *Handbook of quantitative criminology*, 5—24.

Sherman, Lawrence, Patrick Gartin, & Michael Buerger. (1989). Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place. *Criminology*, 27(1), 27—56.

Tita, George, & Steven Radil. (2010). Making space for theory: The challenges of theorizing space and place for spatial analysis in criminology. *Journal of Quantitative Criminology*, 264, 467—479.

United Nations Office on Drugs and Crime. (2023). Victims of intentional homicide. https://dataunodc.un.org/dp-intentional-homicide-victims

U.S. Department of justice Office of justice programs. Practice Profile: Hot Spots Policing. https://crimesolutions.ojp.gov/ratedpractices/8#mam

van Dijk, Jan, Paul Nieuwbeerta, & Jacqueline Larsen. (2021). Global crime patterns: An analysis of survey data from 166 countries around the world, 2006–2019. *Journal of quantitative criminology*, 1—36.

Weisburd, David. (2015). The law of crime concentration and the criminology of place. Criminology, 53(2), 133—157.

Weisburd, David, & Anthony Braga. (2006). Hot spots policing as a model for police innovation. *Police innovation: Contrasting perspectives*, 225—244.

World Population Review. (2022). Crime Rate by Country. https://worldpopulationreview.com/country-rankings/crime-rate-by-country

Wuschke, Kathryn, Martin A. Andresen, Paul J. Brantingham, Christopher Rattenbury, & Andrew Richards. (2018). What do police do and where do they do it? *International Journal of Police Science & Management*, 20(1), 19—27.

Агыбаева, Л. (2023). О некоторых вопросах упрощения досудебного производства. *Zakon.kz.* https://sud.gov.kz/rus/massmedia/o-nekotoryh-voprosah-uproshcheniya-dosudebnogo-proizvodstva-lagybaeva-zakonkz-30052023-g
—Agybayeva, L. (2023). O nekotorykh voprosakh uproshcheniya dosudebnogo proizvodstva. Zakon.kz. https://sud.gov.kz/rus/massmedia/o-nekotoryh-voprosah-uproshcheniya-dosudebnogo-proizvodstva-lagybaeva-zakonkz-30052023-g

Adilet.Zan.kz. Указ Президента Республики Казахстан от 26 февраля 2021 года № 521: «О внесении изменений в Указ Президента Республики Казахстан от 15 февраля 2018 года № 636 «Об утверждении Стратегического плана развития Республики Казахстан до 2025 года и признании утратившими силу некоторых указов Президента Республики Казахстан». https://adilet.zan.kz/rus/docs/U2100000521#z8
—*Adilet.Zan.kz.* Ukaz Prezidenta Respubliki Kazakhstan ot 26 fevralya 2021 goda № 521: «O vnesenii izmeneniy v Ukaz Prezidenta Respubliki Kazakhstan ot 15 fevralya 2018 goda № 636 «Ob utverzhdenii Strategicheskogo plana razvitiya Respubliki Kazakhstan do 2025 goda i priznanii utrativshimi silu nekotorykh ukazov Prezidenta Respubliki Kazakhstan». https://adilet.zan.kz/rus/docs/U2100000521#z8

Baigenews. (2023). Самые опасные места в Астане назвали столичные полицейские. https://news.mail.ru/society/57232024/
—*Baigenews*. (2023). Samyye opasnyye mesta v Astane nazvali stolichnyye politseyskiye. https://news.mail.ru/society/57232024/

ван Дейк, Ян, Джон ван Кестерен, Алексей Трошев, & Гэвин Слейд. (2018). Исследование «Оценка уровня безопасности населения и доверия к правоохранительным органам» (международный опрос виктимизации в Казахстане). *Астана*. https://research.nu.edu.kz/ws/portalfiles/portal/16792006/_.pdf

—van Deyk, Yan, Dzhon van Kesteren, Aleksey Troshev, & Gevin Sleyd. (2018). Issledovaniye «Otsenka urovnya bezopasnosti naseleniya i doveriya k pravookhranitel'nym organam» (mezhdunarodnyy opros viktimizatsii v Kazakhstane). *Astana*. https://research.nu.edu.kz/ws/portalfiles/portal/16792006/_.pdf

Веркеев, Арсений, & Дмитрий Серебренников. (2023). Жертвы своего страха: Субъективная безопасность и опыт виктимизации в России. *Социологическое обозрение*, 22(2), 179—206.
—Verkeyev, Arseniy, & Dmitriy Serebrennikov. (2023). Zhertvy svoyego strakha: Sub"yektivnaya bezopasnost' i opyt viktimizatsii v Rossii. *Sotsiologicheskoye obozreniye*, 22(2), 179—206.

Жижин, Л. А., А. В. Кнорре, Р. К. Кучаков, & Д. А. Скугаревский. Издержки российского общества от преступности: измерение с помощью компенсирующего изменения дохода. http://*pe.cemi.rssi.ru*/pe_2023_69_091-120.pdf
—Zhizhin, L. A., A. V. Knorre, R. K. Kuchakov, & D. A. Skugarevskiy. Izderzhki rossiyskogo obshchestva ot prestupnosti: izmereniye s pomoshch'yu kompensiruyushchego izmeneniya dokhoda. http://*pe.cemi.rssi.ru*/pe_2023_69_091-120.pdf

Кошина, Наталья. (n.d.). Самые опасные и самые безопасные города Казахстана. TravelAsk — специализированный поисковик тревел-услуг. https://*travelask.ru*/articles/samye-opasnye-i-samye-bezopasnye-goroda-kazahstana
—Koshina, Natal'ya. (n.d.). Samyye opasnyye i samyye bezopasnyye goroda Kazakhstana. TravelAsk — spetsializirovannyy poiskovik trevel-uslug. https://*travelask.ru*/articles/samye-opasnye-i-samye-bezopasnye-goroda-kazahstana

Официальный сайт Комитета по правовой статистике и специальным учетам генеральной прокуратуры Республики Казахстан. Карта уголовных правонарушений. https://gis.kgp.kz/arcgis/apps/experiencebuilder/experience/?id=c048e1f975084dc1957108c00c9fb4d7&page=%D0%BA%D0%B0%D1%80%D1%82%D0%B0-%D0%BF%D1%80%D0%B5%D1%81%D1%82%D1%83%D0%BF%D0%BD%D0%BE%D1%81%D1%82%D0%B8
—*Ofitsial'nyy sayt Komiteta po pravovoy statistike i spetsial'nym uchetam general'noy prokuratury Respubliki Kazakhstan*. Karta ugolovnykh pravonarusheniy. https://gis.kgp.kz/arcgis/apps/experiencebuilder/experience/?id=c048e1f975084dc1957108c00c9fb4d7&page=%D0%BA%D0%B0%D1%80%D1%82%D0%B0-%D0%BF%D1%80%D0%B5%D1%81%D1%82%D1%83%D0%BF%D0%BD%D0%BE%D1%81%D1%82%D0%B8

Официальный сайт Президента Республики Казахстан. (2023). Президент провел расширенное заседание коллегии министерства вну-

тренних дел. https://www.akorda.kz/ru/prezident-provel-rasshirennoe-zasedanie-kollegii-ministerstva-vnutrennih-del-3052832
—*Ofitsial'nyy sayt Prezidenta Respubliki Kazakhstan*. (2023). Prezident provel rasshirennoye zasedaniye kollegii ministerstva vnutrennikh del. https://www.akorda.kz/ru/prezident-provel-rasshirennoe-zasedanie-kollegii-ministerstva-vnutrennih-del-3052832

Официальный сайт OpenStreetMap. https://www.openstreetmap.org/
—Ofitsial'nyy sayt OpenStreetMap. https://www.openstreetmap.org/

Сандип, Чавла. (2011). Глобальное исследование по проблеме убийств. *Управление Организации Объединенных Наций по наркотикам и преступности (ЮНОДК)*.
—Sandip, Chavla. (2011). Global'noye issledovaniye po probleme ubiystv. *Upravleniye Organizatsii Ob"yedinennykh Natsiĭ po narkotikam i prestupnosti (YUNODK).*

Титаев, Кирилл, Дмитрий Скугаревский, Алексей Кнорре, Владимир Кудрявцев, & Мария Шклярук. (2018). Манифест новой количественной криминологии "уголовная политика с опорой на данные". *Вестник Санкт-Петербургского университета. Право,* 9(1), 91—101.
—Titayev, Kirill, Dmitriy Skugarevskiy, Aleksey Knorre, Vladimir Kudryavtsev, & Mariya Shklyaruk. (2018). Manifest novoy kolichestvennoy kriminologii "ugolovnaya politika s oporoy na dannyye". *Vestnik Sankt-Peterburgskogo universiteta. Pravo*, 9(1), 91—101.

Уранкаева, Жания. (2023). Астана — антилидер рейтинга по количеству преступлений в Казахстане. *Курсив-Медиа.* https://kz.kursiv.media/2023-06-02/zhnr-prestupnost/
—Urankayeva, Zhaniya. (2023). Astana — antilider reytinga po kolichestvu prestupleniy v Kazakhstane. *Kursiv-Media.* https://kz.kursiv.media/2023-06-02/zhnr-prestupnost/