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FACULTY OF SOCIAL SCIENCES
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Determinants of Crime in Eastern Europe with a Focus on Czechia and Slovakia

Master's thesis

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Declaration of Authorship

The author hereby declares that she compiled this thesis independently, using only the listed resources and literature, and the thesis has not been used to obtain any other academic title.

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Prague, January 3, 2022

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Abstract

This study examines whether determinants of crime, hypothesized in the economic theory of crime and tested in other global regions, also explain crime rates in Eastern Europe, which is often excluded in existing research. Using fixed effects estimation and controlling for social cohesion and law enforcement, the results suggest that increases in income per capita have a negative effect on homicide and violent crime, but the effect on sexual and property crimes is mixed. Furthermore, the significance and sign of the impact of income inequality and unemployment differ across individual crimes. This study also investigates crime determinants specifically in Czechia and Slovakia. Contrary to the cross-country analysis, there appears to be little connection between aggregate income and the regional distribution of crime, indicating the importance of social rather than economic factors.

JEL Classification	K42, O15, O52, P20, C23
Keywords	Crime, Income distribution, Eastern Europe, Panel Data, Czechia, Slovakia
Title	Determinants of Crime in Eastern Europe with a Focus on Czechia and Slovakia

Abstrakt

Tato studie zkoumá, zda determinanty kriminality, předpokládané v ekonomické teorii a testované v jiných oblastech světa, vysvětlují míru zločinosti také ve východní Evropě, která je z existujících výzkumů často vyloučena. Při použití metody fixních efektů se zahrnutím společenské soudržnosti a vymáhání práva výsledky naznačují, že zvýšení příjmu na osobu má negativní vliv na vraždy a násilnou trestnou činnost, ale vliv na sexuální a majetkové trestné činy je smíšený. Dále se statistická významnost a směr dopadu příjmové nerovnosti a nezaměstnanosti liší napříč jednotlivými trestnými činy. Tato studie také zkoumá determinanty kriminality konkrétně v Česku a na Slovensku. Na rozdíl od analýzy napříč zeměmi se ukazuje, že mezi celkovým příjmem a regionálním rozložením zločinosti v Česku a na Slovensku existuje jen malá souvislost, což ukazuje na význam spíše sociálních než ekonomických faktorů.

Klasifikace JEL	K42, O15, O52, P20, C23
Klíčová slova	Kriminalita, Rozdělení příjmů, Východní Evropa, Panelová data, Česko, Slovensko
Název práce	Klíčové faktory kriminality ve východní Evropě se zaměřením na Česko a Slovensko

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Acronyms

EU European Union

GDP Gross Domestic Product

ICCS International Classification of Crime for Statistical Purposes

OECD Organisation for Economic Co-operation and Development

OLS Ordinary Least Squares

OSCE Organization for Security and Co-operation in Europe

UNODC United Nations Office on Drugs and Crime

US United States of America

WB World Bank

WHO World Health Organization

Master's Thesis Proposal

Author	Bc. Anna Umlaufová
Supervisor	Mgr. Roman Kalabiška
Proposed topic	Determinants of Crime in Eastern Europe with a Focus on Czechia and Slovakia

Motivation In 2020 alone, the Police of the Czech Republic recorded over 165,000 crimes. The ratio of solved to reported crimes (i.e. the clearance rate), was slightly below 47%, meaning that over half of all incidents are unsolved. Criminal activity bears vast consequences economically, psychologically as well as socially. Consequently, determinants of crime have received a plethora of attention in academic literature in all these disciplines (Chintrakarn & Herzer 2012).

As for the economic perspective on the topic, in his seminal work, Becker (1968) posits that crime rates depend on the difference between the expected benefits of committing a crime and its expected costs, both of which are affected by socio-economic conditions as well as cultural differences (Kim *et al.* 2020). Economists have studied crime in relation to income inequality (e.g. Chintrakarn & Herzer 2012; Hipp & Kubrin 2017; Kim *et al.* 2020; Süß 2020), poverty (e.g. Anser *et al.* 2020), income (e.g. Buonanno *et al.* 2017), unemployment (e.g. Altindag 2012; Cook *et al.* 2014), or fiscal policy (Goulas & Karidis 2020). Kim *et al.* (2020) question the external validity of past research that had predominantly focused on the USA, and in their meta-analysis, they find that income inequality has smaller effects on crime in Europe. Thus, it is argued that these phenomena need to be understood in their socio-historical region-specific context.

In particular, Stamatel (2009) argues that the region of Eastern Europe is historically unique due to simultaneous democratization and marketization of the countries, while Piatkowska *et al.* (2016) add that democratization and accession to the European Union significantly affected homicide rates in Eastern Europe. However, existing literature has largely omitted Eastern Europe due to lack of data or language barriers (Pridemore 2005; Stamatel 2009). A cross-country analysis focused thereon can help confirm or challenge commonly held notions of crime determinants.

At the same time, a case study of specific countries can help uncover nation-specific influences (Pridemore 2005). Data collection by each granular type of crime published by both the Police of the Czech Republic (2021) and the Ministry of Interior of the Slovak Republic (2021) allows for analysis in unparalleled detail, while overcoming definitional differences of crime categories which typically hinder cross-national studies (Kim *et al.* 2020). Thanks to the shared history of the two countries, both followed the same Criminal Code until its reform in 2006 in Slovakia, respectively in 2010 in Czechia. The new significantly reformed Criminal Code increased the severity of punishments for certain crimes while decreasing others (Český Rozhlas 2009). In line with Becker (1968) cost-benefit approach, this would affect crime rates in the opposite directions and the change would manifest itself in Slovakia sooner than in Czechia. Furthermore, in 2013, president Václav Klaus declared an amnesty which resulted in the release of 6 443 (28%) prisoners (Prison Service of the Czech Republic 2013). Decreasing prison population is expected to increase the crime rate in the Czech Republic while not affecting Slovakia (Freeman 1999; Levitt 2004).

Hypotheses

Hypothesis #1: Increasing income inequality increases crime rates in Eastern Europe.

Hypothesis #2: Increasing unemployment increases crime rates in Eastern Europe.

Hypothesis #3: Increasing, respectively decreasing, the severity of punishments decreases, respectively increases, crime rates in Czechia and Slovakia.

Hypothesis #4: Decreasing prison population increases crime rates in Czechia.

Methodology As for the analysis on Eastern Europe, Eurostat (2021) has published statistics on selected crimes by country since 1998. For additional robustness, I will use data on homicide rates by the World Health Organization (2021), which is regarded as the most reliable source for this criminal offense (Piatkowska *et al.* 2016; Stamatel 2009). Panel data techniques will be used to examine the determinants of crime while considering available and reasonable control variables suggested in the existing literature, including for example level of education, residential mobility (Süß 2020), urban population, prison population, government expenditures (Goulas & Karidis 2020), the share of the male population, size of the police force (Buonanno *et al.* 2017), divorce rate (Piatkowska *et al.* 2016), ethnic diversity (Stamatel 2009), or alcohol consumption (Pridemore 2005). As for the case study of the Czech Republic and Slovakia, I will use data on recorded crimes from 2000 to 2020 published

by the Police of the Czech Republic (2021) and similarly by the Ministry of Interior of the Slovak Republic (2021), both of which are published for individual regions.

To estimate the empirical model and evaluate the hypotheses, I will employ advanced econometric methods and panel data techniques, taking into consideration the nature of the data as well as the existing literature. For instance, Freeman (1999) warns about simultaneity issues, and Chintrakarn & Herzer (2012) recommend panel cointegration. I will also consider additional appropriate robustness checks.

Expected Contribution Given the serious consequences of criminal activity, its determinants have been studied substantially from various scientific perspectives. However, the external validity of the existing literature has come into question due to different social, historical, economic, and cultural circumstances. Research on this topic in Eastern Europe is scarce while the region experienced a historically unique transition from communism to democracy and integration into the European structures. Thus, I will conduct an empirical estimation of determinants of crime in this specific context. Furthermore, I will add a specific analysis of the impact on crime in Czechia and Slovakia, in particular in light of the legal reforms and changing prison population in the two countries. The results can help inform policy decisions regarding crime prevention or legal reforms.

Outline

1. Introduction: I will introduce the topic of the thesis and its contribution.
2. Literature Review: I will summarize the existing literature on determinants of crime.
3. Data: I will describe how I will collect the key variables, data on crime rates as well as control variables, which will be used in the empirical model.
4. Methodology: I will explain the panel data techniques I will use to estimate the model and test the hypotheses. I will also comment on how I will check the robustness of the results.
5. Empirical Results: I will discuss the results of the estimation and evaluate the hypotheses.
6. Case Study: Czechia and Slovakia: I will test the impact of changes in law and prison population in these two countries.
7. Conclusion: I will provide concluding remarks along with potential policy recommendations and areas for future research.

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Chapter 1

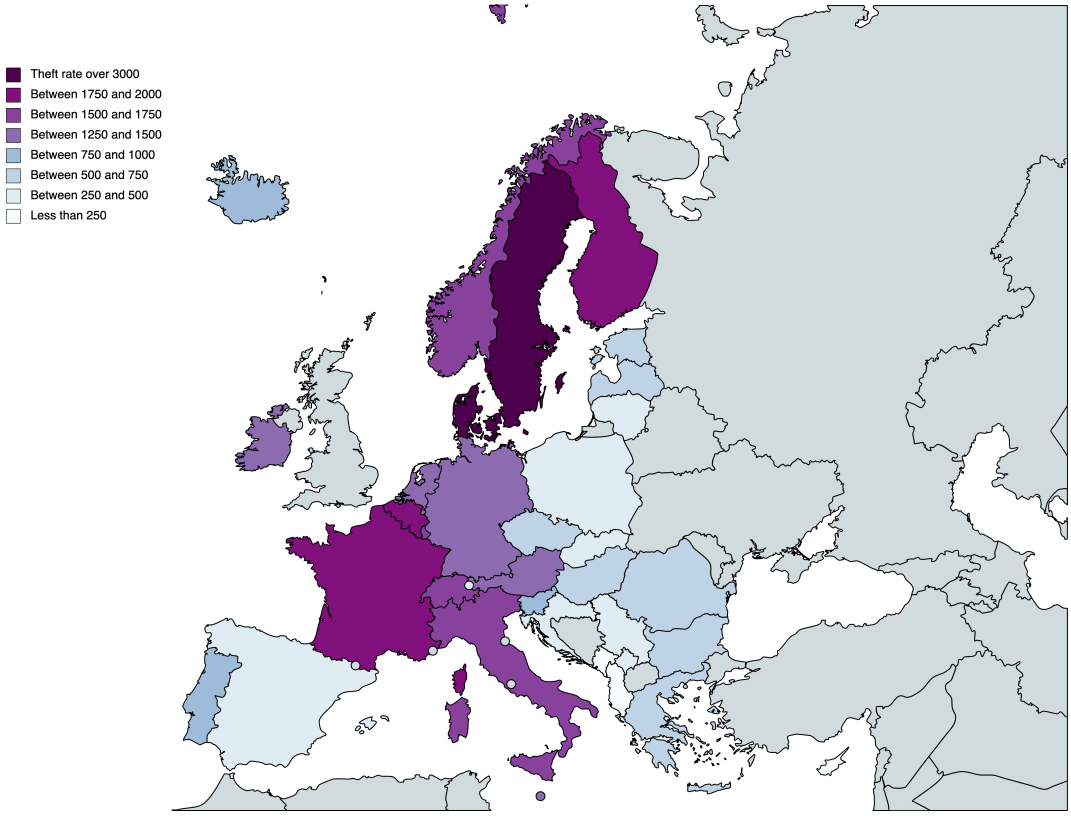
Introduction

In 2020 alone, the Police of the Czech Republic (2021) recorded over 165,000 crimes. The ratio of solved to reported crimes (i.e. the clearance rate), was just below 47%, meaning that over half of all incidents was unsolved. Criminal activity bears vast consequences economically, psychologically as well as socially. Therefore, determinants of crime receive close attention in the academic literature, and yet the immense variation in crime rates across countries persists, as shown in Figure 1.1. Per 100 000 inhabitants, Czechia reports twice as much theft as Slovakia but fades in comparison to Denmark or Sweden, the rates of which exceed it five-fold.

The apparent disparity between Western and Eastern Europe in Figure 1.1 is particularly astounding given the scarcity of crime research focusing on Eastern Europe, often due to its data insufficiency or language barrier (Pridemore 2005; Stamatel 2009). At the same time however, the external validity of past research conducted in the United States or Western Europe has been questioned (Kim *et al.* 2020). Stamatel (2009) argues that the crime composition of Eastern Europe is historically unique due to the simultaneous democratization and marketization of the countries, while Piatkowska *et al.* (2016) add that democratization and accession to the European Union significantly affected homicide rates in Eastern Europe. In a meta-analysis, Kim *et al.* (2020) find that income inequality has smaller effects on crime in Europe than in the USA, thus arguing that these phenomena need to be understood in their socio-historical region-specific context.

Therefore, the aim of this study is to assess the economic determinants of crime in Eastern Europe, thus contributing to the existing literature by verifying the economic theory of crime and existing empirical findings from other

Figure 1.1: Theft rate per 100 000 inhabitants in Europe



Data as of 2018. *Source:* Eurostat (2021).

parts of the world in this singular region. Moreover, the cross-country analysis is expanded upon by studying the crime composition of Czechia and Slovakia in detail, in particular in light of the legal reforms and changing prison population in the two countries. This perspective helps uncover nation-specific influences (Pridemore 2005) while overcoming definitional differences that typically impair cross-country studies (Kim *et al.* 2020).

The theoretical benchmark for studying economic determinants of crime is provided by Becker (1968) and Ehrlich (1973). In their seminal papers, they posit that crime rates depend on the expected difference between legal and illegal earnings, both of which are affected by socio-economic conditions. In empirical literature, these commonly include income and poverty (e.g. Allen 1996), income inequality (e.g. Chintrakarn & Herzer 2012), and unemployment (e.g. Cantor & Land 1985). Based on the theoretical predictions of the economic theory of crime (Becker 1968; Ehrlich 1973) complemented by sociological theories of Merton (1938) and Shaw & McKay (1942), testable hypotheses are

formulated, assuming the effect on crime rate to be negative for income per capita, positive for income inequality, and positive for unemployment.

The hypotheses are tested using data on 11 different crimes for 11 East European countries spanning at most 21 years, collected from Eurostat (2021), UNODC (2021), World Bank (2021), and World Health Organization (2021). Aside from the three key economic determinants, control variables include proxies for social cohesion, number of police officers and imprisonment rate, demographic factors, as well as controls for EU accession or criminal code reforms. The results are obtained using fixed effects estimation and robust standard errors where applicable. Subsequently, the sensitivity of the findings is inspected using alternative independent variables, different data sources, as well as various model specifications to test for multicollinearity, endogeneity, or the effect of outliers. Additionally, data for individual crimes in Czechia and Slovakia are gathered to examine the effect of EU accession, criminal code reforms, and amnesties on crime composition. Using regional data, the influence of economic determinants is investigated and compared to the cross-country analysis.

The results indicate that the economic determinants of crime vary across different crime categories. A negative effect of income, consistent with the hypotheses, is uncovered for violent crimes, whereas non-violent crimes exhibit positive, insignificant, or non-linear relationships. For income inequality and unemployment, the results between as well as within the different crime categories display mixed evidence for the effects, showing the need to understand the motivations for individual crimes separately. Contrary to the cross-country analysis, there appears to be little connection between aggregate income and the regional distribution of crime in Czechia and Slovakia, indicating the importance of social rather than economic factors when addressing crime on the regional level.

The remainder of this study is organised as follows. Chapter 2 provides the theoretical foundations for economic analysis of crime, the empirical performance of which is then reviewed with respect to existing literature. Additionally, the historical and political context of Eastern Europe and its impact on crime is investigated. Chapter 3 describes the data collection process, and Chapter 4 specifies the methods employed to estimate the model. Results thereof are commented on in Chapter 5, which also includes the sensitivity analysis. Chapter 6 focuses on the crime composition and crime determinants of Czechia and Slovakia. Finally, Chapter 7 provides conclusions and policy recommendations.

Chapter 2

Literature Review

This chapter presents the existing literature on the topic. Section 2.1 summarizes the main theoretical foundations of economic analysis of crime, followed by a review of the empirical literature with respect to income and poverty, income inequality, and unemployment in Section 2.2. Next, Section 2.3 focuses on the specifics of Eastern Europe regarding crime, before Section 2.4 formulates the hypotheses.

2.1 Economic theory of crime

The study of crime has been attracting researchers in many fields for decades. Psychologists and sociologists in particular have been contributing to criminology, which is classified as a scientific field of its own. Much of this theory has concentrated on identifying the unique motivation of offenders shaped by their upbringing, family situation, or genetic predisposition, among other factors (Freeman 1999). The interest of economists in determinants of crime has been most notably aroused by Becker (1968), who was not the first, but arguably the most influential author to devise an economic theory of crime in *Crime and Punishment: An Economic Approach*. It was expanded upon by Ehrlich (1973) who established a model that economists use to this day. These two authors laid the groundwork for subjecting crime to economic analysis from the perspective of incentives and resource allocation, thus linking the study of crime to the general theory of economic choice under uncertainty. This section reviews their theoretical models.

Becker (1968) sought to determine the optimal level of punishment in order to minimize the social cost of crime. To this end, the supply of offences is said

to follow the standard economic reasoning – a person chooses to commit a crime if its expected utility exceeds that of a legal way of spending time and other resources. Therefore, unlike in certain psychological and sociological theories of crime according to which the motivation of offenders differs from the law-abiding population (Freeman 1999), the economic perspective allows people to commit crimes while using the same reasoning as the general population (Becker 1968).

Following this approach, the expected utility of committing a crime is determined by the probability of being convicted p_i and the severity of punishment if convicted f_i. Becker (1968) thus constructs the number of offences committed by an individual during a certain period, O_i:

$$O_i = O_i\left(p_i, f_i, u_i\right)$$

where u_i captures all other influences. Using this model, increasing either p_i or f_i would result in a decrease in criminal activity, the relative extent of which depends on the shape of the function as well as an individual's preference for risk. By summing the number of offences across the population, an aggregate model for crime can be formulated.

Ehrlich (1973) extends the model of Becker (1968) by also considering the opportunities of both punishment and reward and presenting the decision as an optimal allocation of time between legal, illegal, and non-market activities, rather than a mutually exclusive choice. The key to the problem is how marginal wage from legal work w_l compares to the expected marginal wage from illegal criminal activity $\mathbb{E}\left(w_i\right)$. With probability $1-p_i$ the offender successfully escapes conviction, thus retaining the net income from the illegal activity w_i, regardless of whether it is a pecuniary or non-pecuniary reward. In contrast, with probability p_i, the offender is caught and punished, hence decreasing the reward w_i by the value of the punishment f_i. In equilibrium, a risk-neutral individual allocates their time such that the expected marginal values of legal and illegal activities are equal:

$$\mathbb{E}\left(w_i\right) = (1 - p_i)w_i + p_i(w_i - f_i) = w_l$$

Depending on the curvature of the utility function U, a risk-averse individual would require a premium paid by the illegal activity to compensate for the risk, whereas a risk-seeking individual would in comparison have a preference for the

illegal activity.

By concentrating on the net (marginal) income generated by legal and illegal activities, the models of Becker (1968) and Ehrlich (1973) are best suited for crimes involving material gains and self-enrichment, such as burglary, theft, and other property crimes. On the contrary, violent crimes such as homicide or rape can be mainly motivated by inter-personal relationships (instigating hate or jealousy) or intra-personal sensations (such as anger or lust). Therefore, Ehrlich (1973) suggests treating these crimes as non-market activities, distinct from their market wealth-generating counterparts.

Finally, the economic theory of crime developed by Becker (1968) and Ehrlich (1973) has since been expanded. For instance, Carfi & Pintaudi (2012) model the decision-making process for m time periods and find Nash equilibria and solution paths for the optimal time allocations in a 2-dimensional case. The empirical tests of the theory with respect to economic variables are presented in the following section.

2.2 Economic determinants of crime

In accordance with the theory of Becker (1968) and Ehrlich (1973), illegal activity is determined through economic incentives similarly to legal work. As such, it is related to economic variables as income per capita, inequality, or unemployment, all of which have sustained considerable changes during the transition period in Eastern Europe. This section reviews existing literature on how they affect crime rates empirically.

2.2.1 Income and poverty

Theoretically, people with low levels of income or even below the poverty line, are more likely to commit crime because they lack legitimate labour market opportunities or their "attainment of widely shared goals is blocked" (Becker 1968; Pare & Felson 2014). According to the relative-deprivation theory (Merton 1938), inclination to crime is not a result of one's absolute lack of wealth or opportunities, but how it compares in the society (Hsieh & Pugh 1993). Individuals transform their frustration into an act against a system that prevents them from controlling their economic or social position (Allen 1996). Therefore, lack of income or poverty can result in both property and violent crimes, through which people express their grievances against the legal system (Pare

& Felson 2014). Furthermore, poor people are more likely to reside in socially disorganized neighbourhoods, the subcultures of which value "toughness, excitement, and fatalism" leading more people into conflicts with the police (Hsieh & Pugh 1993). The risks of violence and being a victim of criminal activity in such districts can propel aggressiveness and firearms possession (Pare & Felson 2014), thus resulting in a vicious cycle of poverty and crime. While theoretically decreasing income or increasing poverty can incentivize illegal activity, there is also empirical support for negative, non-linear as well as non-existent relationships between poverty and crime.

As for the positive effects of poverty on crime, Kim & Pridemore (2005) examine the relationship on data from Russia during its economic and political transition. Using negative binomial regression, they find a positive effect of poverty on regional homicide rates while controlling for family cohesion and education levels. Moreover, in a meta-analysis of the impact of poverty and income inequality on crime rates, Hsieh & Pugh (1993) gather 34 studies published between 1974 and 1991 and present that 97% of their coefficients were positive. Notably, they find strong support for the positive effect of poverty and inequality on violent crime. In particular, homicide and assault are more closely related to these variables than rape and robbery (Hsieh & Pugh 1993). Similarly, Soares (2004) collects a total of 74 coefficients estimated on different types of crimes from a list of 23 studies published between 1971 and 2000. Unlike Hsieh & Pugh (1993), Soares (2004) discovers that just 43% of coefficients describe a positive relationship between poverty and crime, compared to 35% of negative effects and 22% of statistically insignificant coefficients.

Indeed, the negative effects of poverty are also described in the existing literature. For instance, Allen (1996) finds that decreases in absolute poverty are linked to more illegal activity, in particular for property crimes such as robbery, burglary, or vehicle theft. While these findings negate the theory of Becker (1968), Allen (1996) supports Freeman (1999) or Levitt (2004) in showing that the demographic composition of society has a little impact on crime. Furthermore, in relation to income and macroeconomic indicators, Allen (1996) emphasizes the importance of macro-stability, especially inflation, in reducing property crime. The negative effect of poverty can be connected to a reduction of unemployment, which is explained and reviewed in Section 2.2.3.

Nonetheless, the effect of poverty on crime can be both positive and negative depending on the level of per-capita income. Buonanno *et al.* (2017) develop a crime variant of the Kuznets curve to prove the non-linear effect of

poverty. In its original form, the Kuznets curve theorizes an inverted U-shaped relationship between per capita income and inequality as society transforms from agricultural to industrial (Kuznets 1955). Similarly, as countries undergo economic development, crime rates change. Initial increases in income can spur criminal activity as wealthy individuals become more attractive targets, but after a certain threshold, once they can afford better protection such as alarm systems or private security, higher-income classes are no longer appealing targets (Buonanno *et al.* 2017). In this paper, the inverted U-shaped relationship is uncovered on a sample of US states between 1970 and 2011. However, it mainly applies to property crimes or robbery but is not as strong for violent crimes (Buonanno *et al.* 2017).

Similar inconsistency among different crime categories can lead to mixed or no significant effects between poverty or income and crime. For instance, Bushway *et al.* (2012) inspect the effect of business cycles on crime and suggest a counter-cyclical impact on burglary and robbery, pro-cyclical on vehicle theft, and a-cyclical on homicide. Also using homicide rates, Anser *et al.* (2020) find no relationship between crime and income per capita, controlling for different socio-economic factors. No causal relationship is also supported by Soares (2004). Under-reporting obstructs empirical analysis especially on a cross-country level if it is correlated with the country characteristics. Soares (2004) identifies that reporting rates increase with development, which may be the source of the statistically significant relationship between income and crime in the existing literature. Having accounted for it, development has no discernible impact on crime rate (Soares 2004).

Finally, the relationship between income or poverty and crime can be spurious. In particular, both income and criminal behaviour can be determined by individual or group characteristics. Personal history of criminal behaviour or imprisonment affects labour market opportunities (Pare & Felson 2014). Furthermore, illegal activity can discourage entrepreneurship and reduce productivity while further income can be lost in the long term due to the opportunity cost of government spending on crime prevention instead of education, healthcare, or infrastructure (Goulas & Zervoyianni 2015). Nonetheless, Pare & Felson (2014) note that most researchers assume that the relationship between crime and income is such that living in poverty or with lower income increases the chances of criminal behaviour, not vice versa.

2.2.2 Income inequality

Linking income inequality with increasing criminal activity can be supported by similar theoretical arguments as in the case of poverty. In particular, several influential theories of crime can be mentioned in this context: the economic theory of crime of Becker (1968) and Ehrlich (1973) from Section 2.1, the sociological strain theory of Merton (1938), and the social disorganization theory of Shaw & McKay (1942).

Firstly, in the spirit of the economic theory of crime (Becker 1968; Ehrlich 1973), areas of high income inequality have representations of both low-income individuals (with low returns on the legal labour market) and high-income individuals (with material possessions of high value). The difference thereof provides high potential returns and thus high incentives to illegal activity.

Secondly, the strain theory of Merton (1938) posits that the higher the income inequality, the greater the strain and frustration of unsuccessful individuals who are surrounded by relatively more successful people. The greater this frustration, the more likely are such individuals to commit crimes. Also known as the relative-deprivation theory, the strain theory provides theoretical foundations for connecting economic incentives with the occurrence of violent crime (Allen 1996), unlike the economic theory of Becker (1968) and Ehrlich (1973) which focuses on opportunity costs.

Thirdly, the social disorganization theory of Shaw & McKay (1942) argues that crime occurs when social control mechanisms are weakened due to factors such as poverty, family instability, residential mobility, or ethnic diversity, all of which can be linked to income inequality. Again, the social disorganization theory applies to violent as well as property crimes.

Empirically, Soares (2004) finds that the effects of income inequality and crime are generally either positive or insignificant. In a set of 46 coefficients from 16 studies published between 1968 and 2000, 24 were positive, 19 insignificant, and only 3 negative (Soares 2004). Notably, two of the negative coefficients were between income inequality and rape. Similarly, the meta-analysis of Hsieh & Pugh (1993) reports that the effect is primarily positive based on studies published between 1976 and 1991. Like Soares (2004), Hsieh & Pugh (1993) observe that size of the impact varies across different crimes, noting that homicide and assault are more closely linked to inequality than rape and robbery.

Kelly (2000) shows that the effect of inequality on property crimes is in-

significant, but it is strong and robust for violent crimes. In contrast, poverty influences property crimes, but not violent crimes in a panel data analysis. Therefore, Kelly (2000) argues that property crimes can be well explained by the economic theory of crime (Becker 1968; Ehrlich 1973), whereas strain theory (Merton 1938) and social disorganization theory (Shaw & McKay 1942) provide a better justification for violent crimes. Nonetheless, among violent crimes, Choe (2008) reports a significant positive relationship only in the case of rape, while out of property crimes only burglary and larceny show a meaningful effect. The study uses US state-level data controlling for education, demographic composition, as well as ethnic diversity, comparably to Hipp & Kubrin (2017) who focus specifically on small neighbourhoods in the Los Angeles area to also conclude a positive effect of inequality on crime.

However, the external validity of findings from the United States, on which crime research has mainly focused, is questioned by Kim *et al.* (2020). Especially in Europe, crime is found to be less affected by income inequality than in other parts of the world (Kim *et al.* 2020). On a panel of 39 countries from around the world, Fajnzylber *et al.* (2002) uncover a positive effect of inequality, offering an explanation expanding on the strain theory of Merton (1938). Assuming that security is a normal good the demand for which increases with income, poor communities are provided with less police protection and criminal activity can consequently flourish (Fajnzylber *et al.* 2002).

Nevertheless, negative or insignificant effects of inequality on crime are obtained especially when advanced econometric methods are used. For instance, Chintrakarn & Herzer (2012) control for omitted variable and endogeneity biases using cointegration, arriving at a negative coefficient. To explain the result, Chintrakarn & Herzer (2012) also recall demand for security like Fajnzylber *et al.* (2002). Assuming its normality, the demand for police as well as private protection increases with income, thus reducing the potential returns to illegal activity in line with the findings of Allen (1996). Another econometric innovation in the crime literature is the use of spatial lags by Süß (2020). Using data on German districts, the positive impact of inequality on crime disappears due to local spillover effects. Finally, Pare & Felson (2014) claim that the positive signs of coefficients found in previous literature on inequality and crime stem from the lack of control for poverty. Once controlled for on a panel of 63 countries, the impact is insignificant. However, in conclusion, it should be reiterated that only a minority of studies uncover a negative effect of inequality, robust to different methodological specifications (Soares 2004).

2.2.3 Unemployment

The effect of unemployment can also be considered through several major themes in the existing literature. Firstly, the theory of Becker (1968) and Ehrlich (1973) concentrates on opportunity costs, in which wage is typically compared to the costs and benefits of illegal activity. Thus, during periods of high unemployment, the opportunity cost of crime is relatively lower and crime can be more pervasive. This result is found in a plethora of empirical studies (Freeman 1999; Levitt 2004; Cook *et al.* 2014). The effect is typically stronger for property crime (Cantor & Land 1985; Levitt 2004), yet even for homicide rates, Anser *et al.* (2020) find a positive effect on a diversified panel of countries from around the world. Altindag (2012) dissects the effect based on education levels and suggests that the unemployment of individuals with low education levels is a significant component of the impact of unemployment on crime. The result corresponds to Gould *et al.* (2002) who also consider the unemployment rates of less educated males as the key determinant of crime. However, wage trends are found to be the major driver in this nexus (Gould *et al.* 2002).

Secondly, Cantor & Land (1985) divide the relationship into two separate effects. First is the motivation effect, similar to Becker (1968) and Ehrlich (1973), which concludes that worse economic conditions together with higher unemployment would provide more incentives for criminal activity, counter-cyclically. In contrast, the second – the guardianship effect (or opportunity effect (Cook *et al.* 2014)) – is pro-cyclical. As economic conditions and employment rates improve, people are expected to spend less time in their homes protecting their property, and thus crime can sprout (Cantor & Land 1985; Andresen 2012). Moreover, the availability of "theft-worthy" goods improves (Altindag 2012). Cantor & Land (1985) verify these effects empirically on post-war data for the USA, concluding that the guardianship effect dominates the motivation effect. The presence of both the effects is also confirmed by Andresen (2012) who adds that the guardianship effect is key for the short-term, but the motivation effect prevails in the long-term.

Thirdly, the potential disparity and the importance of the time dimension is also highlighted by Mocan & Bali (2010). They suggest that the relationship between unemployment and crime is asymmetric as the increases of crime during economic contractions are larger than its decreases during expansions. This finding implies the persistence of crime rates that do not revert to their pre-recession values, however, thanks to the asymmetric duration of expansions,

neither do crime rates perpetually rise (Mocan & Bali 2010).

Finally, the guardianship effect of Cantor & Land (1985) can be enriched with a gender dimension. Lower female unemployment reduces not only supervision of valuables, but also maternal supervision (Cook *et al.* 2014). Statistically, such children are claimed to be more prone to committing crimes and consuming drugs (Altindag 2012). Furthermore, higher employment of women can be perceived as a threat to masculinity, resulting in increased domestic violence as well as other forms of violent crimes (Cook *et al.* 2014). Empirically, Cook *et al.* (2014) confirm the significance of female, but not male, unemployment on guardianship effect for both violent and property crimes while proposing that gender does not influence motivation effects.

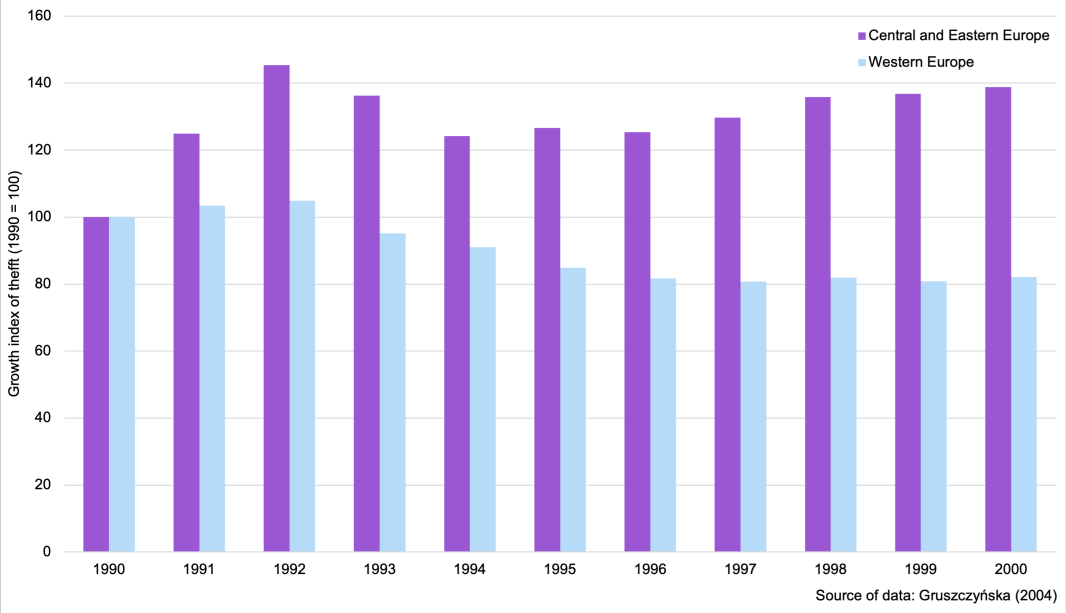
Nonetheless, the size of the effect of unemployment is not particularly strong (Freeman 1999) and insufficient to explain the variation in crime rates (Levitt 2004). There are a few possible explanations, including the fact that legal employment and illegal activity need not be mutually exclusive (Ehrlich 1973; Freeman 1999). Furthermore, other non-economic factors, such as education (Choe 2008; Altindag 2012; Anser *et al.* 2020; Süß 2020), divorce rate (Ceccato 2008; Stamatel 2009; Piatkowska *et al.* 2016), ethnic diversity (Stamatel 2009; Hipp & Kubrin 2017), or alcohol consumption (Pridemore 2005; Ceccato 2008) are also at play.

2.3 Crime in Eastern Europe

Crime in Eastern Europe has sustained considerable changes in recent history, mainly affected by the transition from communism to market economy and democracy. With respect to crime, Stamatel (2009) argues that the region is historically unique thanks to its simultaneous democratization and marketization. Its crime growth rates in the 1990s, such as in Figure 2.1, were generally exceeding those of Western Europe while in absolute terms crime rates remained lower than in Russia, whose experience after the dissolution of the Soviet Union is not considered as representative for the region as a whole (Stamatel 2009; Šelih 2014; Piatkowska *et al.* 2016). The singularity of the region is also demonstrated in the burdens it carries from both the communist era as well as the transition era, the accounts of which are discussed in this section.

During the communist era, the regime's Marxist and Leninist ideology considered crime as a product of the social class divide arising from private ownership, and by abolishing thereof, the roots of crime should have disappeared

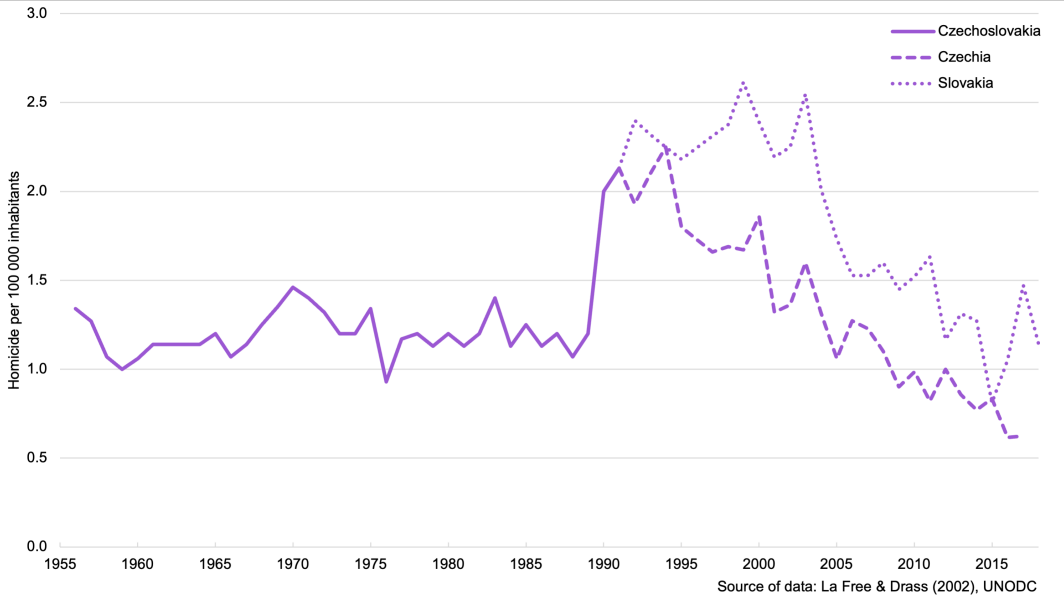
Figure 2.1: Change in theft rates in CEE vs. Western Europe



(Farrell & Heidensohn 1991). Illegal activity was thus solely explained as a relic of capitalism or a consequence of an individual's unfavourable social or psychological conditions. Nevertheless, not only did crime prevail, as shown in the example of Czechoslovakia in Figure 2.2, but the ideological contextualization thereof resulted in insufficient statistical data collection, deliberate under-reporting, and a nearly complete lack of victimization surveys (Farrell & Heidensohn 1991; Lévay 2000; Ceccato 2008). Furthermore, the stigmatization of crime and repressive measures used by the communist regime bore their consequences in the following decades, by undermining the public trust in rule of law (Fijalkowski 2007), fostering the growth of the shadow economy (Lotspeich 1995), and spreading corruption (Holmes 2009).

The mostly peaceful transition to democracy stands in stark contrast to its violent aftermaths in crime occurrence. The sharp year-on-year increase in 1990 portrayed in Figure 2.2 manifested itself across all countries and crime categories (Free & Drass 2002; Karstedt 2003; Gruszczyńska 2004) as well as on the overall mortality, including homicides and suicides (Ceccato 2008). However, the rise in criminal behaviour cannot be attributed to improvements in reporting alone (Lévay 2000), and there is a general consensus in the existing literature that illegal activity increased as a consequence of the transition and its strain on society. Crime alone can be seen as defining characteristic of social transformation (Lévay 2000), but it is also the outcome of other economic,

Figure 2.2: Homicide rates in Czechoslovakia



social, and political changes that were ubiquitous during this period, including deteriorating economic conditions (Lotspeich 1995) such as rising inflation, unemployment, and inequality (Stamatel 2009), destabilization of social norms (Shaw & McKay 1942; Lotspeich 1995), loss of certain social services (Stamatel 2009), or increased availability of alcohol (Ceccato 2008). The greater occurrence of crime can also be demonstrated by the demand for private protection against theft or burglary as a large number of security companies was founded during the transition period (Gruszczyńska 2004).

Aside from the quantity of crime, its structure was also affected. Whereas property crimes represented around 60% of total incidents during the 1980s, in the 1990s it was nearly 80% due to the increase in rates of theft and burglary (Lévay 2000). Nonetheless, simultaneously, violent crimes including homicides were surging (Free & Drass 2002; Karstedt 2003), ascribed to a spike in violence and brutality leading to crimes becoming more lethal (Lévay 2000; Ceccato 2008).

Additionally, the nature of political and economic reforms also determined the levels of violence. Gati (1996) distinguishes between two groups of East European countries. Czechia, Hungary, Poland, Slovakia, and Slovenia are described as leaders thanks to having economically performed better and having had looser ties to the Soviet Union during the communist era, which allowed for a relatively easier transition towards democracy and market economy. On the contrary, Bulgaria, Croatia, Macedonia, and Romania are labelled as laggards

for having been less economically developed and more dependent on the Soviet Union. Stamatel (2004) expands on this concept by categorizing countries by their form of socialism, whether or not their revolutions were violent, to what extent communists have retained power, and what level of democratization and marketization they demonstrated. Both Stamatel (2004) and Stamatel (2009) find evidence that more progressive and extensive economic and political reforms are related to lower levels of violence and homicide rates. Furthermore, Karstedt (2003) emphasizes the importance of strong institutions dedicated to civil rights protection and rule of law, especially in explaining the differences between independent countries and the successor states of the Soviet Union.

Another notable transition, though not as significant as the shift towards democracy and market economy in the 1990s, was the accession to the European Union. Entering the EU can be approached as a factor disrupting economic and social stability, and thus affecting crime rates along the contours of the social disorganization theory (Shaw & McKay 1942). In a study of 10 East European countries that joined the EU in 2004 or 2007, Piatkowska *et al.* (2016) observe a downward trend in homicide rates before as well as after entering the EU, as can be seen in Figures 2.2 and 3.1. However, the study uncovers a positive effect of EU accession on homicide rates, implying that membership in the EU slowed down the ongoing declining trend in East European countries.

2.4 Hypotheses

Using cross-national data on economic indicators as well as non-economic control variables to identify determinants of crime in Eastern Europe, the following hypotheses will be tested:

Hypothesis #1 Increases in income per capita lead to lower crime rates.

Hypothesis #2 Increases in income inequality lead to higher crime rates.

Hypothesis #3 Increases in unemployment lead to higher crime rates.

Chapter 3

Data

This chapter covers how data that is used in the empirical analysis is obtained and processed. Section 3.1 introduces the dependent as well as independent variables, followed by a discussion of their descriptive statistics in Section 3.2. The treatments of outliers and missing data are described in Section 3.3 and Section 3.4 respectively.

3.1 Variables

The following section characterizes the variables used in the empirical analysis, the reasons for their choice, and the caveats they include.

3.1.1 List of countries

In order to analyze the crime determinants in Eastern Europe, one must first define what countries fall under this umbrella term. Different geographical, historical, or political definitions result in the loose usage of the term Eastern Europe. To overcome this ambiguity, a list published by the OECD (2001) is used, which includes the following 12 countries: Albania, Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

Due to an insufficient data availability, the final list for the empirical analysis is missing Albania. While its omission reduces the scale of available data points, it needs not decrease the quality of the research, but on the contrary, improve it. Kim *et al.* (2020) demonstrate that the specific socio-historical context of each region should be considered when studying the effect of macroeconomic variables on crime. In this line of argument, Albania can be deemed as

substantially different in its societal composition and historical experience so as to justify its exclusion from this study. Unlike every other country on the OECD (2001) list, Albania is not a member of the EU, the accession to which is shown to have a significant impact on levels of homicide (Piatkowska *et al.* 2016). Furthermore, Albania's most common religion is Islam, representing 56.7% of its population (CIA World Factbook 2020). In comparison, the most popular declarations of faith in the remaining countries are either Christianity or agnosticism/atheism (Baronavski & Evans 2018). For these reasons, excluding Albania from the sample is consistent with the conclusions of Kim *et al.* (2020).

In comparison to existing research that focuses on Eastern Europe, the list used in this study is also missing North Macedonia. However, it is neither on the OECD (2001) list nor a member of the EU. Therefore, its omission can be justified similarly to Albania.

In total, the final number of countries is 11 which is similar or greater than other existing studies in this field (e.g. Stamatel 2009; Piatkowska *et al.* 2016). Table 3.1 lists the countries that are included in this study together with their accession years into the European Union and Eurozone as well as with other dates, the importance of which is explained Section 3.3.

Table 3.1: List of countries

	EU accession	Eurozone accession	Criminal code reform	Istanbul Convention signed	Istanbul Convention in force
Bulgaria	2007		2005	2016	
Croatia	2013		2011	2013	2018
Czechia	2004		2010	2016	
Estonia	2004	2011	2002	2014	2018
Hungary	2004		2013	2014	
Latvia	2004	2014	1999	2016	
Lithuania	2004	2015	2003	2013	
Poland	2004		1997	2012	2015
Romania	2007		2014	2014	2016
Slovakia	2004	2009	2006	2011	
Slovenia	2004	2007	2008	2011	2015

Source: OECD (2001); European Union (2020); OSCE (2021); Council of Europe (2021).

3.1.2 Dependent variables

Legal differences in classifying crimes restrict the empirical analysis of crime on a cross-country level. Moreover, Buonanno *et al.* (2017) note that data comparability among countries is another problem constraining this strand of research. Therefore, in order to improve comparability and consistency for both statistical and analytical purposes, the International Classification of Crime for Statistical Purposes (ICCS) was adopted in 2015 (UNODC 2015). Based on internationally agreed concepts and behavioural descriptions, the ICCS categorizes criminal activity into 11 mutually exclusive and exhaustive classes while providing definitions, inclusions, and exclusions of each crime. Thanks to this effort, future research can benefit from the consistency of collected data.

Nonetheless, the ICCS categorization is not applied to historical data where usual concerns of institutional heterogeneity apply. Moreover, the creation and adoption of the ICCS impacted the publication of crime statistics between 2009 and 2015 (UNODC 2021). While the United Nations Office on Drugs and Crime warns against breaks in its database, Eurostat (2021) presents certain crime time series until 2007 only and others since 2008 only. The only continuously reported crime in the available databases is homicide which is also subject to the least definitional differences across countries and is thus most easily comparable (e.g. Goulas & Zervoyianni 2015; Piatkowska *et al.* 2016). While studying other criminal offences can provide useful insights due to their distinct motivations (e.g. Freeman 1999; Levitt 2004; Bushway *et al.* 2012; Buonanno *et al.* 2017), its contribution is strictly limited by their definition changes and shorter available time dimension. Results of these estimations are reported, despite being inferior to the analysis of homicide rates.

Data on homicide as the most consistent crime statistic is available from multiple sources, including Eurostat (2021), UNODC (2021), World Bank (2021), and World Health Organization (2021). Since their collection methods differ, all are used and compared for additional robustness. Eurostat (2021) data is collected from official sources "such as the National Statistics Office, the National Prison Administration, the Ministries of the Interior or Justice and the Police." Similarly, the UNODC (2021) assembles its dataset "from national authorities through the annual United Nations Crime Trends Survey." In contrast, World Bank (2021) adopts data from the UNODC (2021). Despite the clear linkage, at a closer inspection, the two datasets are not identical. Therefore, the time series published by the World Bank (2021) is considered in the empirical anal-

ysis mainly for the sake of comparability with other studies that employ its data. However, results based on the UNODC (2021) and World Bank (2021) can be expected to be very similar. Last but not least, unlike other databases that rely on crimes reported to the police and official authorities, World Health Organization (2021) provides estimates based on mortality, as determined by medical examiners. Accordingly, it is independent of reporting crimes and police records, and as a result, it is generally considered the most reliable source of homicide data (e.g. Neapolitan 1997; Stamatel 2009; Piatkowska *et al.* 2016).

Other available crime statistics in Eurostat (2021) and UNODC (2021) include violent crimes (acts causing harm, robbery, assault, and serious assault), sexual crimes (sexual violence, sexual assault, and rape), and property crimes (burglary, theft, and car theft). It is noteworthy that these criminal offences are not mutually exclusive as there are examples of Level 1, Level 2 as well as Level 3 crimes following the ICCS classification. In fact, acts causing harm as a wider category include, among others, assault, the subcategories of which include serious assault and threats. Furthermore, sexual assault and rape together comprise the sexual violence category. Last but not least, car theft is a subcategory of theft. Full definitions of each crime according to the ICCS (UNODC 2015) are listed in Appendix A. Individual crimes within each wider category can exhibit similar trends stemming from either their direct colinearity, or being affected by similar factors due to the nature of the criminal acts. In contrast, considerable differences are expected to be found when comparing the classes. For instance, economic incentives are expected to be less robust in affecting violent crimes (e.g. Freeman 1999; Levitt 2004; Buonanno *et al.* 2017).

As is a common practice, each crime statistic is scaled to rates per 100 000 inhabitants. By doing so, the size effect of larger countries recording more crime is mitigated. Both Eurostat (2021) and UNODC (2021) report crime statistics as an absolute number of recorded offences as well as rates per 100 000 inhabitants. To minimize inconsistency resulting from each database using different data on population, the absolute number of offences is used and scaled by each country's population obtained from Eurostat (2021). In contrast, World Bank (2021) and World Health Organization (2021) only provide rates per 100 000 inhabitants. Another common procedure is using logarithms of crime rates in order to account for skewness in the data (e.g. Cantor & Land 1985; Fajnzylber *et al.* 2002; Choe 2008; Stamatel 2009; Anser *et al.* 2020).

3.1.3 Independent variables

The key variables of interest in estimating economic determinants of crime are income per capita, income inequality, and unemployment, all of which are related to the opportunity cost associated with illegal activities (Becker 1968; Ehrlich 1973; Freeman 1999).

Firstly, for income, Eurostat (2021) provides data on real GDP, which is divided by the population size of each country-year to produce real GDP per capita in 2010 euros. To account for the skewness of the data, natural logarithms are applied, similarly to e.g. Gould *et al.* (2002) or Piatkowska *et al.* (2016).

Secondly, as for income inequality, the Gini coefficient is chosen as the most appropriate measure, with data from Eurostat (2021). On a 0-to-100 scale, the Gini coefficient calculates how a country's income distribution deviates from perfect equality represented by 0. As a result, it cannot fully describe specific income distributions of the poorest or wealthiest quantiles of the population. However, unlike alternative measures such as poverty headcount index or the percentage of income held by a certain quintile or decile, all population segments are accounted for within the Gini coefficient. Importantly, it is the most frequently used measure of inequality, allowing the results of this study to be comparable with related literature, such as Allen (1996), Stamatel (2009), Chintrakarn & Herzer (2012), Pare & Felson (2014), Piatkowska *et al.* (2016), Goulas & Karidis (2020), or Süß (2020).

For additional robustness, an alternative measure of inequality is considered, namely the ratio of total income received by the top quintile to that received by the bottom quintile. It is selected as the other available measure of inequality in the Eurostat (2021) database which is also used by Kim & Pridemore (2005). Chintrakarn & Herzer (2012) argue for the share of income of the wealthiest decile as the preferred measure of inequality when studying crime determinants, data for which is unavailable for the selected countries and years. Nonetheless, the Gini coefficient is then also used in the study for robustness, so the results are comparable.

Thirdly, unemployment data can also be obtained from Eurostat (2021). In particular, four different rates of unemployment are used – total unemployment, male unemployment, unemployment in the age category 15 to 24 years old, and male unemployment in the said age category. The demographic of young men are known to be the most prone to criminal activity (Freeman 1999), despite

some studies claiming the obsolescence of demographics in crime composition (Allen 1996; Levitt 2004). Regardless, Cook *et al.* (2014) study the effect of male and female unemployment separately, whereas Goulas & Karidis (2020) include the growth rate of unemployment of men with basic education.

In a similar line of argument, the share of the young male population is often incorporated in related literature, either as a simple percentage of total (Hipp & Kubrin 2017; Süß 2020), or as a ratio between the young and the old population (Altindag 2012). Similarly, the number of 15- to 24-year-old men is obtained from Eurostat (2021) and their share of the total population is calculated for each country-year. Hipp & Kubrin (2017) also propose total population as an independent variable determining crime. Despite the fact that each crime variable is scaled to a rate per 100 000 inhabitants, population size may still affect it and is therefore included in this study.

Fourthly, aside from the composition of the population, further control variables are used to capture the demographic context of the society, namely the education level and social cohesion. The reason for the inclusion of education relies upon the theory that incentives for crime are determined by their opportunity costs (Becker 1968; Ehrlich 1973). In particular, education spending and attainment affect labour market opportunities, through which income distribution can be influenced, thus determining the crime rate (Altindag 2012; Anser *et al.* 2020). Therefore, data on the percentage share of population whose highest attained education is less than primary, primary, or lower secondary is obtained from Eurostat (2021).

Similarly, social cohesion is an important factor impacting crime. Through greater integration, social ties between individuals can facilitate greater social control and protection against violence (Shaw & McKay 1942; Gartner 1990). This aspect is particularly important for Eastern Europe in which social norms were greatly challenged and changed by the economic and political transition following the dissolution of the Eastern bloc (Stamatel 2009). To quantify social cohesion, Stamatel (2009) suggests a distinction between intra-group and inter-group cohesion. Similarly to this study as well as to Piatkowska *et al.* (2016), intra-group cohesion is proxied by divorce rate per 1000 inhabitants, calculated from the total recorded number of divorces from Eurostat (2021). As for inter-group cohesion, measures of ethnic diversity (Stamatel 2009; Hipp & Kubrin 2017) or migration (Goulas & Karidis 2020; Süß 2020) are often employed. Similarly to Doležalová (2019), the percentage share of foreigners in population is produced based on Eurostat (2021).

Fifthly, to capture the probability of punishment in line with Becker (1968) and Ehrlich (1973), the numbers of police officers and prisoners are also procured. The perceived risk of being sanctioned for an offence influences the scale of illegal activity, and such risk is negatively affected by the number of police officers (Levitt 2004). Similarly, a greater number of prisoners can signal a greater risk of being incarcerated, while also reducing the pool of potential criminal offenders in population (Freeman 1999; Levitt 2004). Consequently, the police and prison population rates are calculated from Eurostat (2021), similar to Altindag (2012), Buonanno *et al.* (2017), and Goulas & Karidis (2020).

Finally, several dummy variables are used to characterize other factors, some of which are described in the remainder of this chapter. These include a dummy variable for criminal code reforms and for signing and ratifying the Istanbul Convention. Furthermore, Piatkowska *et al.* (2016) show the impact of accession into the EU on homicide rates. Therefore, a dummy variable is constructed taking the value of 0 before each respective country joined the EU, and taking the value of 1 in each year thereafter. Additionally, a dummy variable for the adoption of the Euro is created because of its effect on the economic situation of a country that may also influence crime rates.

Full definitions of each independent variable are provided in Table B.1.

3.2 Descriptive statistics

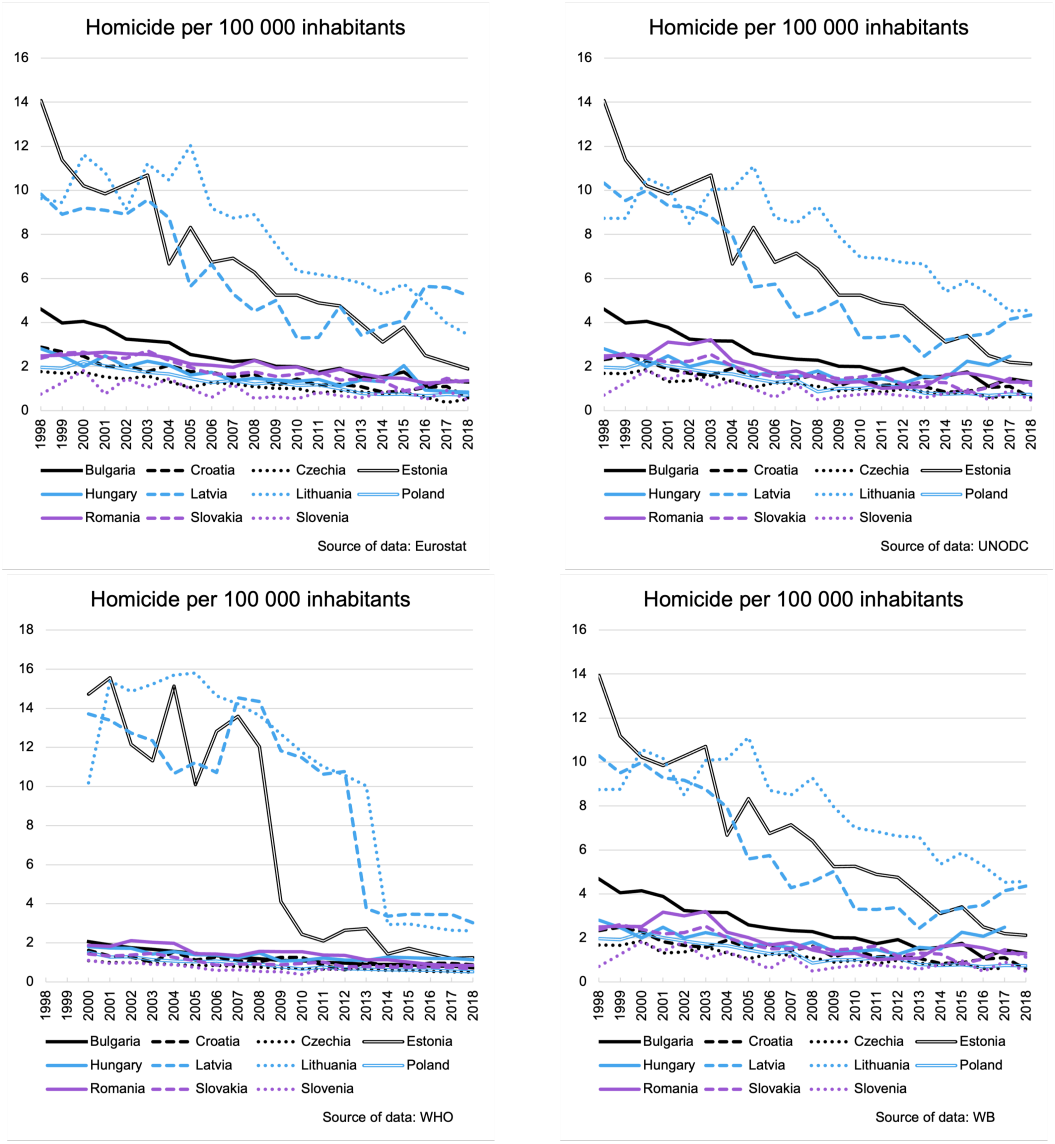
In this section, descriptive statistics of the variables employed within the model are interpreted. Table 3.2 specifies statistics for homicide rates from different sources as described in Section 3.1.2. Statistics for other variables as well as a correlation matrix are available in Appendix B.

Table 3.2: Descriptive statistics: Homicide per 100 000 inhabitants

Source	Obs.	Years	Mean	St. Dev.	Min	Max
Eurostat	231	1998-2018	3.06	2.87	0.38	14.07
UNODC	229	1998-2018	3.02	2.82	0.48	14.07
World Bank	229	1998-2018	3.02	2.82	0.48	13.94
WHO	209	2000-2018	3.24	4.49	0.39	15.81

As for homicide rates, between 3.02 and 3.24 homicides per 100 000 inhabitants occur on average in a year in an East European country. World

Figure 3.1: Homicide in Eastern Europe



Health Organization (2021) reports a greater number of instances which is reasonable given its methodology that combines officially reported cases (used by the other sources) with estimates of mortality by medical experts. Furthermore, its records exhibit a greater standard deviation, indicating that officially reported homicide rates across countries are affected differently by their mortality estimates. Consequently, it implies that police records can be relied upon to different extents across East European countries as suggested by Soares (2004).

This finding mainly concerns Baltic countries which display the highest homicide rates across all four databases. As can be seen in Figure 3.1, the occurrence of this crime per 100 000 inhabitants exceeds that of other coun-

tries in Eastern Europe. On average, homicides are recorded 4.22 times more frequently in the Baltic republics. Ceccato (2008) argues that the economic and political transition following the dissolution of the Soviet Union generated social instability and uncertainty in which violent crime could flourish. Similarly, Šelih (2014) claims that Russia represents a substantially different case in terms of crime because of its different policies as well as, according to Pridemore (2005), alcohol consumption. Estonia, Latvia, and Lithuania, as the only post-Soviet countries on the list, were therefore presumably affected by these differences. To account for it, Piatkowska *et al.* (2016) suggest a post-Soviet dummy variable, and estimation of the model without the Baltic republics is included in the sensitivity analysis.

As for other crimes, its descriptive statistics are shown in Appendix B. Plots for each crime can be found in Appendix C. The most frequently reported crime is theft with an average of 801.76 instances per 100 000 inhabitants each year according to Eurostat (2021), respectively of 847.15 according to UNODC (2021) which covers a longer time period. Conversely, the least common crime is kidnapping, with less than one occurrence per 100 000 inhabitants each year. In general, property crimes occur the most frequently, followed by violent crimes and sexual crimes. It should be noted that the comparison involves reported crimes only, and the measurement bias can affect various crime categories to a different extent.

Additionally, Table B.4 shows the breakdown of the standard deviations into within and between standard deviation. The within statistic describes the variation of crime within individual countries over time, calculated as an average of standard deviations for each country. On the contrary, the between statistic examines the variation among countries, calculated as a standard deviation of averages of each country. The comparison, visible from graphs in Appendix C as well, reveals that the between statistic is the major driver in the overall standard deviation, implying that there is relatively more variability between countries than there is within individual countries over time. Finally, the between/within standard deviation is the square root of the sum of the between variance and the within variance, and it reflects the total common-cause variation. Were the overall and the between/within standard deviations considerably different, the data-generating process could be unstable, which is however not the case, looking at Table B.4.

Over time, while homicides, robbery, or theft show decreasing trends, instances of acts causing harm or rape are increasing. Certain crimes, such as

sexual violence or assault are stagnating. Multiple of these time series exhibit notable breaks, as mentioned in Section 3.1.2 due to the adoption of the ICCS, or outliers, as described in Section 3.3.

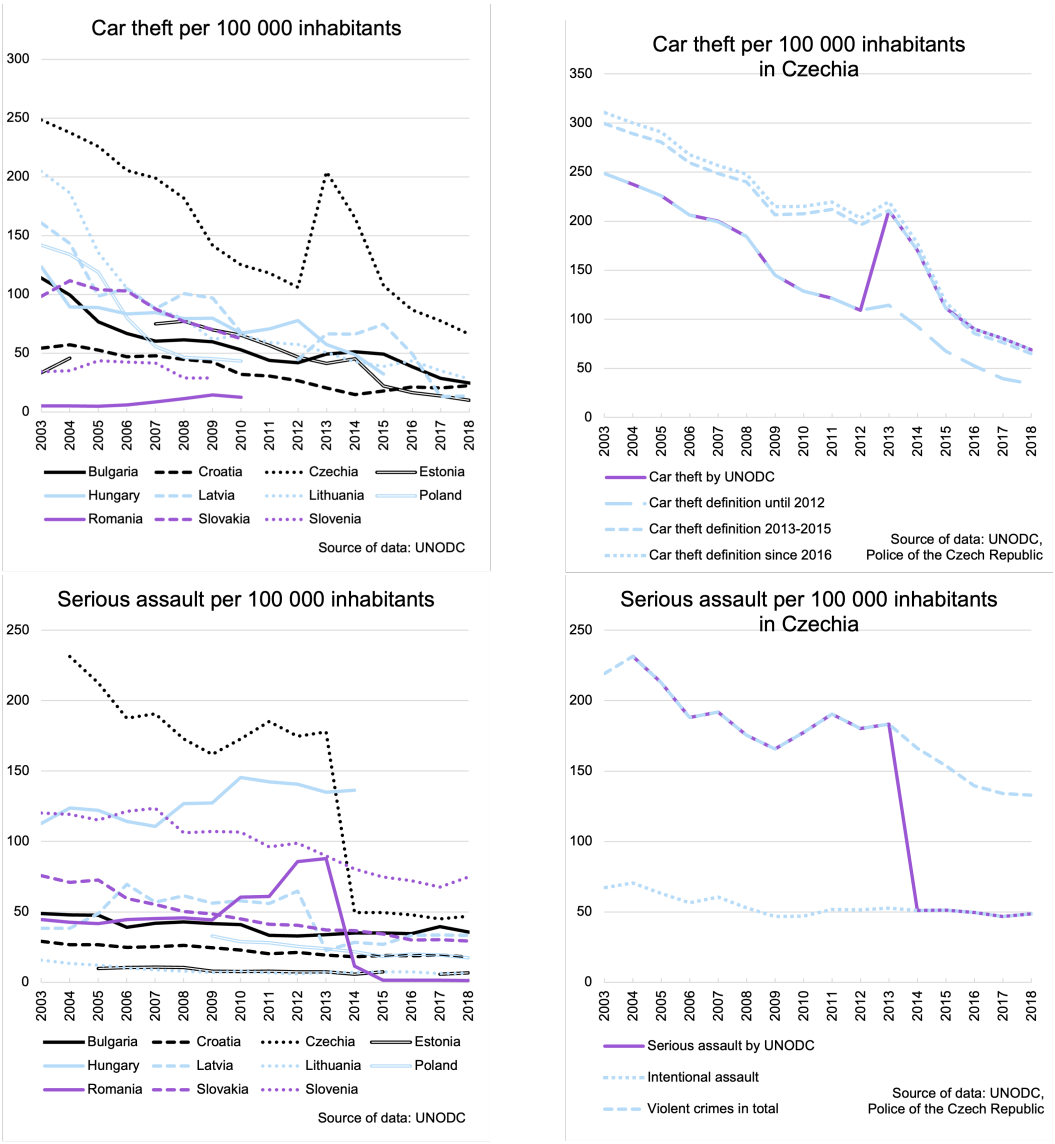
3.3 Outliers

Appendix C reveals the considerable variability in the criminal statistics data. While reporting and definitional inconsistency may explain some of the outliers, others require further interpretation.

Firstly, the studied period between 1998 and 2018 is considered transitional for this region (Šelih 2014). Aside from adopting principles of market economy, substantial political and legal reforms were introduced during this period. Importantly, each country amended its criminal code (OSCE 2021), often rejecting the philosophy of the former regimes of protecting state property and society first and foremost in favour of safeguarding the health and lives of individuals as its main priority (Český Rozhlas 2009). Such changes can affect not only the definitions by which crimes are recorded but also the severity of these crimes and their respective punishments, thus influencing the motivation of offenders and the frequency of these crimes (Becker 1968; Ehrlich 1973; Freeman 1999; Ceccato 2008). These reforms coincide with several structural breaks in the data, in particular in the case of robbery in Estonia, theft and assault in Romania, or burglary in Latvia. Following Table 3.1, a dummy variable is introduced for each country, taking the value of 0 prior to the criminal code reform, and the value of 1 hereinafter.

Secondly, another set of outliers concerns offences in the sexual crime category. During the studied period, the societal approach to these crimes as well as to their reporting to official authorities has evolved. Legally, a major effort in preventing and combating not just sexual crimes, but also domestic violence and violence against women, has been the Istanbul Convention (Council of Europe 2021). Since its introduction in 2011, the convention has been signed by all members of the Council of Europe except for Azerbaijan and Russia. However, its provisions are legally binding only once it enters into force after ratification. As of writing this thesis, of the 11 East European countries, only 5 have had the Istanbul Convention come in force, as listed in Table 3.1. Legally binding effects of the convention as well as discussions associated with non-binding signing thereof may help explain the breaks in rates of sexual assault

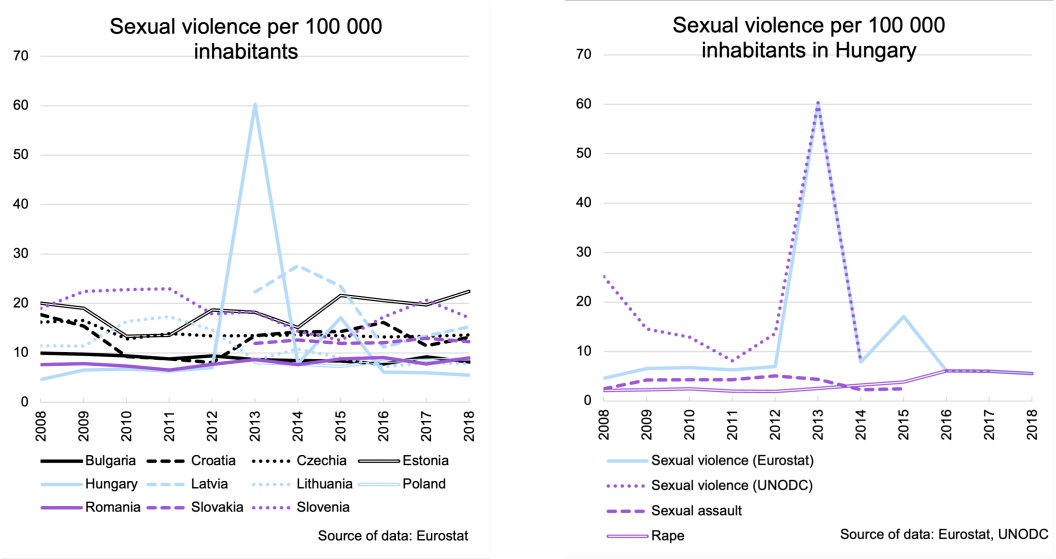
Figure 3.2: Outliers in Czechia



in Slovenia and Latvia. Similarly to the criminal code reform, two dummy variables are defined for the signing and ratifying of the Istanbul Convention.

Thirdly, definitional inconsistency affects certain variables, for example, car theft and serious assault in Czechia. Data gathered by the UNODC (2021) can be cross-checked by records published by Police of the Czech Republic (2021). In the case of car theft, it appears that the car theft definition has been modified at least twice between 2003 and 2018, as shown in the first two panels of Figure 3.2. Until 2012, it included theft of two-wheeled as well as four-wheeled motorized vehicles (*krádeže motorových vozidel jednostopých, krádeže motorových vozidel dvoustopých*). Between 2013 and 2015, theft of two-wheeled

Figure 3.3: Outliers in Hungary



vehicles was replaced by theft of parts of motorized vehicles (*krádeže součástek motorových vozidel, jednostopých a dvoustopých*), explaining the sharp increase in car theft records. Finally, since 2016, all three components have been reported under car theft published by UNODC (2021). According to the ICCS definition, available in Appendix A, the latest of the three modifications best reflects the internationally accepted definition.

Similarly, in case of serious assault, the definition was changed in 2014, as shown in the bottom half of Figure 3.2. Before, violent crimes in total (*násilné činy celkem*) were reported. This category also includes homicide, kidnapping or robbery, among others, contradictory to the ICCS definition of serious assault listed in Appendix A. Since 2014, the count only includes intentional assault (*úmyslné ublížení na zdraví*), thus better reflecting the ICCS definition.

In the case of these two crimes, imputed time series corrected for the definitional inconsistency can be used for the empirical analysis. However, it represents a larger problem mentioned in Section 3.1.2 that complicates the analysis of crime data on a cross-country level. Ideally, each crime category of each country would be cross-checked so as to ensure the best alignment with the ICCS definitions of historical data. Nonetheless, not only is such a procedure complicated due to the language barrier, but also not all countries publish their criminal statistics in such detail. While this procedure could be followed for Czechia (thanks to data of Police of the Czech Republic 2021) or Slovakia (thanks to data of Ministry of Interior of the Slovak Republic 2021),

other countries publish only total crime counts or homicide rates. Therefore, to allow for comparability with studies that draw their data from UNODC (2021) and that may not uncover this inconsistency, both the original and the corrected time series are used for the empirical analysis.

Finally, certain observations defy either of the aforementioned explanations. Namely, it concerns the rates of sexual violence in Hungary, pictured in Figure 3.3. According to data published by Eurostat (2021), it increased by 763% between 2012 and 2013. In absolute terms, the number of reported cases rose from 694 to 5 974, before falling back to 774 the following year. Data by UNODC (2021) exhibit a similar, though slightly different pattern with a surge of 342%. The series return to their original levels in 2014, implying that there was a reporting error. This can also be verified by inspecting data on sexual assault and rape which together comprise the sexual violence category of ICCS. However, neither of these two series display such dramatic upsurges in 2013. Consequently, the 2013 observation of Hungarian sexual violence should be considered as an outlier and treated as a missing value, the treatment of which is described in Section 3.4.

3.4 Missing data

This section comments on why certain observations are missing and what consequences it is expected to have on the empirical results and their external validity.

Data is collected for 11 countries described in Section 3.1.1 for the full available period between 1998 and 2018, resulting in an ideal number of 231 observations in a balanced panel of each variable. As noted in Section 3.1.2, Eurostat (2021) publishes certain crime statistics for years 1998 to 2007 only (ideally producing 110 observations), whereas others are reported for years 2008 to 2018 (resulting in a balanced panel of 121 observations). In comparison, UNODC (2021) mostly covers the period between 2003 and 2018, with a few exceptions.

Nonetheless, virtually every variable used in this analysis is missing certain observations, which can be seen in Table 3.2 or Appendix B. While the majority of these missing values are either at the beginning or the end of the studied period, some cause gaps in the data. Since panel data techniques require continuous time series so as to make use of first differencing and transformations thereof, such breaks substantially affect the analysis. Therefore, following Pi-

atkowska *et al.* (2016) and Stamatel (2009), these missing values are imputed using four-year averages of two preceding and two consecutive observations. This procedure is applied for dependent crime statistics, independent control variables as well as two outlying observations described in Section 3.3. It is noteworthy that descriptive statistics as well as graphs presented hitherto report available data only.

As a result of this procedure, the maximum potential amount of observations is gathered for analysis of crime determinants in Eastern Europe. Values missing at the beginning or the end of the studied period do not follow any particular pattern in terms of years, regions, or crime categories. Therefore, the conclusions thereof can be applied to all East European countries and categories of violent, sexual, and property crime, as well as homicide. However, given the different socio-economic, cultural, and historical contexts of the region, the validity of the conclusions does not extend towards other global regions (Kim *et al.* 2020).

Chapter 4

Methodology

The strategy for testing the hypotheses outlined in Section 2.4 is described in this chapter. Section 4.1 specifies the model that is estimated using methods depicted in Section 4.2. Finally, Section 4.3 summarizes applicable tests for choosing the optimal methods and assessing the sensitivity of the results.

4.1 Model

The estimated model has the following form:

$$\log crime_{it} = \beta_0 + \mathbf{X}_{it}\beta_1 + u_{it},$$
$$i \in \{1, \ldots, 11\},\ t \in \{1, \ldots, T\}$$

where *crime* represents one of the modelled crime rates per 100 000 inhabitants. A total of 11 crimes is studied, separated into the respective crime categories defined by the ICCS (UNODC 2015). Namely, it is homicide, violent crimes (acts causing harm, assault, serious assault, and robbery), sexual crimes (sexual violence, sexual assault, and rape), and property crimes (burglary, theft, and car theft). Another available crime statistic in the UNODC (2021) database is kidnapping, but since it occurs relatively infrequently, commonly reporting zero cases per year, it cannot be used in the analysis. Depending on the source of the data, the maximum time periods of available data T differ across crimes. Moreover, to account for skewness in the data, natural logarithms are applied to the data, as is a common practice in existing literature (e.g. Cantor & Land 1985; Fajnzylber *et al.* 2002; Choe 2008; Stamatel 2009; Anser *et al.* 2020).

$\mathbf{X}_{it}$ represents a matrix of control variables that include the presumed key

economic determinants of crime: logarithm of real GDP per capita, Gini coefficient, and unemployment. Control variables also encompass proxies for both intra-group and inter-group social cohesion proposed by Stamatel (2009). Specifically, they are represented by divorce rate and the share of foreigners in population, both expressed in terms per 1000 inhabitants. Next, there are indicators of the probability of punishment, the shares of police officers and prisoners in total population, equivalently per 1000 inhabitants. The demographic context of each country is captured by the share of the young male population, the logarithm of the total population, and education level. Additionally, there is a set of dummy variables representing the year of accession to the EU and the Eurozone, and the year of reforming the criminal code. It is noteworthy that time dummies are added to account for a time trend within the data.

Table B.6 presents the correlation matrix to check for multicollinearity. Importantly, it does not reveal potential issues with the key variables of interest – logarithm of real GDP per capita, Gini coefficient, and unemployment. Nonetheless, there can be concerns in the case of the share of foreigners and total population, with a correlation coefficient of -0.81. The problem of multicollinearity does not violate any of the standard estimation assumptions, but the variance of the coefficients for the concerned variables can be high. If excluded, the model can suffer from omitted variable bias. Including population size is supported in existing literature (Hipp & Kubrin 2017), as is the share of foreigners as a control for inter-group cohesion (Stamatel 2009; Hipp & Kubrin 2017; Goulas & Karidis 2020; Süß 2020), along the reasoning of the social disorganization theory (Shaw & McKay 1942). It is therefore theoretically justifiable to include the explanatory variables in the analysis. Nonetheless, the effect of their exclusion is commented on in the sensitivity analysis in Section 5.5.

4.2 Methods

For the available panel data, the choice is narrowed down to several methods: pooled ordinary least squares (OLS), fixed effects estimations, and random effects estimation. The optimal selection depends on the structure of the errors in the model equation. In particular, the error term u_{it} can be decomposed into an unobserved time-invariant error term a_i and an idiosyncratic error v_{it}, such that $u_{it} = a_i + v_{it}$. The characteristics of the unobserved time-invariant

error term a_i ultimately determine which of the three methods should be used primarily.

As for pooled OLS, in order to consistently and efficiently estimate the model, the individual time-fixed effect a_i must be observed. In other words, unless a_i is fully captured by control variables $\mathbf{X}_{it}$, its presence results in a built-in heteroskedasticity. However, by adding the assumption of mean independence of a_i, efficient estimates can be obtained using robust standard errors.

To test for the presence of the time-fixed errors a_i, the Lagrange-Multiplier Breusch-Pagan test for heteroskedasticity is used. Under the null hypothesis, there is no heteroskedasticity in pooled OLS, and consequently, this method produces efficient estimates. Conversely, under the alternative hypothesis, the random effects estimation is preferred due to the built-in heteroskedasticity. A limitation of using this test is that it needs to be assumed that the time-fixed effects a_i, if present, are not correlated with the independent variables.

This testing constraint can be overcome by turning to existing literature, where time-invariant variables, unobserved in the model and correlated with $\mathbf{X}_{it}$, can be found. For instance, Stamatel (2004) concludes that the manner in which East European countries transitioned from socialism influenced their levels of violence. At the same time, the nature of their reforms towards democratization and marketization in the early transitional years has had a persistent effect on the GDP per capita while also affecting when the countries entered the EU. From the perspective of the studied time period starting in 1998, the crucial distinction between transitional paths occurred prior to this year, implying that it can be approached as a time-invariant variable. Other examples can be found among cultural, social, historical, or geographic conditions, such as latitude which affects the amount of nighttime hours. Although these notions may render the Breusch-Pagan-Lagrange Multiplier test ineffective, it alone answers the original question on the presence of time-fixed effects, and thus confirms the inappropriateness of using pooled OLS.

This assumption is also used by the random effects estimation. Though existing literature can provide reasons for its violation, assuming that a_i and $\mathbf{X}_{it}$ are uncorrelated, and adding the assumption of strict exogeneity conditional on a_i, random effects estimates are consistent and more efficient than pooled OLS. However, the results are not unbiased, unless the θ parameter is known. Furthermore, random effects estimation uses degrees of freedom that are lost to using control variables in this model, and is thus unavailable for the majority

of the crime series.

The third and the most recommended method in existing literature is the fixed effects (within) estimation (e.g. Gould *et al.* 2002; Fajnzylber *et al.* 2002; Hu *et al.* 2015; Piatkowska *et al.* 2016). The within estimator subtracts the within mean from the equation and thus eliminates the individual time-fixed unobserved error a_i. However, by doing so, the effect of time-fixed dummy variables cannot be estimated. Nevertheless, its advantage is that it allows for the presence of unobserved time-invariant errors a_i, unlike pooled OLS, and its correlation with independent variables, unlike random effects estimation. Results are consistent and unbiased using standard OLS assumptions of linearity in parameters, random sampling, and no perfect collinearity together with strict exogeneity conditional on the unobserved effect.

4.3 Tests

Several tests are performed to choose the optimal method of estimation. Firstly, the aforementioned Lagrange-Multiplier Breusch-Pagan test is used to decide between pooled OLS and random effects estimation. Its results, where applicable, are reported along with the regression estimates and other tests in Chapter 5. Accordingly, it signals over 99% confidence for the rejection of the null hypothesis and supports the use of random effects estimation.

Secondly, the F-test indicates the preference for either pooled OLS or fixed effects estimation. The null hypothesis assumes there are no significant individual fixed effects, and therefore, both estimators are consistent. Under the alternative hypothesis, the presence of the significant individual fixed effects renders pooled OLS inconsistent, so fixed effects estimation is preferred. Its results across all models provide over 98% confidence for avoiding the use of pooled OLS.

Thirdly, the Hausman test is used to decide between the use of fixed or random effects estimators. Both methods are consistent under the null hypothesis, but random effects estimation is efficient and thus preferred. In contrast, only fixed effects estimation is consistent under the alternative. Its results indicate that the null hypothesis cannot be rejected and thus random effects estimation should be used, where applicable.

As outlined in Section 4.2, random effects estimation is unavailable in small samples with a large number of control variables. This limits crime rates that are available over relatively shorter time periods, which concerns all crimes

except homicide. In choosing between pooled OLS and fixed effects estimation, the F-test indicates the preference for the within estimator in all estimated models with over 98% of confidence. Therefore, the fixed effects method is used primarily.

Furthermore, the Durbin-Watson test and the Breusch-Pagan test are used to examine the presence of serial correlation and heteroskedasticity, respectively. Their p-values vary considerably across the different models and are reported along with the regression results in Chapter 5. Unless both their null hypotheses cannot be rejected, Arellano's robust standard errors are used to correct these defects. Standard errors, reported in parentheses, are clustered at the country level throughout the analysis.

Last but not least, to test for the sensitivity of the results, the model is re-estimated with several modifications. Firstly, data for inequality and unemployment are replaced with alternative data series – the ratio of total income received by the top quintile to that received by the bottom quintile, male unemployment, youth unemployment, and male youth unemployment. This allows for controlling of gender and age effects in unemployment that are considered in existing literature, such as by Gould *et al.* (2002) and Cook *et al.* (2014). Secondly, several crime statistics are available from both Eurostat (2021) and the UNODC (2021). Therefore, results of using different sources of data are compared. Thirdly, alternative model specifications are studied, adding a square of real GDP per capita to the model, to test the crime Kuznets curve of Buonanno *et al.* (2017). The sensitivity of the model to potential multicollinearity and endogeneity is also examined. Next, since certain outliers were uncovered in Section 3.3, the sensitivity of the model to their inclusion or exclusion is tested. Finally, as the crime trends in Baltic countries can significantly differ, as commented on in Section 3.2, the model is re-estimated without these states.

Chapter 5

Empirical Results

In this chapter, the proposed model is estimated and interpreted in terms of its results, the underlying theory, existing literature, and the proposed hypotheses. The chapter is structured according to the different crime categories, with homicide in Section 5.1, violent crime in Section 5.2, sexual crime in Section 5.3, and property crime in Section 5.4. The model is then re-estimated with different specifications to test for its robustness and sensitivity in Section 5.5. Finally, Section 5.6 evaluates the performance of the hypotheses.

5.1 Homicide

The estimation starts with homicide as the most serious of crimes as well as the one with the most consistent data available. Table 5.1 presents the regression results when the model is estimated with the key economic determinants of crime only, and Table 5.2 adds the control variables.

Before turning to the results, as explained in Section 3.1.2, it should be noted that it is expected to observe similar results between columns (2) and (3) since the World Bank (2021) retrieves the data from the UNODC (2021). Additionally, results in column (4) could display the greatest differences because World Health Organization (2021) uses a distinct methodology for data collection based on mortality.

Both the simple and the expanded models in Tables 5.1 and 5.2 provide evidence for the negative effect of increases in income per capita on homicide rates according to Hypothesis #1 and the economic theory of crime of Becker (1968) and Ehrlich (1973). Since both this independent and dependent variable are expressed in logarithms, the coefficients can be interpreted such that 1%

Table 5.1: Regression results for homicide

	Dependent variable:			
	Homicide			
	(1)	(2)	(3)	(4)
Logarithm of real GDP	-1.020*	-1.206*	-1.218*	-1.304
	(0.543)	(0.632)	(0.634)	(0.890)
Gini coefficient	0.012	0.013	0.013	0.033
	(0.044)	(0.044)	(0.044)	(0.052)
Unemployment	-0.007	-0.009	-0.009	0.002
	(0.029)	(0.033)	(0.033)	(0.042)
Constant	9.791	11.452*	11.575*	11.490
	(5.972)	(6.833)	(6.854)	(9.377)
Source of data	Eurostat	UNODC	WB	WHO
Years	'98-'18	'98-'18	'98-'18	'00-'18
Model	Random	Random	Random	Random
Robust errors	Yes	Yes	Yes	Yes
F-test	<0.01	<0.01	<0.01	<0.01
Lagrange-Multiplier				
Breusch-Pagan test	<0.01	<0.01	<0.01	<0.01
Hausman test	0.767	0.684	0.686	0.988
Breusch-Pagan test	0.169	0.454	0.458	<0.01
Durbin-Watson test	<0.01	<0.01	<0.01	<0.01

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values.

growth in real GDP per capita results in between 1.02% and 1.22% reduction in homicide rates, respectively between 2.82% and 4.83% decline when control variables are included. The different size of the coefficients between the two model specifications hints at a potential omitted variable bias in the simple model, whereas the significance of the coefficients in both models shows the robustness of the results. In the case of homicide data from World Health Organization (2021) in Table 5.1 and from World Bank (2021) in Table 5.2 which appear to be insignificant, it is noteworthy that the coefficients have p-values of 14.5% and 10.5%, respectively.

With respect to Hypothesis #2, the empirical evidence is inconsistent with the theoretical expectations. Mostly insignificant, the coefficient is negative in columns (2) and (3) of Table 5.2, implying that higher levels of income inequality lead to lower levels of homicide. These findings partly correspond to

Table 5.2: Regression results for homicide *(continued)*

	Dependent variable:			
	Homicide			
	(1)	(2)	(3)	(4)
Logarithm of real GDP	-3.718*	-2.821*	-2.768	-4.832***
	(1.863)	(1.667)	(1.684)	(1.085)
Gini coefficient	-0.019	-0.022**	-0.021*	0.006
	(0.013)	(0.011)	(0.011)	(0.017)
Unemployment	-0.006	0.009	0.010	0.013
	(0.035)	(0.031)	(0.031)	(0.019)
Divorces	0.014	-0.072	-0.078	0.343***
	(0.153)	(0.114)	(0.113)	(0.106)
Foreigners	-0.004	-0.0005	-0.0004	0.0003
	(0.010)	(0.009)	(0.009)	(0.005)
Police	0.057	0.165	0.165	0.156
	(0.093)	(0.135)	(0.135)	(0.106)
Prisoners	-0.224*	-0.112	-0.120	0.573***
	(0.115)	(0.109)	(0.110)	(0.164)
Young male population	12.339	21.582	21.314	6.607
	(11.933)	(13.008)	(13.086)	(17.370)
Logarithm of population	-5.033***	-6.597***	-6.468***	3.426
	(1.511)	(2.068)	(2.108)	(2.430)
Education	-0.055	0.029	0.029	-0.073*
	(0.064)	(0.079)	(0.080)	(0.038)
EU accession	-0.475***	-0.367**	-0.363**	-0.100
	(0.159)	(0.140)	(0.140)	(0.227)
Eurozone accession	-0.003	0.034	0.037	0.175
	(0.110)	(0.100)	(0.100)	(0.122)
Criminal code reform	0.034	0.319**	0.320**	0.138
	(0.115)	(0.127)	(0.127)	(0.105)
Source of data	Eurostat	UNODC	WB	WHO
Years	'98-'18	'98-'18	'98-'18	'00-'18
Model	Within	Within	Within	Within
Robust errors	Yes	Yes	Yes	No
F-test	<0.01	<0.01	<0.01	<0.01
Breusch-Pagan test	<0.01	<0.01	<0.01	0.401
Durbin-Watson test	0.208	0.399	0.390	0.177

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values.

the often insignificant relationship reported by Soares (2004) and the generally less strong effect in Europe (Kim *et al.* 2020) due to cultural and historical differences. Meanwhile, the two singular negative coefficients evoke the conclusions of Chintrakarn & Herzer (2012) who provide the reasoning that demand for private protection increases with income, thus reducing the return of illegal activity in line with the theory of Becker (1968) and Ehrlich (1973).

The insignificant impact of unemployment on homicide rates meets the expectations set by the existing literature. Firstly, legal and illegal activity are not necessarily mutually exclusive (Ehrlich 1973; Freeman 1999). Secondly, neither the counter-cyclical motivation effect nor the pro-cyclical guardianship is dominant in this setting (Cantor & Land 1985; Freeman 1999).

As for the control variables in Table 5.2, this is where the disparity between the data collection methodology of World Health Organization (2021) and the other sources is the most pronounced. Starting with column (4), the positive effect of divorce rate can be related to lower social cohesion and stability following the social disorganization theory of Shaw & McKay (1942), thus implying the increasing rate of homicides. Unintuitively, a greater prison population is linked to more homicides, though the result in column (1) shows that the evidence is rather mixed. Levitt (2004) argues that rising incarceration is one of the factors explaining the fall of crime in the 1990s, contrary to the result in column (4). However, it is worth mentioning that homicide is only a small proportion of the total crime rate studied by Levitt (2004). In the remaining three columns, countries with growing populations observe declining rates of homicide, implying that the crime could be harder to detect in larger countries. Unlike in the findings by Piatkowska *et al.* (2016), EU accession has a negative impact on homicide rates. Since this analysis includes a longer time period than Piatkowska *et al.* (2016), the long-term effect may indeed be negative as countries become accustomed to the membership and the initial disruptions to social stability (Shaw & McKay 1942). Finally, the higher rates of homicide following the criminal code reforms indicate changes in definitions or reporting.

5.2 Violent crimes

By definition, homicide falls under the category of violent crimes, which are examined next with results reported in Table 5.3. Since data on the share of foreigners in the population is only available since 2008, the model for acts causing harm, data for which only cover the period until 2007, is estimated

without this variable. To allow for comparison, other violent crime types are also estimated without the share of foreigners as the results appear sensitive to its inclusion (as noted in Section 4.1 and further commented on in Section 5.5). When included, the model's estimates for violent crimes are mostly insignificant. Additionally, the effect of eurozone accession on acts causing harm cannot be estimated since no country had adopted the currency in the studied period (Table 3.1.1).

Results for assault and serious assault both show a negative impact of income per capita on crime, resembling the direction of the coefficients for homicide and validating Hypothesis #1 in line with the economic theory of Becker (1968) and Ehrlich (1973). However, there is evidence of a positive effect in the case of robbery. To find an explanation, the economic theory of crime might be extended since robbery contains elements of property crime. An increase in income implies that there are more valuable possessions worth stealing, thus potential income from both legal and illegal activity can rise simultaneously.

Neither of the available violent crimes exhibits an impact of income inequality that would be significantly different from zero. These findings contrast the predictions of Hypothesis #2 and the conclusions of Kelly (2000) who found strong and robust coefficients for violent crime. However, it can be supported by Choe (2008) who also fails to find a meaningful connection between violent crimes and income inequality. Since violent crimes can be mainly motivated by inter-personal relationships (Ehrlich 1973), it is reasonable to expect that income inequality has little to no impact in this crime category.

As for unemployment, while assault and serious assault support the guardianship effect similarly to Cantor & Land (1985), motivation effect is dominant in the case of robbery, following the theory of Becker (1968) and Ehrlich (1973) and results of Anser *et al.* (2020). Again, the property crime elements of robbery may influence its results, as the effect is typically stronger for property crime (Cantor & Land 1985; Levitt 2004).

Control variables show mostly insignificant effects, with the exception of prison population share and criminal code reform. Starting with the first, unlike in the case of homicide, acts causing harm and robbery rates show that greater incarceration leads to lower crime rates, as supported by Levitt (2004). Secondly, the mixed evidence for criminal code reform alludes to changes in definitions and potential reclassification of individual crimes.

Before progressing onto the next crime category, it is notable that the coefficients for all three key economic variables are insignificant for acts causing

Table 5.3: Regression results for violent crimes

	Dependent variable:			
	Acts causing harm	Assault	Serious assault	Robbery
	(1)	(2)	(3)	(4)
Logarithm of real GDP	-2.923	-9.585**	-7.311***	4.344**
	(2.268)	(3.700)	(2.633)	(1.868)
Gini coefficient	-0.054	0.042	0.040	-0.008
	(0.040)	(0.035)	(0.028)	(0.014)
Unemployment	0.017	-0.168*	-0.141**	0.097***
	(0.032)	(0.085)	(0.069)	(0.032)
Divorces	-0.573	-0.224	-0.200	-0.025
	(0.406)	(0.261)	(0.188)	(0.068)
Police	0.379	-0.284	-0.360*	-0.011
	(0.416)	(0.228)	(0.201)	(0.136)
Prisoners	-0.433**	0.650	0.418	-0.431**
	(0.202)	(0.414)	(0.279)	(0.181)
Young male population	57.517	-18.551	3.863	28.658
	(44.196)	(35.860)	(22.734)	(30.267)
Logarithm of population	9.177	0.100	0.747	-1.057
	(6.746)	(4.097)	(2.652)	(2.989)
Education	0.144	-0.199	-0.162	0.137
	(0.095)	(0.161)	(0.122)	(0.088)
EU accession	-0.461	0.441	0.452	0.254
	(0.563)	(0.437)	(0.336)	(0.182)
Eurozone accession		0.234	0.175	0.095
		(0.296)	(0.161)	(0.077)
Criminal code reform	0.684*	-0.993	-1.139*	-0.022
	(0.394)	(0.609)	(0.603)	(0.107)
Source of data	Eurostat	Eurostat	UNOCD	UNODC
Years	'98-'07	'08-'18	'03-'18	'10-'17
Model	Within	Within	Within	Within
Robust errors	Yes	Yes	Yes	Yes
F-test	<0.01	<0.01	<0.01	<0.01
Breusch-Pagan test	0.053	<0.01	<0.01	<0.01
Durbin-Watson test	0.357	<0.01	0.050	0.064

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values. Column (2) works with data corrected for reporting errors using data from Police of the Czech Republic (2021) and definition of serious assault by UNODC (2015) as explained in Section 3.3.

harm. As explained in Section 3.1.2 and detailed in Appendix A and UNODC (2015), this crime is an overarching category of crimes, including assault, threat or kidnapping, but also forced labour, negligence, discrimination, or operating a vehicle under the influence of psychoactive substances. As such, it combines acts that are subject to different motivations, resulting in the insignificance of the coefficients. By extension, this finding supports the need to analyze crimes individually to understand their motivations.

5.3 Sexual crimes

Existing literature on economic determinants of crime mostly focuses on homicide, violent, and property crimes, refraining from the sexual crime category. An exception thereof is the inclusion of rape in some studies (Hsieh & Pugh 1993; Soares 2004; Choe 2008), despite being labelled as a violent crime. The gap in the existing research is filled by the results in Table 5.4. Following Section 3.3 on outliers, dummy variables for the signing and ratifying of the Istanbul Convention are included.

In neither of the models does income per capita have a significant impact on sexual crimes. This outcome is contrary to the expectations set by Hypothesis #1 and the empirical findings hitherto. Nonetheless, no causal relationship between income and crime is also supported by Anser *et al.* (2020), alas by using the intentional homicide rate, and by Soares (2004), who estimates the model for contact crimes that include sexual incidents and rape. As suggested by Ehrlich (1973), sexual crimes can be regarded as non-market activities which are not subject to the cost-benefit analysis of the economic theory of crime, thus justifying its insignificant effect.

In terms of income inequality, only rape exhibits a significant relationship. The negative sign of the coefficient for rape specifically corresponds to the meta-analysis results by Soares (2004), but not the empirical findings of Choe (2008). It also disproves the strain theory of Merton (1938), implying that growing frustration does not translate into a higher occurrence of rape. A possible explanation can be related to reporting rates. The greater strain stemming from the more unequal society may result in lower motivation for reporting. And vice versa, since income inequality rates are decreasing or stagnating in the studied period, lower inequality can provide an incentive for better reporting rates and thus explain the growing number of rape cases.

Increases in unemployment lead to a lower rate of sexual assault, confirming

Table 5.4: Regression results for sexual crimes

	Dependent variable:		
	Sexual violence (1)	Sexual assault (2)	Rape (3)
Logarithm of real GDP	-0.749	5.179	-1.058
	(1.917)	(4.629)	(1.199)
Gini coefficient	0.023	-0.054	-0.037**
	(0.019)	(0.046)	(0.014)
Unemployment	-0.073	-0.113*	-0.023
	(0.046)	(0.060)	(0.030)
Divorces	-0.082	-0.821	-0.146
	(0.237)	(0.552)	(0.115)
Foreigners	-0.007	0.017	-0.019**
	(0.007)	(0.021)	(0.009)
Police	-0.089	0.006	0.148
	(0.129)	(0.357)	(0.198)
Prisoners	0.199	-0.563	-0.095
	(0.340)	(0.483)	(0.161)
Young male population	-74.158***	-26.153	3.156
	(19.959)	(36.105)	(27.372)
Logarithm of population	5.656	5.889	-4.938
	(4.517)	(7.928)	(3.341)
Education	-0.079	0.197*	0.122**
	(0.054)	(0.112)	(0.054)
EU accession	0.186	0.956***	0.118
	(0.189)	(0.331)	(0.206)
Eurozone accession	-0.321	-0.535	0.154
	(0.265)	(0.568)	(0.262)
Criminal code reform	-0.141	-0.576	0.898***
	(0.208)	(0.456)	(0.183)
Istanbul treaty signed	-0.047	-0.151	-0.036
	(0.080)	(0.239)	(0.092)
Istanbul treaty in force	0.251	-0.004	-0.041
	(0.181)	(0.222)	(0.138)
Source of data	UNODC	Eurostat	Eurostat
Years	'03-'17	'08-'18	'08-'18
Model	Within	Within	Within
Robust errors	Yes	Yes	Yes
F-test	0.016	0.012	<0.01
Breusch-Pagan test	<0.01	0.028	0.006
Durbin-Watson test	0.511	0.013	0.077

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values. Column (3) works with an imputed value of an outlier described in Section 3.3.

the presence of guardianship effect. In other words, when unemployment rates rise, people are expected to spend more time in their homes, being better able to guard themselves against crime (Cantor & Land 1985). This finding also raises questions about the presence of sexual assault in the workplace.

As for control variables, the share of foreigners has a negative effect on the occurrence of rape. This variable is used as a proxy for inter-group social cohesion (Stamatel 2009), the lack of which is expected to lead to greater crime rates in the spirit of the social disorganization theory (Shaw & McKay 1942). The opposite result found in this model implies that inter-group social cohesion has the inverse effect, such that more cohesive societies can display greater rates of rape or a better reporting thereof. Education, as a share of the population whose highest attained education is less than primary, primary, or lower secondary, has a positive impact on sexual assault and rape, indicating that increasing educational attainment in the society can help reduce sexual crime rates. This follows the reasoning that education improves labour market opportunities, and by extension income, lowering crime rates (Altindag 2012; Anser *et al.* 2020). Finally, the positive effect of EU accession on sexual assault corresponds to Piatkowska *et al.* (2016), and the significance of the criminal code reform coefficient once again suggests changes to reporting and definitions.

5.4 Property crimes

Results of the estimation for property crime are shown in Table 5.5.

Based on the economic theory of crime of Becker (1968) and Ehrlich (1973), property crime is expected to be influenced by economic determinants more than other crime categories, by the nature of the outcome of the illegal activity. However, contrary to the theoretical expectations, two of three crime rates, burglary and theft, exhibit an insignificant effect of income, which replicates the findings of Soares (2004). Only car theft meets Hypothesis #1, indicating that a 1% growth in real GDP per capita leads to a 4.54% reduction in car theft.

Changes in inequality display a significant impact on burglary, alas contrary to Hypothesis #2. Its negative sign corresponds to the findings hitherto, in the cases of homicide and rape, as well as the evidence presented by Chintrakarn & Herzer (2012). Their explanation relying on the increasing demand for private protection is particularly relevant in the case of burglary.

As for unemployment, the model once again uncovers mixed evidence, in line

Table 5.5: Regression results for property crimes

	Dependent variable:		
	Burglary	Theft	Car theft
	(1)	(2)	(3)
Logarithm of real GDP	4.630	-1.607	-4.542*
	(2.974)	(1.380)	(2.531)
Gini coefficient	-0.085**	-0.018	-0.020
	(0.037)	(0.021)	(0.037)
Unemployment	0.211**	0.007	-0.122**
	(0.089)	(0.035)	(0.045)
Divorces	-0.068	-0.045	-0.234
	(0.108)	(0.129)	(0.206)
Foreigners	-0.037*	0.013**	0.033**
	(0.021)	(0.006)	(0.015)
Police	-0.167	0.009	-0.162
	(0.248)	(0.069)	(0.186)
Prisoners	-0.503**	-0.396*	-0.190
	(0.190)	(0.230)	(0.307)
Young male population	77.379***	37.330*	48.779
	(20.721)	(19.488)	(33.004)
Logarithm of population	-16.080**	-7.493***	-5.941
	(6.452)	(1.169)	(6.280)
Education	0.393**	0.079	-0.049
	(0.175)	(0.077)	(0.116)
EU accession	-0.034	-0.025	0.041
	(0.230)	(0.132)	(0.430)
Eurozone accession	0.335	-0.113	0.095
	(0.442)	(0.097)	(0.214)
Criminal code reform	0.300	-0.079	-0.493*
	(0.195)	(0.104)	(0.245)
Source of data	UNODC	UNODC	UNODC
Years	'03-'18	'03-'18	'03-'18
Model	Within	Within	Within
Robust errors	Yes	Yes	No
F-test	<0.01	<0.01	<0.01
Breusch-Pagan test	<0.01	0.058	0.896
Durbin-Watson test	0.049	<0.01	0.212

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values. Column (3) works with data corrected for reporting errors using data from Police of the Czech Republic (2021).

with the existing literature (Freeman 1999; Levitt 2004). The motivation effect, which stems from the economic theory of crime by Becker (1968) and Ehrlich (1973), is dominant for burglary. Lower unemployment rates provide more opportunities for legal endeavours, thus reducing the motivation for burglary, in the spirit of Cantor & Land (1985). On the other hand, the guardianship effect prevails for car theft. As employment rates rise, so does the availability of "theft-worthy" vehicles while people spend less time protecting their cars during work hours, thus providing the opportunity for car theft (Cantor & Land 1985).

Finally, coefficients of control variables are interpreted. The share of foreigners presents mixed evidence for the effect of social cohesion on crime. Lower social cohesion results in lower rates of burglary, but higher rates of theft and car theft, following the theoretical foundation of Shaw & McKay (1942). Nonetheless, it is noteworthy that the model is sensitive to the inclusion of foreigners, as noted in Section 4.1 and further commented on in Section 5.5. Growing rates of incarceration lead to lower occurrences of burglary and theft, similarly to the conclusion reached by Levitt (2004). In line with the economic theory of crime (Becker 1968; Ehrlich 1973), a greater imprisonment rate signifies a higher probability of being convicted, lowering the expected utility of illegal activity, and discouraging burglary and theft. A greater share of the young male population results in more property crime, as observed by Freeman (1999) who explains the elasticity of crime participation to age through rising wages. Countries with positive growth rates of population experience declining property crime rates per 100 000 inhabitants. In the studied period, most countries in Eastern Europe reported falling property crime rates as well as negative population growth, with the exception of Czechia, Slovakia, and Slovenia. This result can thus be interpreted such that positive population growth accelerates the decline in property rates.

5.5 Sensitivity analysis

The results presented hitherto are now subjected to several model modifications to test for their sensitivity. These amendments include different data series, model functional forms, as well as the inclusion of identified outliers.

Alternative data series Income inequality and unemployment in the original model can both be replaced by alternative variables. Starting with income

inequality, the alternative to the widely used Gini coefficient is the ratio of total income received by the top quintile to that received by the bottom quintile. With a strong correlation of 0.98 with the Gini coefficient, it is understandable that the results show minimal changes. Several of the key variables of interest become insignificant, namely income for homicide (UNODC 2021) and car theft and unemployment for sexual assault, albeit with significance close to the 90% level of confidence. Conversely, some income inequality coefficients overcome the significance cut-off level, in particular homicide (Eurostat 2021) and sexual violence. Similarly to homicide levels from other data sources, the coefficient for homicide (Eurostat 2021) is negative, which can be explained by the demand for private security (Chintrakarn & Herzer 2012). On the other hand, the coefficient is positive for sexual violence, following the economic theory of crime (Becker 1968; Ehrlich 1973), strain theory (Merton 1938), social disorganization theory (Shaw & McKay 1942), and Hypothesis #2.

Unemployment can be replaced by three different series – male unemployment, youth unemployment, and male youth unemployment – which follows the observation that young men are the most prone to criminal activity (Freeman 1999). As for male unemployment, with a correlation of 0.97 with total unemployment, it slightly affects the magnitude of coefficients but significance remains stable for the majority of coefficients. The exceptions thereof concern sexual crimes. While unemployment is no longer significant for sexual assault, for sexual violence the p-value drops from 0.12 to 0.07. The newly significant negative coefficient provides further evidence of the guardianship effect.

Exchanging total unemployment for youth unemployment leads to several changes in coefficients for income. In particular, homicide rate (World Bank 2021) joins the rest of the homicide rates to exhibit a significant negative relationship with income, previously with a p-value of 0.105. Contrary to Hypothesis #1, the income coefficient for sexual assault is newly significantly positive, resembling the findings of Allen (1996). Newly significant is also the unemployment coefficient for acts causing harm. With a positive sign, it supports Hypothesis #3 and the motivation effect.

Focusing specifically on male youth unemployment, there are again several changes in terms of income and unemployment coefficients. Similar to the previous case, the homicide rate (World Bank 2021) is found to have a significant negative relationship with per capita income. Meanwhile, the income coefficient for car theft is no longer significant, as supported by Soares (2004). Similar to the previous data series changes, the unemployment coefficients for acts

causing harm and sexual violence are significant, being positive and negative, respectively.

Overall, using alternative data series for income inequality and unemployment slightly affects the magnitude of coefficients. The p-values that shift above or below the 90% confidence level belong mainly to those variables which were already close to being declared as (in)significant in the main analysis. This sensitivity analysis thus helps identify effects that would have been disregarded using the standard, albeit arbitrarily chosen, required level of significance.

Alternative crime data sources The differences between crime data series have hitherto been discussed primarily with respect to homicide data. The estimation results thereof, though slightly different in magnitude, are mostly consistent. However, there are other crimes for which data from different sources are available as well, namely robbery, sexual violence, burglary, and theft. Upon estimating the model with the alternative data, the results are notably dissimilar. Nonetheless, this disparity may be explained by the distinct available time periods. To test the robustness of the results to using different data sources, equivalent time periods must therefore be used.

In case of robbery, such analysis is not feasible as the data from Eurostat (2021) and UNODC (2021) are not overlapping. Similarly, data for burglary only share five years, however, looking at the graphs alone (Appendix C), there is considerable inconsistency. For instance, between 2003 and 2007, Slovenia reported an average of 119 instances per 100 000 inhabitants per year according to Eurostat (2021). In the same period, a mean of 963 burglaries was documented by UNODC (2021), hinting at definitional differences in data collection by both entities.

Concerning sexual violence and theft, Table 5.5 shows the comparison between estimation on the different data sources. The majority of explanatory variables for sexual violence exhibit a consistently insignificant effect. Only the share of the young male population is found to be significantly affecting the occurrence of sexual violence, however, the finding is sensitive to the data source. The discrepancy lies in the reporting issues noticeable in the graph in Appendix C. For example for Estonia, while Eurostat (2021) lists an average of 18 cases per year, UNODC (2021) records 27.

As for theft, empirical results (Table 5.5) are mostly consistent except for two variables – the shares of foreigners and prisoners. Both appear significant

Table 5.6: Regression results for sensitivity to different data sources

	Dependent variable:			
	Sexual violence		Theft	
	(1)	(2)	(3)	(4)
Logarithm of real GDP	0.207	-0.749	-0.773	-1.607
	(2.783)	(1.917)	(1.329)	(1.380)
Gini coefficient	-0.003	0.023	0.006	-0.018
	(0.031)	(0.018)	(0.024)	(0.021)
Unemployment	-0.040	-0.073	0.023	0.007
	(0.040)	(0.046)	(0.032)	(0.035)
Divorces	0.132	-0.082	-0.003	-0.045
	(0.258)	(0.237)	(0.117)	(0.129)
Foreigners	0.0005	-0.007	-0.0001	0.013**
	(0.013)	(0.007)	(0.008)	(0.006)
Police	0.072	-0.089	-0.029	0.009
	(0.154)	(0.129)	(0.065)	(0.069)
Prisoners	0.297	0.199	-0.394	-0.396*
	(0.247)	(0.340)	(0.250)	(0.230)
Young male population	-0.344	-74.158***	43.158*	37.330*
	(32.998)	(19.959)	(22.186)	(19.488)
Logarithm of population	4.069	5.656	-5.481***	-7.493***
	(5.911)	(4.517)	(1.485)	(1.169)
Education	0.077	-0.079	0.041	0.079
	(0.073)	(0.054)	(0.082)	(0.077)
EU accession	0.218	0.186	-0.102	-0.025
	(0.335)	(0.189)	(0.144)	(0.132)
Eurozone accession	0.060	-0.321	-0.168	-0.113
	(0.196)	(0.265)	(0.112)	(0.097)
Criminal code reform	0.179	-0.141	-0.063	-0.079
	(0.164)	(0.208)	(0.099)	(0.104)
Istanbul treaty signed	0.072	-0.047		
	(0.119)	(0.080)		
Istanbul treaty in force	0.253	0.251		
	(0.175)	(0.181)		
Source of data	Eurostat	UNODC	Eurostat	UNODC
Years	'08-'17	'08-'17	'08-'18	'08-'18
Model	Within	Within	Within	Within
Robust errors	No	Yes	Yes	Yes
F-test	<0.01	0.016	<0.01	<0.01
Breusch-Pagan test	0.208	<0.01	<0.01	<0.01
Durbin-Watson test	0.276	0.511	0.082	<0.01

Note: *p<0.1; **p<0.05; ***p<0.01
Time dummies were used in each model. Tests are reporting p-values. Columns (1) and (2) work with an imputed value of an outlier described in Section 3.3.

when using data from UNODC (2021) but not Eurostat (2021). Importantly, graphs for the crime series in Appendix C display similar patterns.

Crime Kuznets curve Buonanno *et al.* (2017) develop the crime Kuznets curve, inspired by the original Kuznets (1955) curve. By allowing for a non-linear relationship between income and crime, the model can account for both the initial period of accumulation of "theft-worthy" possessions and growing opportunities for illegal activity, and the latter period of rising demand for private protection and discouragement for crime in comparison to benefits from legal activity. To test for the presence of the crime Kuznets curve, a squared term of the logarithm of real GDP per capita is added to the model, which is re-estimated. The results affect only homicide (Eurostat 2021; World Health Organization 2021) and theft, for which the inverted-U-shaped curve is found.

A point of interest is the turning point – the level of income that determines when crime rises and when it falls with increasing levels of income. It is calculated as follows:

$$\begin{aligned}
\frac{\partial \text{crime}_{it}}{\partial \log(\text{real GDP per capita}_{it})} &= \beta_A + 2\beta_B \log(\text{real GDP per capita}_{it}) = 0 \\
\log(\text{real GDP per capita}_{it}) &= -\frac{\beta_A}{2\beta_B} \\
\text{real GDP per capita}_{it} &= e^{-\frac{\beta_A}{2\beta_B}}
\end{aligned}$$

The estimated coefficients indicate that there is a turning point of per capita income of €1 854 for homicide (Eurostat 2021), €3 163 for homicide (World Health Organization 2021), and €8 386 for theft. In the studied period between 1998 and 2018, the lowest level of real GDP per capita was recorded in Bulgaria in 1999, with a value of €2 852. This implies that for homicide (Eurostat 2021), all countries in Eastern Europe are on the downward-sloping part of the crime Kuznets curve, unaffected by the turning point. In case of homicide (World Health Organization 2021), the upward-sloping part of the curve only affected Bulgaria until 2001, since when all countries had reported higher levels of income. Therefore, these results are consistent with Hypothesis #1 and the main analysis in Section 5.1 in which the homicide coefficients for income were negative, following the economic theory of crime (Becker 1968; Ehrlich 1973).

In comparison, the case of theft is more complicated. Two countries in the sample reported income above the threshold in each of the studied years, namely Czechia and Slovenia, positioning themselves on the downward-sloping

part of the crime Kuznets curve, along with Hypothesis #1. In contrast, two countries exhibited a consistently lower level of real GDP per capita, Bulgaria and Romania, the latter of which exceeded the turning point only in a singular year, 2018. As a result, they are mostly subject to increasing rates of theft as real GDP per capita grows. Though this finding contrasts the expectations of Hypothesis #1, it can be explained. As income rises, more "theft-worthy" items are accumulated, boosting the expected income from illegal activity, up until the estimated turning point of €8 386 when demand for private protection helps explain the reversal of the relationship. This occurred for the remainder of the countries between the years 2001 and 2006. Furthermore, the presence of the crime Kuznets curve for theft justifies why its income coefficients have been estimated as insignificant thus far.

Multicollinearity As presented in the correlation matrix in Table B.6 and noted in Section 4.1, there is a potential multicollinearity issue. It concerns the relationship between the share of foreigners and the logarithm of population which yields a correlation coefficient of -0.81. To test for the robustness of the results to this phenomenon, the model is re-estimated without the logarithm of population size.

The findings indicate that the key economic indicators are not particularly sensitive to its exclusion in either significance, magnitude, or sign, disproving the effect of multicollinearity on the results. Exceptions thereof include the impact of income on homicide (UNODC 2021) and car theft, neither of which is significant once the population logarithm is removed. Additionally, the effect of income on burglary proves to be significant, implying that a 1% increase in GDP per capita leads to a 5.87% rise in the occurrence of burglary. Notably, three of the four significant coefficients for inequality are no longer statistically different from zero, apart from rape. The effect of unemployment on crime is consistent with the results of the main analysis.

Nonetheless, it should be noted that when removing the share of foreigners from the model instead, the findings differ substantially. The explanation thereof lies in the theoretical foundations for including the two variables in the model. On one hand, the share of foreigners is supported as a control for intra-group cohesion (Stamatel 2009), stemming from the social disorganization theory (Merton 1938). On the other hand, the exclusion of population size can be justified more easily as all relevant variables are scaled to per capita terms, respectively to multiples thereof.

Endogeneity The relationship between income and crime is commonly assumed to be such that living in poverty or with lower income increases the chances of criminal behaviour, not vice versa (Pare & Felson 2014). However, the potential endogeneity should be considered. As noted in Section 2.2.1, crime can discourage entrepreneurship and reduce productivity (Goulas & Zervoyianni 2015). To address the potential endogeneity, relevant explanatory variables are lagged by one year, namely the logarithm of real GDP, Gini coefficient, unemployment rate, and shares of police officers and prisoners. In case of other variables, it is either unlikely that crime would influence them or the change is only conceivable in a very long term.

In terms of per capita income, its coefficients are no longer significantly different from zero in two instances of homicide (UNODC 2021; World Health Organization 2021). Conversely, burglary exhibits a positive relationship, such that a 1% increase in income translates to a 5.56% increase in burglary in the following year as more "theft-worthy" possessions are accumulated. In other crimes, there are no notable changes, indicating that potential endogeneity does not impact the effect of income on crime.

In contrast, the results for income inequality appear more sensitive. Compared to the main analysis, the first lag of the Gini coefficient is significant and positive for assault, serious assault, sexual violence, and sexual assault. This finding supports Hypothesis #2. Since neither of these crimes has property elements, the most relevant explanation thereof can be provided by the strain theory (Merton 1938), which posits that greater economic inequality is associated with greater frustration that can spark violent criminal activity. Similar to the main analysis and Chintrakarn & Herzer (2012), a negative relationship is estimated for acts causing harm. Finally, the effect of contemporaneous but not lagged inequality is significant for rape.

To finish the discussion of the effect of endogeneity, using the first lag of unemployment prompts minimal changes to the results, similarly to per capita income. This corresponds to the general expectations set by the existing literature (Freeman 1999; Levitt 2004) in that changes in unemployment, albeit lagged, are insufficient to explain the variation in crime rates. The only notable differences lie in the effect on assault and sexual assault being no longer significant.

Outliers Section 3.3 identified several outlying observations which were excluded from the study and imputed with corrected data from a different source.

Nonetheless, it is noteworthy that neglecting this treatment does not alter the overall findings of this analysis. Differences occur mainly in the scale of the coefficients, but not in their significance.

A discussion related to outliers concerns the sensitivity to including the Baltic states in the sample of countries. While it is featured in the referenced list of East European countries by the OECD (2001) as well as in the study by Piatkowska *et al.* (2016), it is excluded by Stamatel (2009). The reasons for its exclusion are covered in Section 3.2. In terms of homicide, the Baltic republics on average record 4.22 times more homicides than other East European countries. The discrepancy can be related to its historical ties to Russia (Šelih 2014), alcohol consumption (Pridemore 2005), or reporting (Ceccato 2008).

Excluding Latvia, Lithuania, and Estonia from the modelled sample leads to various results. For certain crimes, there are no discernible changes, whereas for others, the findings change both in terms of magnitude and significance, without displaying any notable pattern across crime categories or explanatory variables. The sensitivity thereof emphasizes the importance of the specific economic, social, political, cultural, and historical context in cross-country crime analysis (Kim *et al.* 2020) and supports the relevance of studying countries individually, which is conducted in Chapter 6.

5.6 Evaluation of hypotheses

Section 2.4 proposed three hypotheses based on economic theory and the existing crime literature. Table 5.7 reviews the empirical results presented hitherto while indicating their sensitivity. The following section discusses these observations for each hypothesis.

Hypothesis #1 Increases in income per capita lead to lower crime rates.

The negative effect of income on crime is supported for homicide, consistent across different data sources, alas sensitive, and additionally also for other violent crimes – assault and serious assault. Thus this study shows that economic incentives of the level of income or poverty are relevant for violent crimes, which demonstrate a higher degree of market-like reasoning than assumed in the original economic theory of crime. According to Ehrlich (1973), violent crimes should be treated as non-market activities since they yield non-pecuniary gains motivated mainly by personal relationships. Given the empirical results, economic motives are applicable to violent crimes, consistent with Hsieh & Pugh

Table 5.7: Evaluation of hypotheses

	Income	Inequality	Unemployment
Hypotheses	–	+	+
Homicide			
Homicide (Eurostat)	–	–*	
Homicide (UNODC)	–†	–†	
Homicide (WB)	–*	–†	
Homicide (WHO)	–†		
Violent crimes			
Acts causing harm		–*	+*
Assault	–	+*	–†
Serious assault	–	+*	–†
Robbery	+		+
Sexual crimes			
Sexual violence		+*	–*
Sexual assault	+*	+*	–†
Rape		–†	
Property crimes			
Burglary	+*	–†	+
Theft			
Car theft	–†		–

Note: * shows coefficients that were not significant in the main analysis but the sensitivity analysis showed they can become significant in certain model specifications. † shows the reverse, i.e. coefficients that lose their significance from the main analysis in the sensitivity analysis.

(1993). The insignificance of the coefficient for acts of causing harm can be explained easily since it is an overarching crime category combining acts with conflicting motivations. Similarly, the positivity of the robbery coefficient does not disprove this conclusion as robbery includes prominent elements of property crime.

Conversely, other types of crime exhibit mixed or even non-linear relationships with income. This is particularly puzzling in the case of property crimes and robbery, in which the relevance of the economic theory of crime (Becker 1968; Ehrlich 1973) would theoretically be the greatest. This finding thus highlights the importance of other kinds of incentives to determine the level of non-violent crime.

Hypothesis #2 Increases in income inequality lead to higher crime rates.

The regression results generally display mixed evidence for the effect of income inequality on crime, even within individual crime categories. In terms of the theoretical foundation, in the strain theory (Merton 1938) as well as the social disorganization theory (Shaw & McKay 1942), income inequality can be understood as a proxy for other social variables, such as frustration or social cohesion. Studying crime composition using other variables and focusing more on the social rather than economic aspect may therefore be suggested.

In terms of the comparability of the results to the existing literature, insignificant results are often reported (Soares 2004), particularly when income is controlled (Pare & Felson 2014). Furthermore, past research focused mainly on the United States or Western Europe, in which the levels of inequality exceed those found in Eastern Europe (World Bank n.d.). Arguably, due to the low income inequality in this region, its impact is more nuanced than in other studies. The historical, political, and economic reasons for this phenomenon of low income inequality comply with the proposition of Kim *et al.* (2020) on the need to consider the country- or region-specific context when studying crime.

Hypothesis #3 Increases in unemployment lead to higher crime rates.

The evidence for unemployment is again rather mixed. It shows that the motivation effect (assumed in Hypothesis #3) and the opposite guardianship effect are relevant for different types of crimes, even within the same crime category. This observation accentuates the importance of studying individual crimes to understand their particular motivations rather than aggregating them into overarching categories, which is pursued in Chapter 6. Finally, it should be reiterated that empirical literature suggests that the effect of unemployment on crime is not particularly strong (Freeman 1999; Levitt 2004).

Chapter 6

Case study: Czechia and Slovakia

Sensitivity analysis in Section 5.5 revealed the volatility of the results to the inclusion or exclusion of the Baltic republics in the sample of countries. Once removing the countries and thus abandoning the umbrella term of Eastern Europe as defined by the OECD (2001), the question of which countries to study persists. As Kim *et al.* (2020) argue, the historical, social, and cultural context is vital for crime composition, lending the grounds to, for instance, excluding countries which joined the EU after 2004, or the successor states of Yugoslavia. Since each country has its individual characteristics, proven by the presence of unobserved country-specific fixed effects in Chapter 5, it is reasonable to study countries individually, as opposed to an ever-imperfect panel.

In this chapter, the case of Czechia and Slovakia is examined. Selecting these two countries in particular is based on several reasons. Firstly, both publish extremely detailed crime statistics, allowing for inspection of each granular crime while also overcoming the language barrier and definitional differences which obscure cross-country analysis, as noted in Section 3.1.2 (Police of the Czech Republic 2021; Ministry of Interior of the Slovak Republic 2021). Secondly, their shared history spans not only the pre-1993 era of Czechoslovakia, but they have continued to share important milestones even as independent states. For instance, both entered the European Union within the 2004 enlargement (European Union 2020), and they followed the same criminal code until its reform in 2006 in Slovakia, respectively in 2010 in Czechia (OSCE 2021). To mark the 20^{th} anniversary of independence, both declared an amnesty, albeit with different terms, releasing hundreds of prisoners (Ministry of Interior of the Czech Republic 2013; Ministry of Justice of the Slovak Republic 2013).

The rest of this chapter is structured as follows: Section 6.1 describes the crime composition and its trends over time while Section 6.2 focuses on the major milestones and to what extent they served as shocks to crime. Finally, Section 6.3 studies crime on a regional level, and by comparing the distribution of crime to macroeconomic indicators, it ties this chapter together with the cross-country analysis presented hitherto.

6.1 Crime composition

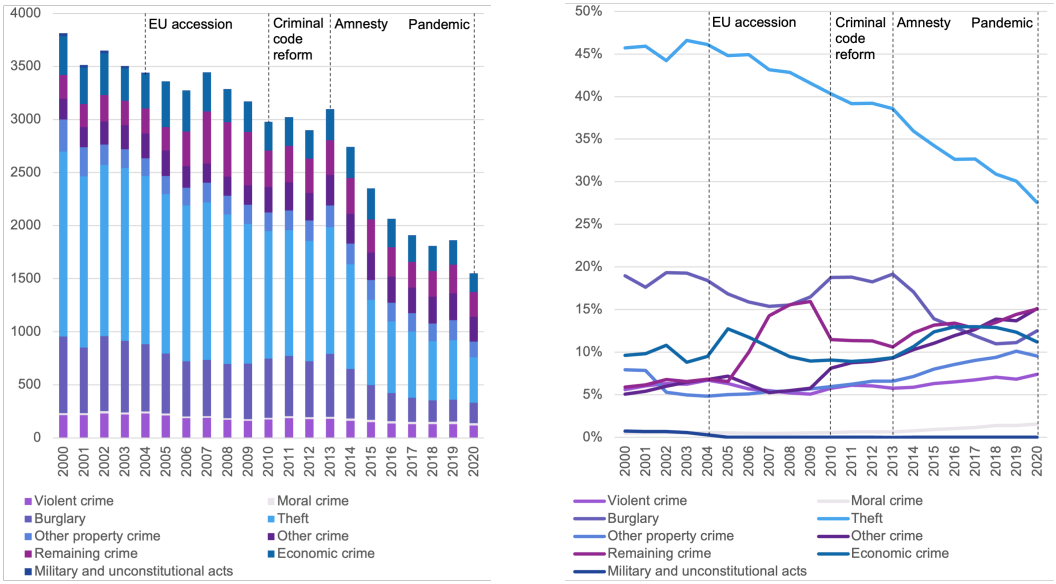
In the analysis of crime determinants in the remainder of this study, observations of trends in crime were strictly limited by data availability. Only selected crimes or crime categories are being published by Eurostat (2021) or UNODC (2021). In contrast, the full crime spectrum is issued by Police of the Czech Republic (2021) and Ministry of Interior of the Slovak Republic (2021), which allows for a description of crime composition and its temporal trends in full context.

Crime compositions of Czechia and Slovakia are presented in Figures 6.1 and 6.2. Data from Police of the Czech Republic (2021) and Ministry of Interior of the Slovak Republic (2021) were scaled to 100 000 inhabitants, using data from Czech Statistical Office (2021a) and Statistical Office of the Slovak Republic (2021b). This practice allows for the comparison between the two different-sized countries while accounting for the potential effect of demographic changes on the total number of crimes.

The left panels in Figures 6.1 and 6.2 clearly demonstrate the differences between the total recorded crime rate, the Czech levels of which have exceeded Slovakia in each of the presented years. Whereas Czechia has exhibited a mostly decreasing trend since the year 2000 when data publication began, in Slovakia, the total crime rate was surging between 2000 and 2004, adding 46% in four years. Nonetheless, since 2004, the crime rate has relatively steadily decreased.

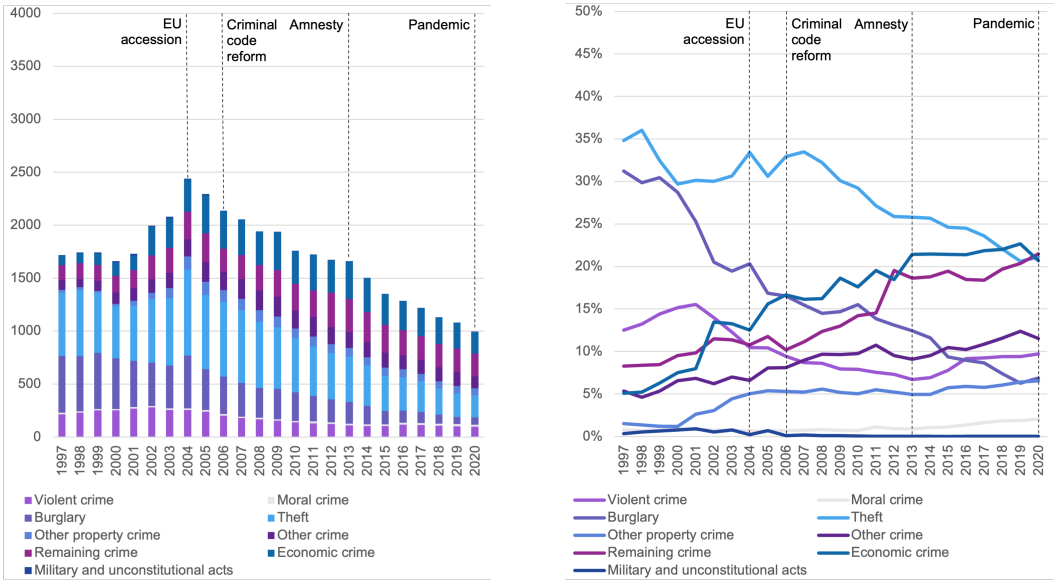
As for individual crime categories, first on the list is violent crime, indicating its utmost seriousness. Both countries underwent slight increases in the early 2000s when violent crime rate peaked at 230.70 occurrences per 100 000 inhabitants in Czechia and 279.24 in Slovakia, both in 2002. Since then, it has declined more than twofold, to 114.44 in Czechia and 96.74 in Slovakia. Unlike in the case of total crime rate, until 2006, Slovakia recorded more violent crime than Czechia, resulting in its greater share on total crime as shown in right panels of Figures 6.1 and 6.2. The most frequent violent crime in Czechia is

Figure 6.1: Crime in Czechia by category



On the left: crime rate per 100 000 inhabitants. On the right: percentage share of each crime category on total. *Source:* Police of the Czech Republic (2021); Czech Statistical Office (2021a).

Figure 6.2: Crime in Slovakia by category



On the left: crime rate per 100 000 inhabitants. On the right: percentage share of each crime category on total. *Source:* Ministry of Interior of the Slovak Republic (2021); Statistical Office of the Slovak Republic (2021b).

intentional assault, which takes second place in Slovakia while threat is the most frequent.

Homicides also fall under the category of violent crime. Out of 1.21 cases per 100 000 inhabitants in 2020, 0.71 were motivated by personal relationships in Czechia, respectively 0.38 out of 1.15 in Slovakia, where the most common form of homicide are those further unspecified. Staňková *et al.* (2014) add that typical offenders in Czechia are men who already have a criminal record. They commonly use knives as their killing weapon while under the influence of alcohol or other substances, and the act usually takes place at the victim's home. Interestingly, suicides with a rate of 0.51 in 2020 are also listed as violent crimes in Slovakia, but not in Czechia.

Moral crime could also be labelled as sexual crime since it includes rape, sexual assault, prostitution, or child pornography. Its rates have been increasing in recent years to current values of 24.34 and 20.37 for Czechia and Slovakia respectively, thus disproving the general trend of falling total crime rates. Sexual abuse is one of the most common moral crimes in both countries. As for rape, its rates have been stagnating in both countries in recent years, however, around very different values – 6.02 for Czechia and 1.68 for Slovakia. Another major component of moral crimes is child pornography, which showed a major upsurge in the last decade. This trend can also explain the growing share of moral crime in total (Figures 6.1 and 6.2).

Burglary used to be the second biggest component of total crime in both countries but fell dramatically in the last 20 years. In Czechia, the 2020 rate is less than 27% of its 2000 value. The decline has been even sharper in Slovakia, as the 2020 value represented less than 13% of the total in 2000. Burglary as a category is broken down into different subcategories by the type of the affected object, including apartments, shops, or schools. However, its most frequent subcategory by a substantial margin is burglary into unspecified objects, which includes motorized vehicles and bicycles.

Theft covers the largest share in total crime composition in both countries, though it is significantly more dominant in Czechia (Figures 6.1 and 6.2). Furthermore, since 2019, economic crime and remaining crime have replaced theft in the leading spot in Slovakia. Its rates per 100 000 inhabitants have been decreasing in Czechia to less than a quarter of its 2000 value. Similarly, Slovakia has marked a steady decline. While the trends seem alike, the number of thefts per 100 000 inhabitants in Slovakia, which is less than half of that in Czechia, is one of the main drivers for why total Slovak crime rates are lower than Czech

ones. As for the individual theft types, the 2000s decade was dominated by theft of possessions from cars, but it has nearly disappeared since. At the time of writing, the most frequent category is theft in unspecified objects, i.e. excluding apartments, cars, or bicycles. Similarly to burglary, the pervasiveness of unspecified thefts can be a sign of under-reporting.

Other property crime is the third part of the property crime category which also includes the aforementioned burglary and theft. It mainly includes different types of damages to property. Generally stagnant since 2002 in Czechia, it marked a notable drop in 2020, possibly affected by the COVID-19 pandemic. In Slovakia, after a sudden six-fold rise in the early 2000s, the number has steadily decreased. Aside from different crime environments as shown in the previous example of theft, this disparity between the two countries could point to definitional differences of which crime types are included in this category.

The next category is other crime, which for instance includes disorderly conduct, selling alcohol to minors, unlawful use or possession of weapons, or the obstruction of official proceedings, which is also the most common crime in this category in both countries. Other crime has been generally stagnant in recent years, which is the reason why its share on the declining total crime rates has increased in both countries (Figures 6.1 and 6.2).

Remaining crime features categories such as defamation, usury, hijacking an aircraft, or different kinds of car accidents. Its most common categories in both countries are unlawful acts under the influence of alcohol or addictive substances and neglect of alimony. There is notable volatility in crime rates of individual categories as well as of remaining crime as a whole which indicates institutional inconsistency, legal changes, or (de-)criminalization of certain acts.

Examples of economic crime include tax evasion, counterfeiting of money, money laundering, but also animal cruelty. Economic crime in Czechia showed a considerable decline during the Global Financial Crisis, and interestingly, it did not recover to the pre-crisis levels during the following period of economic boom. The economic contraction during the COVID-19 pandemic resulted in another steep decline in 2020. But perhaps more interestingly, it has not exhibited similar pro-cyclical patterns in Slovakia, where economic crime became the most common category in 2019.

The last category of crime is military and unconstitutional acts. Both countries observed their near extinction with a year-on-year drop from 9.13 to 0.83 in 2005 and Czechia and from 15.75 to 2.32 in 2006 in Slovakia. However,

there is a rather simple explanation as these were the years when mandatory military service was abandoned.

6.2 Major milestones

Description in the previous section has already revealed the effect of certain shocks on the reported crime rate, e.g. the Global Financial Crisis or the abolition of mandatory military service. The impact of several other milestones is discussed in this section, focusing on events that at some point affected all East European countries and were thus considered in the cross-country analysis, namely EU accession and criminal code reform, as well as an event unique to Czechia and Slovakia, the amnesty to hundreds of selected inmates to mark the 20^{th} anniversary of independence.

To identify crimes that were subject to unusual shocks caused by these events, traditional methods of estimation are limited by the small available sample size. An alternative method is used instead, comparing the trends before and after the shock. Selected crimes with a sizeable increase or decrease and a significant deviation from the historical mean in terms of their standard deviations are presented for each of the milestones. While the absence of a robust methodological approach limits the contribution of this section, interesting findings revealing the nature of crime in the two countries are uncovered nonetheless.

6.2.1 EU accession

Czechia and Slovakia entered the European Union on May 1^{st}, 2004, together with 8 other mostly East European countries (European Union 2020). This milestone can be seen as a trigger to societal and structural changes, disrupting economic and social stability, which in turn raises crime rates, following the social disorganization theory (Shaw & McKay 1942). In the cross-country analysis in Chapter 5, EU accession exhibited a significant impact on crime in two instances – homicide and sexual assault – being negative and positive, respectively. Piatkowska *et al.* (2016) support a positive effect of EU accession on homicide rates, adding that entering the international organization did not increase crime, but rather slowed down its gradual decrease.

Figures 6.1 and 6.2 already reveal some changes that occurred during the EU accession. While Czechia continued its downward trend in total crime, Slo-

vakia reached its peak value in the same year it entered the EU. The increase was mainly driven by a boom in theft and its subcategories, which surged from 637.39 to 814.45 occurrences per 100 000 inhabitants. Individual theft types that exhibited a sizeable and significant increase were for instance thefts on passengers during transport (up by 158% in year-on-year comparison), pick-pocketing (+123%), theft of components of motor vehicles (+37%), and theft of possessions from cars (+29%). Other notable gainers were counterfeiting of goods (+163%) and illicit alcohol production (+105%), the rules for which could have been affected by entering the European Union.

A similar impact on theft was not found in Czechia. This could explain why its overall crime rate continued to decrease between years since theft is the main component of crime (Figure 6.1). A crime affected by the EU accession was for instance robbery in financial institutions, a violent crime that nearly tripled in 2004 and only returned to its pre-EU value after 10 years. Entering the EU could have also induced a +157% rise in bribery or a –40% fall in abuse of power by an official.

6.2.2 Criminal code reform

Czechia and Slovakia both inherited the same criminal code when separating in 1993 and followed it until its reform, which entered in force on January 1st, 2006 in Slovakia and January 1st, 2010 in Czechia (OSCE 2021). The reform was substantial in both countries, outlawing certain new crimes and decriminalizing other acts, for instance driving without a licence (Český Rozhlas 2009). However, the most substantial change was allowing for stricter punishment of the most serious crimes (Scheinost 2010). In the economic theory of crime by Becker (1968) and Ehrlich (1973), the expected utility of crime is determined by the severity of punishment if convicted. Therefore, introducing stricter penalties could have resulted in lower crime rates. However, a side effect of applying the criminal code reform was the release of hundreds of prisoners (Český Rozhlas 2009), which could have had the opposite effect.

Slovakia was the first to reform its criminal code, affecting a large variety of crimes. Many of the most significant and sizeable changes were to economic crimes. Poaching soared from 0.89 to 10.87 incidents per 100 000 inhabitants while counterfeiting of marking of a product and bribery tripled. On the other hand, smuggling fell by 79%. Among newly defined crimes, threat was introduced with 53.92 cases per 100 000 inhabitants, presumably replacing violence

against an individual which dropped from 72.35 to just 0.35 occurrence per 100 000 inhabitants. As described in Section 6.1, by 2020, threat became the most common violent crime in Slovakia. Overall, violent crime declined by 16%, significantly outpacing its previous diminishing trend, and thus providing evidence that stricter punishment can discourage crime.

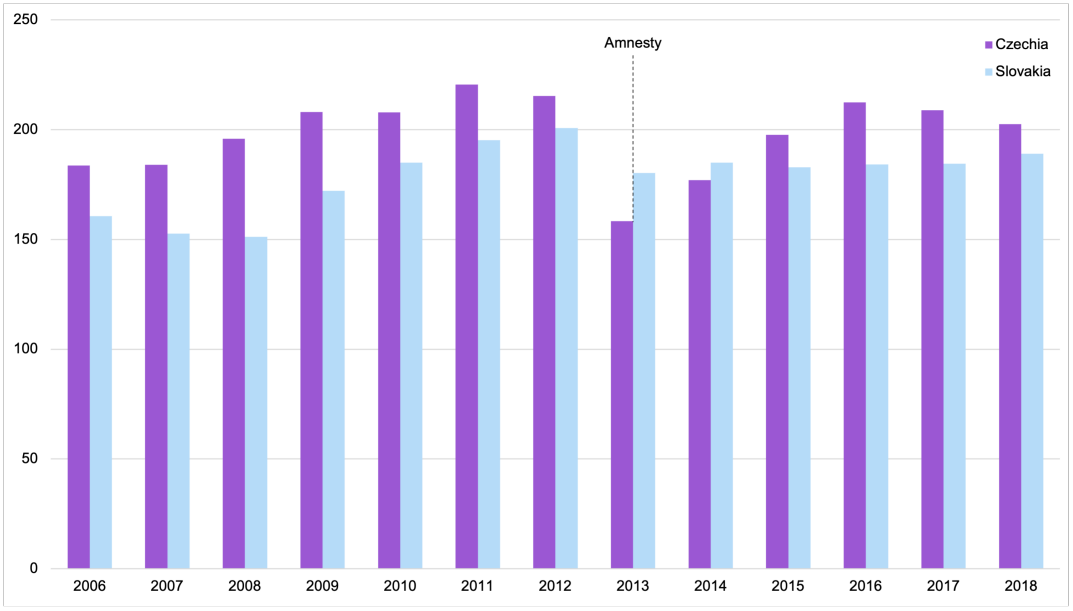
In Czechia, as seen in Figure 6.1, the most notable change after the criminal code reform was the slump in remaining crime. This is explained by the redefinition of the residual category titled other criminal activity, which dropped from 175.51 to 24.61 between 2009 and 2010. Similar to Slovakia, economic crime marked several considerable changes, including money laundering (+198%), fraud in public procurement awarding process (+199%), or counterfeiting of marking of a product (+59%). Nevertheless, violent crime increased, alas by only 7%, aided by the newly defined crimes of death resulting from negligence and stalking.

6.2.3 Amnesty

To mark the 20th anniversary of the separation of Czechoslovakia on January 1st, 1993, presidents of both countries, Václav Klaus and Ivan Gašparovič, declared nationwide amnesties, though with different conditions. The amnesty in Slovakia applied to conditionally deferred prison sentences and unfinished prison terms up to 18 months in jails with the lowest level of security (Ministry of Justice of the Slovak Republic 2013). Furthermore, it excluded intentionally committed crimes or acts which resulted in death or serious injury, thus mainly applying to unintentional acts and crimes caused by negligence (Havlíčková 2017). On the contrary, the amnesty in Czechia applied to conditionally deferred prison sentences and unfinished prison terms up to 12 months (Ministry of Interior of the Czech Republic 2013), primarily affecting people convicted of thefts, obstructions of official proceedings, or not paying alimony (Havlíčková 2017). This particular crime was specifically excluded from the amnesty in Slovakia (Ministry of Justice of the Slovak Republic 2013). Additionally, unlike the amnesty of president Gašparovič, the amnesty declared by president Klaus included an abolition act, stopping unfinished criminal proceedings exceeding 8 years of duration (Ministry of Interior of the Czech Republic 2013). Regarded as the most problematic part of the amnesty, it eventually led the Senate of the Czech Republic to file a constitutional claim for treason (Hrušková 2013).

Given the distinct scopes of the amnesties, different shares of inmates were

Figure 6.3: Prison population rate per 100 000 inhabitants in Czechia and Slovakia



Source: Eurostat (2021); Czech Statistical Office (2021a); Statistical Office of the Slovak Republic (2021b).

released, as shown in Figure 6.3. In Czechia, 6 471 prisoners were pardoned, representing a 28.5% decline (Besedová 2017). In Slovakia, 798 prisoners were released thanks to the amnesty (Prison and Court Guard Service 2013), a much lower number due to the smaller size of the country, its generally lower imprisonment rate (Figure 6.3), and the stricter terms of the amnesty (Havlíčková 2017). By 2018, in neither of the two countries had per capita imprisonment rates exceeded their pre-amnesty levels.

The disparity between countries was translated into the impact on crime rates. In Czechia, total crime rate had risen for the first time since 2007 (Figure 6.1), mainly driven by increases in property crimes. As for individual crimes, there was a surge in bicycle theft (+25%), theft of two-wheeled motorized vehicles (+25%), and burglary into detached houses (+22%). A possible explanation is that people convicted of thefts were among the main recipients of the amnesty (Havlíčková 2017).

In contrast, total crime rate in Slovakia plateaued. In fact, each crime category marked a decrease with the exception of economic crime, driven by tax evasion (+64%) and money counterfeiting (+23%). Overall, the impact of the amnesty was less pronounced, which corresponds to its smaller scale and focus on the least serious crimes.

6.3 Regional comparison

By inspecting crime on a regional scale and considering the differences in macroeconomic indicators among regions, the analysis of this chapter can be connected to the cross-country results in Chapter 5. Figures 6.4 and 6.5 display the regional distribution of total crime and homicide, respectively, each scaled per 100 000 inhabitants. In order to consider the latest developments while avoiding one-off outliers, the rates exhibited are 5-year averages from 2016 to 2020. Although the pandemic of COVID-19 could have affected crime as a notable disturbance to social and economic stability (Shaw & McKay 1942), the overall crime rates of 2020 generally follow the long-term trends and are therefore included in the average.

Firstly, Figure 6.4 shows total crime, the distribution of which mimics property crime which is its major component in both countries. Prague is a prominent outlier, with an average total crime rate of 3 715 reported acts per 100 000 inhabitants. It is followed by Ústecký and Liberecký regions in the north and Moravskoslezský region in the east of Czechia, each with total crime rate of around 2 000. Slovakia, with the exception of the Bratislavský region, stands in stark contrast to Czechia, confirming that its crime rates are lower on both national (Figure 6.2) and regional levels.

Secondly, homicide rates in Figure 6.5 resemble the spatial distribution of violent crime whilst substantially differing from the total crime rate in Figure 6.4. In this case, Trnavský and Bratislavský regions in the west of Slovakia and Karlovarský region in the west of Czechia deviate from the remainder of the map. Importantly, the disparity between Czechia and Slovakia in terms of crime disappears.

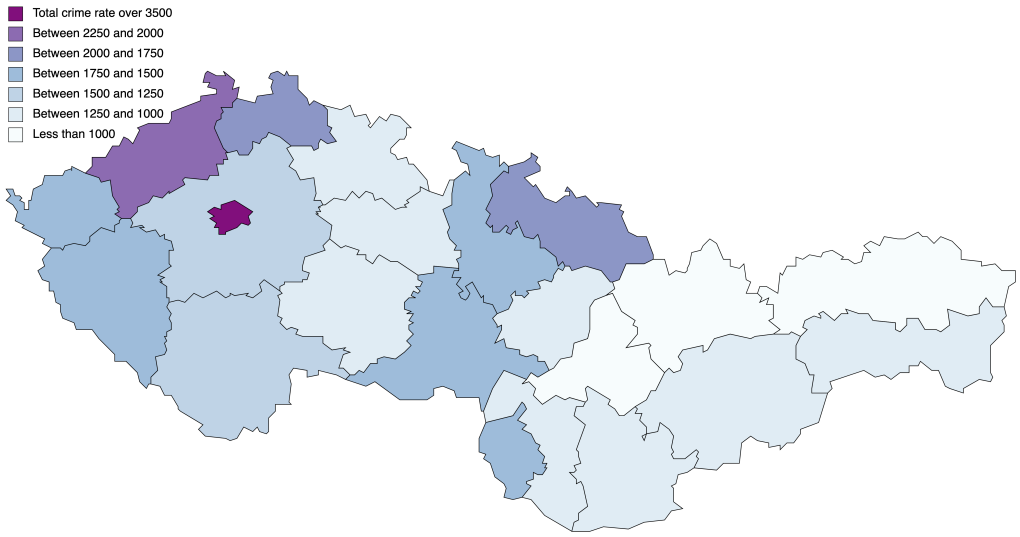
To study the regional distribution of crime in relation to the macroeconomic determinants used in Chapter 5, data on GDP and unemployment are gathered from the respective national statistical offices (Czech Statistical Office 2021a; Statistical Office of the Slovak Republic 2021a;c). Data on inequality is not available on a regional level. Furthermore, to compare the GDP per capita between the two countries, data from Czechia are converted to euros using an average of monthly exchanges rates published by Czech National Bank (2021).

There appears to be little connection between either of the macroeconomic indicators to the spatial distribution of crime. While there may be evidence that regions with higher levels of income are subject to greater levels of crime, such as in the case of Prague, Plzeňský, Jihomoravský, or Bratislavský regions, this

finding is disproved by Ústecký and Liberecký regions. However, when focusing solely on Slovakia, income displays a positive correlation with homicide rates, contrary to the findings of Section 5.1. As for unemployment, it is the highest in regions with low crime rates in Slovakia, but in Czechia, unemployment is a precursor for regions with a high incidence of crime, with the exception of Prague. This conclusion corresponds to the mixed evidence uncovered in the cross-country analysis in Section 5.6 as well as in the existing literature (Freeman 1999; Levitt 2004).

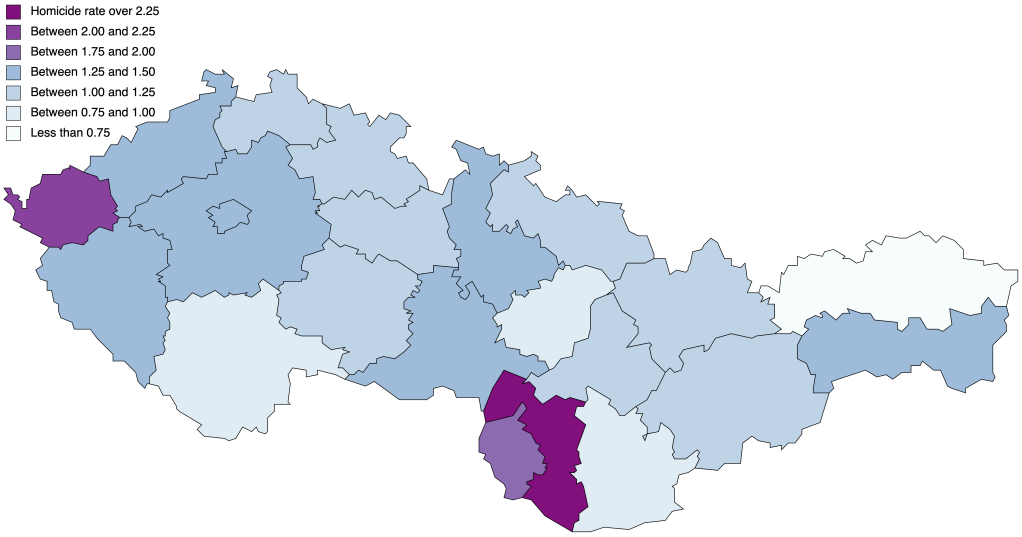
These observations beg several important questions to the overall analysis of economic determinants of crime, the effect of which seems to disappear on a sub-national level. Unemployment and income inequality can be described as factors influencing social and economic stability, the weakening of which can result in a higher crime rate within the social disorganization theory of Shaw & McKay (1942). Its applicability was tested on a sample of neighbourhoods in Czechia by Holas *et al.* (2016), who used questionnaires on the perceived risk of crime as well as signs of social disorganization, such as the presence of trash in the streets, graffiti, the extent of homelessness or the quality of relationships between neighbours. The results confirm the relevance of the social disorganization theory and its strong influence on fear of crime, which is positively correlated with crime occurrence itself. Interestingly, different neighbourhoods within the same city can display varying levels of social disorganization as well as crime. This implies the importance of sociology theories in crime analysis as well as of the scale on which crime is studied, as cross-national, national, regional, and sub-regional results can vary.

Figure 6.4: Total crime rate per 100 000 inhabitants in Czechia and Slovakia



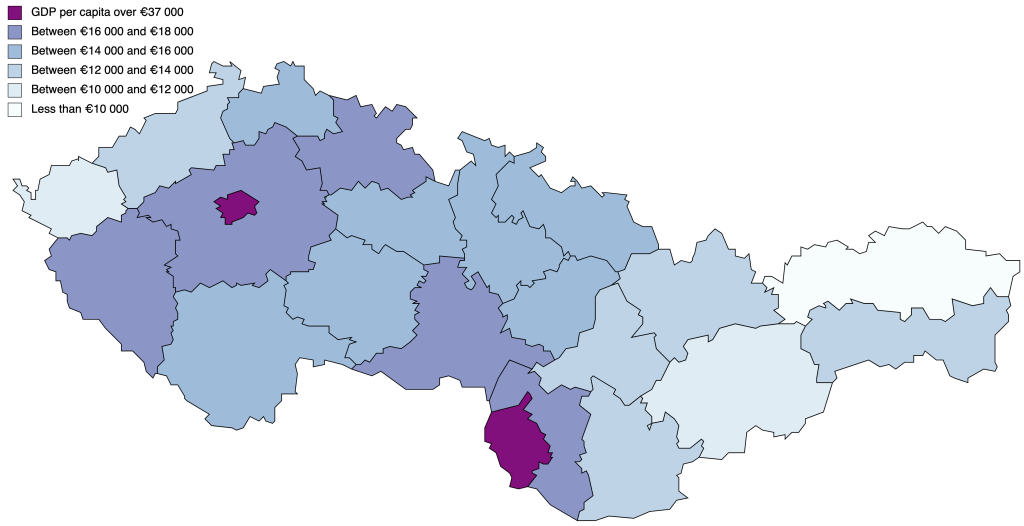
5-year average of 2016-2020. *Source:* Police of the Czech Republic (2021); Czech Statistical Office (2021a); Ministry of Interior of the Slovak Republic (2021); Statistical Office of the Slovak Republic (2021b).

Figure 6.5: Homicide rate per 100 000 inhabitants in Czechia and Slovakia



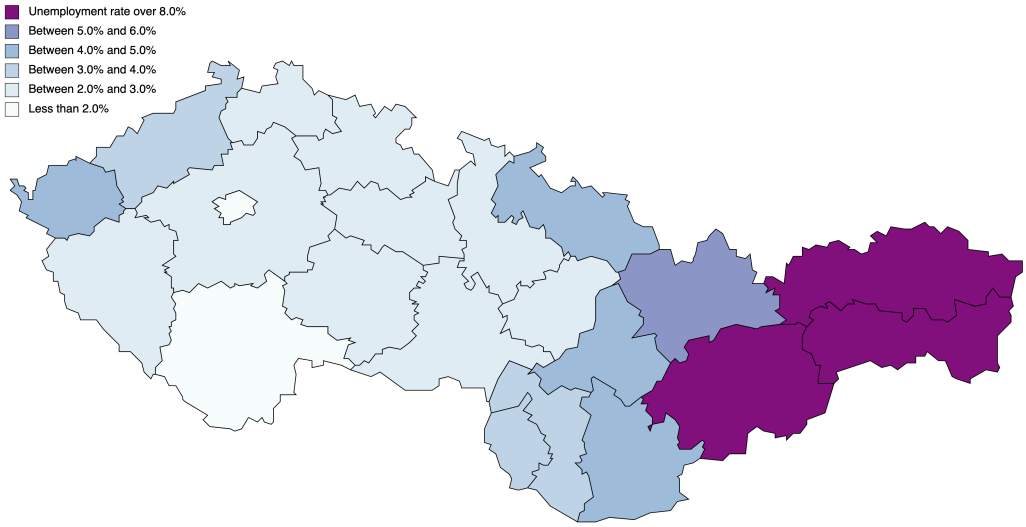
5-year average of 2016-2020. *Source:* Police of the Czech Republic (2021); Czech Statistical Office (2021a); Ministry of Interior of the Slovak Republic (2021); Statistical Office of the Slovak Republic (2021b).

Figure 6.6: GDP per capita in Czechia and Slovakia



5-year average of 2015-2019. Yearly data for Czechia converted to euros using average of monthly exchange rates. *Source:* Czech Statistical Office (2021a); Czech National Bank (2021); Statistical Office of the Slovak Republic (2021a).

Figure 6.7: Unemployment rate in Czechia and Slovakia



5-year average of 2016-2020. *Source:* Czech Statistical Office (2021a); Statistical Office of the Slovak Republic (2021c).

Chapter 7

Conclusion

Criminal activity has far-reaching consequences on society, affecting it economically, socially, as well as psychologically. Despite the aims of academic literature to understand the factors determining crime both nationally and internationally, the external validity of existing research is questioned (Kim *et al.* 2020). This is particularly astounding with respect to Eastern Europe, whose historical experience with simultaneous democratization and marketization and its stark impact on crime composition is considered unique (Stamatel 2009). The region is often disregarded in cross-country analyses, citing data scarcity and language barrier as the primary reasons (Pridemore 2005; Stamatel 2009).

Therefore, this study has aimed at identifying economic determinants of crime in Eastern Europe in a cross-country panel analysis. Additionally, it has been extended through a national- and regional-level analysis of Czechia and Slovakia. Furthermore, unlike existing empirical literature in this field which tends to generalize the findings based on homicide data for all crime categories, this study has examined a total of 11 crimes to consider their individual motivations and capture a wider spectrum of illegal activities.

The theoretical foundation of the economic perspective on crime stems from the seminal work of Becker (1968) and Ehrlich (1973). According to their theory, crime depends on how the expected utility from illegal activities compares to legal earnings, both of which are subject to variation in macroeconomic factors. In empirical studies, these commonly include income and poverty (e.g. Hsieh & Pugh 1993; Allen 1996; Soares 2004; Buonanno *et al.* 2017), income inequality (e.g. Kelly 2000; Chintrakarn & Herzer 2012; Kim *et al.* 2020), and unemployment (e.g. Cantor & Land 1985; Levitt 2004; Cook *et al.* 2014). Based on the economic theory of crime, several sociological theories, and existing lit-

erature, three hypotheses have been formulated, presuming the effect on crime rate to be negative for income per capita, positive for income inequality, and positive for unemployment.

The hypotheses have been tested employing data for 11 countries over the period of at most 21 years. The model has been estimated for 11 different crimes, spanning violent, sexual, as well as property crimes. The sensitivity of the results has also been investigated for alternative independent variables, different data sources, as well as various model specifications to test for multicollinearity, endogeneity, or the effect of outliers.

The results are as follows: (1) Increases in income display a significant negative effect on violent crimes, particularly on homicide, assault, and serious assault. Consistent with the hypotheses and Hsieh & Pugh (1993), this finding shows that economic incentives of the level of income are relevant for violent crimes, which demonstrate a higher degree of market-like reasoning than assumed in the original economic theory of crime (Ehrlich 1973). (2) However, non-violent crimes exhibit positive, insignificant, or non-linear relationships with per capita income. This implies that different crimes are subject to different motivations, which need to be understood separately. Furthermore, it highlights the importance of non-economic incentives in determining crime variation across Eastern Europe as opposed to other global regions. (3) These implications are particularly acute in the case of income inequality and unemployment, both of which showcase mixed evidence for the impact on crime even within individual crime categories. (4) Applying the conclusions from the cross-country analysis to regional crime variation in Czechia and Slovakia, there is little connection to aggregate income. Studying crime determinants on national and regional levels thus accentuates the relevance of social, rather than economic, conditions when addressing crime distribution.

These findings present important policy implications for East European countries. Within international cooperation, the negative effect of economic development on crime can be emphasized to bridge cross-country differences and reduce primarily violent crime. Addressing income inequality or unemployment may be useful when focusing on specific crimes, though improving social conditions may emerge as more effective. Similarly, on the national level, social factors rather than income and unemployment need to be handled to lower crime rates.

Given the scarcity of crime analysis in Eastern Europe, there is undeniable room for future research. The social dimension of crime determinants should be

better understood in this region, following the strain theory of Merton (1938) and the social disorganization theory of Shaw & McKay (1942). In doing so, the difference between cross-national and national factors for crimes should be better emphasized and more closely studied. Furthermore, as the International Classification of Crime for Statistical Purposes continues to align the reporting standards, East European countries could be more frequently included in panel data analyses to account for their unique historical experience in formulating future policy recommendations for international crime mitigation.

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Appendix A

Crime definitions

Definitions were taken directly from the International Classification of Crime for Statistical Purposes (UNODC 2015).

Acts causing harm

ICCS Number 02

Definition Acts causing harm or intending to cause harm to the person.

Inclusions Assaults and threats, acts against liberty, slavery and exploitation, trafficking in persons (TIP), coercion, negligence, dangerous acts, acts intended to induce fear or emotional distress, defamation or insult, discrimination, acts that trespass against the person, other acts causing harm or intending to cause harm to the person.

Exclusions Serious assault leading to death, all injurious acts of a sexual nature, using force to take property, acts against freedom or control of expression acts violating labour laws, acts against public order sexual standards, smuggling of migrants and other migration offences, taking property through the use of force threat or threat of force threatening a witness, justice or law enforcement official, threatening voters to influence their vote, manslaughter caused by negligence, dangerous acts or behaviour causing death, acts related to freedom or control of expression, invasion of computer data or computer systems that is not an intrusion upon a person's privacy, trespassing on property.

Assault

ICCS Number 02011

Definition Intentional or reckless application of physical force inflicted upon the body of a person. Acting recklessly, at minimum, is acting without thinking or caring about the consequences of an action.

Inclusions Inflicting grievous bodily harm, wounding, aggravated assault, inflicting bodily harm under aggravating circumstances, battery, acid attacks, female genital mutilation, poisoning, assault with a weapon, forced sterilization, taking human blood, organs or tissues by use of violence Inflicting minor

bodily harm, simple assault, pushing, slapping, kicking, hitting, drugging or spiking.

Exclusions Serious assault leading to death, all injurious acts of a sexual nature, using force to take property, using threat of force to demand a particular course of action from a person.

Burglary

ICCS Number 0501

Definition Gaining unauthorized access to a part of a building/dwelling or other premises with or without the use of force against the building/dwelling, with intent to commit theft or when actually committing theft.

Inclusions Breaking and entering, unlawful entry with intent to commit theft, access by deception with intent to commit theft, breaking and entering business premises, ram raiding, unlawful entry into a business with intent to commit theft, burglary of a house, apartment or other dwelling that is the habitual place of residence of the victim, burglary of summerhouses, burglary of secondary houses, breaking, entering and stealing from hotel rooms or other temporarily rented premises, breaking and entering public premises, unlawful entry into public property with intent to commit an offence, burglary of mobile homes, burglary of premises that cannot be identified as public, private or business premises.

Exclusions Unlawfully taking or obtaining property with the intent to permanently or temporarily deprive it from a person or organization without consent and without the use of force, threat of force or violence, coercion or deception, possession of stolen goods or money, receiving, handling, disposing, selling or trafficking stolen goods, using stolen parts for producing other goods, concealment of stolen goods, property damage, unlawfully taking or obtaining property directly from a person with the intent to permanently or temporarily withhold it from a person or organization with the use of force or threat of force.

Car theft

ICCS Number 05021

Definition Unlawfully taking or obtaining of a motorized land vehicle or parts thereof with the intent to permanently withhold it from a person or organization without consent and without the use of force, threat of force or violence, coercion or deception. Motorized land vehicle means all land vehicles with an engine that run on the road, including cars, motorcycles, buses, lorries, construction and agricultural vehicles.

Inclusions Larceny of a car, van or truck, theft of a motorcycle, joyriding, theft of car tires, motors, transmission, windows, etc., theft of boat or aircraft, theft of boat or aircraft parts.

Exclusions Robbery of a car or vehicle, possession of stolen goods or money, receiving, handling, disposing, selling or trafficking stolen goods, using stolen parts for producing other goods, concealment of stolen goods, obtaining money or other benefit or evading a liability through deceit or dishonest conduct, robbery, property damage, theft after unauthorized access to premises, theft of intellectual property, identity theft.

Intentional homicide

ICCS Number 0101

Definition Unlawful death inflicted upon a person with the intent to cause death or serious injury.

Inclusions Murder, honour killing, serious assault leading to death, death as a result of terrorist activities, dowry-related killings, femicide, infanticide, voluntary manslaughter, extrajudicial killings, killings caused by excessive use of force by law enforcement/state officials.

Exclusions Death due to legal interventions, justifiable homicide in self-defence, attempted intentional homicide, homicide without the element of intent is non-intentional homicide, non-negligent or involuntary manslaughter, assisting suicide or instigating suicide, illegal abortion, euthanasia.

Kidnapping

ICCS Number 020221

Definition Unlawful detainment and taking away of a person or persons against their will (including through the use of force, threat, fraud or enticement) for the purpose of demanding an illicit gain, any other economic gain or other material benefit for their liberation, or in order to oblige someone to do or not to do something.

Inclusions Kidnapping, express kidnapping.

Exclusions Abduction of a minor, trafficking in persons (TIP), illegal adoption, taking a hostage, slavery and exploitation, acts against freedom or control of expression, all acts of a sexual nature.

Rape

ICCS Number 03011

Definition Sexual penetration without valid consent or with consent as a result of intimidation, force, fraud, coercion, threat, deception, use of drugs or alcohol, abuse of power or of a position of vulnerability, or the giving or receiving of benefits. Sexual penetration, at minimum, is the penetration of the vulva, anus or mouth with any body part or object.

Inclusions Sexual penetration with physical force, deception to procure sex, drug-facilitated rape, non-consensual sexual penetration without physical force, sexual intercourse with a person below the age of consent, sexual intercourse with a person incapable of consent, other rape.

Exclusions Acts of abuse of a position of vulnerability, power or trust, or use of force or threat of force, for profiting monetarily, socially or politically from the prostitution or sexual acts of a person, coercion, prostitution offences, pornography offences and other acts against public order sexual standards such as incest not amounting to rape and exhibitionism, assaults and threats, slavery and exploitation not amounting to injurious acts of a sexual nature, trafficking in persons for sexual exploitation, harassment and stalking.

Robbery

ICCS Number 0401

Definition Unlawfully taking or obtaining property with the use of force or threat of force against a person with intent to permanently or temporarily withhold it from a person or organization.

Inclusions Theft with violence, banditry, dacoity, street robbery, mugging, bag snatching with force, force or threat of force used to steal during the course of a residential burglary, robbery from a person in miscellaneous locations, carjacking, robbery of property in a vehicle in transit, taxi robbery, robbery of a security van, robbery in or from a railway, robbery of cargo on highways, robbery of a bank, robbery of an ATM, robbery of a post office, robbery of petrol/gas station, robbery of a business, shop robbery, robbery of cattle, goats, sheep, chickens or other livestock, cattle rustling, other acts of robbery.

Exclusions Burglary, theft and other acts only against property, assaults and threats, possession of stolen goods or money, receiving, handling, disposing, selling or trafficking stolen goods, using stolen parts for producing other goods, concealment of stolen goods, property damage, kidnapping, demanding a particular course of action through a written or verbal threat.

Serious assault

ICCS Number 020111

Definition Intentional or reckless application of serious physical force inflicted upon the body of a person resulting in serious bodily injury. Acting recklessly, at minimum, is acting without thinking or caring about the consequences of an action. Serious bodily injury, at minimum, includes gunshot or bullet wounds, knife or stab wounds, severed limbs, broken bones or teeth knocked out, internal injuries, being knocked unconscious, and other severe or critical injuries.

Inclusions Inflicting grievous bodily harm, wounding, aggravated assault, inflicting bodily harm under aggravating circumstances, battery, acid attacks, female genital mutilation, poisoning, assault with a weapon, forced sterilization, taking human blood, organs or tissues by use of violence.

Exclusions Threat to inflict serious bodily injury, torture, serious assault leading to death, all injurious acts of a sexual nature, using force to take property, using threat of force to demand a particular course of action from a person.

Sexual assault

ICCS Number 03012

Definition Unwanted sexual act, attempt to obtain a sexual act, or contact or communication with unwanted sexual attention not amounting to rape.

Inclusions Drug-facilitated sexual assault, sexual harassment, sexual assault committed against a marital partner against her/his will, sexual assault against a helpless person, unwanted groping or fondling, sexual assault by abuse of position, sexual harassment, threat of a sexual nature, voyeurism (obtaining sexual gratification by observing unsuspecting individuals who are partly undressed, naked or engaged in sexual acts).

Exclusions Rape, acts of abuse of a position of vulnerability, power or trust, or use of force or threat of force, for profiting monetarily, socially or politically from the prostitution or sexual acts of a person, coercion, prostitution offences, pornography offences and other acts against public order sexual standards such as incest not amounting to rape and exhibitionism, assaults and threats, slavery and exploitation not amounting to injurious acts of a sexual nature, trafficking in persons for sexual exploitation, harassment and stalking.

Sexual violence

ICCS Number 0301

Definition Unwanted sexual act, attempt to obtain a sexual act, or contact or communication with unwanted sexual attention without valid consent or with consent as a result of intimidation, force, fraud, coercion, threat, deception, use of drugs or alcohol, or abuse of power or of a position of vulnerability.

Inclusions Sexual penetration with physical force, deception to procure sex, drug-facilitated rape, non-consensual sexual penetration without physical force, sexual intercourse with a person below the age of consent, sexual intercourse with a person incapable of consent, drug-facilitated sexual assault, sexual harassment, sexual assault committed against a marital partner against her/his will, sexual assault against a helpless person, unwanted groping or fondling, sexual assault by abuse of position, sexual harassment, threat of a sexual nature, voyeurism (obtaining sexual gratification by observing unsuspecting individuals who are partly undressed, naked or engaged in sexual acts), other acts of sexual violence.

Exclusions Acts of abuse of a position of vulnerability, power or trust, or use of force or threat of force, for profiting monetarily, socially or politically from the prostitution or sexual acts of a person, coercion, prostitution offences, pornography offences and other acts against public order sexual standards such as incest not amounting to rape and exhibitionism, assaults and threats, slavery and exploitation not amounting to injurious acts of a sexual nature, trafficking in persons for sexual exploitation harassment and stalking.

Theft

ICCS Number 0502

Definition Unlawfully taking or obtaining of property with the intent to permanently withhold it from a person or organization without consent and without the use of force, threat of force or violence, coercion or deception.

Inclusions Larceny of a car, van or truck, theft of a motorcycle, joyriding, theft of car tires, motors, transmission, windows, etc., theft of boat or aircraft, theft of boat or aircraft parts, theft where entry was lawfully gained, pick pocketing, bag snatching not amounting to robbery, theft of a purse from a vehicle, theft of an electronic device from a vehicle, theft of a GPS device, siphoning gas or oil, theft without breaking and entering, theft of property outside the dwelling, theft from garages or sheds and lock-ups with no connecting door to a dwelling, theft of a bicycle, theft of a pet, dine and dash, leaving without payment, theft by employees, shoplifting, theft of merchandise from a shop, theft of business/office supplies by an employee, theft from a vending machine,

theft from hotels, restaurants, cinemas, theatres, places of entertainment, offices, workshops, theft of public property, theft of public park equipment, theft of cows, chicken, sheep, fish, etc., theft of electric power, water or other utility services, theft of television/cable signals, fare evasion, avoiding payment for services, theft of mail, theft by conversion.

Exclusions Possession of stolen goods or money, receiving, handling, disposing, selling or trafficking stolen goods; using stolen parts for producing other goods, concealment of stolen goods, obtaining money or other benefit or evading a liability through deceit or dishonest conduct, robbery, property damage, theft after unauthorized access to premises, theft of intellectual property, identity theft.

Appendix B

Descriptive statistics

Table B.1: Definitions of independent variables

Independent variables	Definition
Nominal GDP	Gross domestic product at market prices, in million euro
Real GDP	Gross domestic product at market prices with chain-linked volumes (2010), in million euro
Population (total)	Total population on Janurary 1st
Population (15-24-year-olds)	Sum of population in age groups from 15 to 19 years old and 20 to 24 years old on Janurary 1st
Population (15-24-year-old males)	Sum of male population in age groups from 15 to 19 years old and 20 to 24 years old on Janurary 1st
Gini coefficient	Gini coefficient of equivalised disposable income
Income inequality	Ratio of total income received by the 20 % of the population with the highest income (the top quintile) to that received by the 20 % of the population with the lowest income (the bottom quintile)
Unemployment (total)	Unemployment as percentage of active total population from 15 to 74 years old
Unemployment (male)	Unemployment as percentage of active male population from 15 to 74 years old
Unemployment (15-24, total)	Unemployment as percentage of active total population from 15 to 24 years old
Unemployment (15-24, male)	Unemployment as percentage of active male population from 15 to 24 years old
Educational attainment	Percentage of total population, aged 15 to 64 years, whose highest attained education is less than primary, primary and lower secondary education (levels 0-2)
Foreigners	Number of persons born abroad, (according to present time borders), who are usually resident in the reporting country on January 1st of the respective year
Divorces	Number of divorces in the respective year
Police officers	Number of police officers
Prisoners	Number of persons held in prison

Source: Eurostat (2021).

Table B.2: Descriptive statistics: Dependent variables

	Observations	Years	Mean	St. Dev.	Minimum	Maximum
Homicide	231	1998-2018	188.55	167.77	10.00	855.00
Acts causing harm	107	1998-2007	16 394.89	19 430.51	638.00	79 763.00
Robbery	108	1998-2007	5 912.02	10 063.60	349.00	44 086.00
Burglary	106	1998-2007	16 038.03	18 511.86	988.00	77 397.00
Assault	117	2008-2018	3 676.29	4 424.02	76.00	17 572.00
Sexual violence	106	2008-2018	900.43	876.56	178.00	5 974.00
Rape	121	2008-2018	365.21	390.32	33.00	1 611.00
Sexual assault	100	2008-2018	342.16	257.31	30.00	1 250.00
Theft	120	2008-2018	59 603.65	56 455.58	7 403.00	230 751.00
Source: Eurostat (2021).						
Homicide	229	1998-2018	185.74	166.12	10.00	855.00
Burglary	146	2003-2018	34 664.84	46 428.34	501.00	294 654.00
Car theft	137	2003-2018	6 110.21	9 053.91	134.00	54 291.00
Kidnapping	167	2003-2018	59.25	96.99	0.00	445.00
Robbery	87	2010-2017	2 818.20	4 090.78	201.00	19 533.00
Serious assault	162	2003-2018	4 610.20	5 665.71	76.00	23 579.00
Sexual violence	152	2003-2017	934.73	888.57	145.00	5 974.00
Theft	175	2003-2018	62 597.78	61 744.71	7 403.00	287 936.00
Source: UNODC (2021).						

Table B.3: Descriptive statistics: Dependent variables per 100 000 inhabitants

	Observations	Years	Mean	St. Dev.	Minimum	Maximum
Homicide	231	1998-2018	3.06	2.87	0.38	14.07
Acts causing harm	107	1998-2007	177.83	86.70	26.41	434.43
Robbery	108	1998-2007	66.81	64.66	11.81	356.57
Burglary	106	1998-2007	193.52	132.13	42.72	550.16
Assault	117	2008-2018	42.03	35.68	1.29	145.48
Sexual violence	106	2008-2018	13.03	6.82	4.62	60.29
Rape	121	2008-2018	4.53	2.74	1.51	16.07
Sexual assault	100	2008-2018	6.10	4.42	0.40	20.29
Theft	120	2008-2018	801.76	426.65	202.92	1 894.04
Source: Eurostat (2021).						
Homicide	229	1998-2018	3.02	2.82	0.48	14.07
Burglary	146	2003-2018	343.04	218.61	25.23	1 125.01
Car theft	137	2003-2018	71.14	51.09	5.06	248.52
Kidnapping	167	2003-2018	0.61	0.71	0.00	2.68
Robbery	87	2010-2017	30.26	16.04	8.58	86.79
Serious assault	162	2003-2018	54.28	49.82	1.29	231.27
Sexual violence	152	2003-2017	14.02	7.58	2.94	60.29
Theft	175	2003-2018	847.15	465.51	191.51	2 488.02
Source: UNODC (2021).						

Table B.4: Standard deviation within and between for dependent variables per 100 000 inhabitants

	Mean	St. Dev.	St. Dev. Within	St. Dev. Between	St. Dev. B/W
Homicide	3.06	2.87	1.16	2.55	2.80
Acts causing harm	177.83	86.70	38.56	70.78	80.60
Robbery	66.81	64.66	19.73	57.72	61.00
Burglary	193.52	132.13	39.88	127.03	133.14
Assault	42.03	35.68	8.75	37.57	38.57
Sexual violence	13.03	6.82	3.61	4.09	5.46
Rape	4.53	2.74	1.29	2.45	2.76
Sexual assault	6.10	4.42	2.35	3.25	4.01
Theft	801.76	426.65	214.55	369.02	426.85
Source: Eurostat (2021).					
Homicide	3.02	2.82	1.14	2.49	2.74
Burglary	343.04	218.61	105.15	194.62	221.21
Car theft	71.14	51.09	27.95	38.84	47.85
Kidnapping	0.61	0.71	0.34	0.58	0.67
Robbery	30.26	16.04	8.74	13.89	16.41
Serious assault	54.28	49.82	16.28	46.45	49.22
Sexual violence	14.02	7.58	4.41	5.33	6.92
Theft	847.15	465.51	215.93	408.66	462.20
Source: UNODC (2021).					

Table B.5: Descriptive statistics: Independent variables

	Observations	Years	Mean	St. Dev.	Minimum	Maximum
Real GDP per capita	231	1998-2018	10 049.36	3 864.02	2 851.61	20 273.94
Population (total)	231	1998-2018	9 591 772.39	10 541 505.17	1 314 870.00	38 666 983.00
Population (15-24-year-olds)	228	1998-2018	1 328 607.25	1 581 851.03	126 766.00	6 471 107.00
Population (15-24-year-old males)	228	1998-2018	679 327.90	806 948.99	65 037.00	3 296 314.00
Gini coefficient	168	2000-2018	30.33	4.86	20.90	40.20
Income inequality	147	2004-2018	5.19	1.43	3.03	8.32
% of total population						
Population (15-24-year-olds)	228	1998-2018	13.27	1.99	9.05	17.23
Population (15-24-year-old males)	228	1998-2018	6.79	1.00	4.66	8.77
Unemployment (total)	227	1998-2018	9.94	4.10	2.20	20.30
Unemployment (male)	227	1998-2018	10.02	4.39	1.80	22.70
Unemployment (15-24, total)	227	1998-2018	22.07	8.42	6.70	50.00
Unemployment (15-24, male)	226	1998-2018	22.17	8.68	6.40	49.90
Educational attainment	225	1998-2018	22.22	6.07	11.70	36.50
Foreigners	99	2009-2018	6.92	5.24	0.91	16.49
per 100 000 inhabitants						
Divorces	231	1998-2018	208.78	74.65	82.19	400.17
Police officers	220	1998-2018	350.64	80.04	197.90	499.04
Prisoners	228	1998-2018	185.98	82.10	39.95	415.98

Source: Eurostat (2021).

Table B.6: Correlation matrix

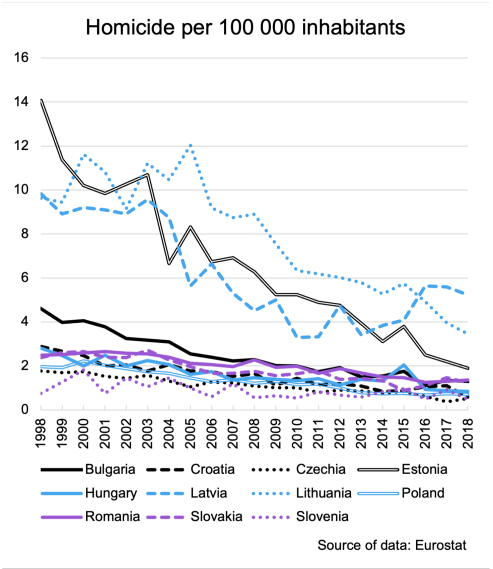
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	Real GDP (log)	1.00									
(2)	Gini coeffient	-0.51	1.00								
(3)	Unemployment (%)	-0.35	0.15	1.00							
(4)	Divorces (per 1000 inhabitants)	0.11	0.30	-0.04	1.00						
(5)	Foreigners (per 1000 inhabitants)	0.33	0.06	0.27	0.17	1.00					
(6)	Police (per 1000 inhabitants)	0.29	-0.23	0.15	0.01	0.35	1.00				
(7)	Prisoners (per 1000 inhabitants)	-0.19	0.47	0.18	0.73	0.03	-0.16	1.00			
(8)	Young male population (%)	-0.41	0.05	0.41	0.11	-0.09	-0.32	0.30	1.00		
(9)	Population (log)	-0.33	-0.07	-0.09	-0.30	-0.81	-0.37	-0.17	0.16	1.00	
(10)	Education (%)	-0.68	0.09	0.05	-0.42	-0.08	-0.26	-0.25	0.38	0.26	1.00

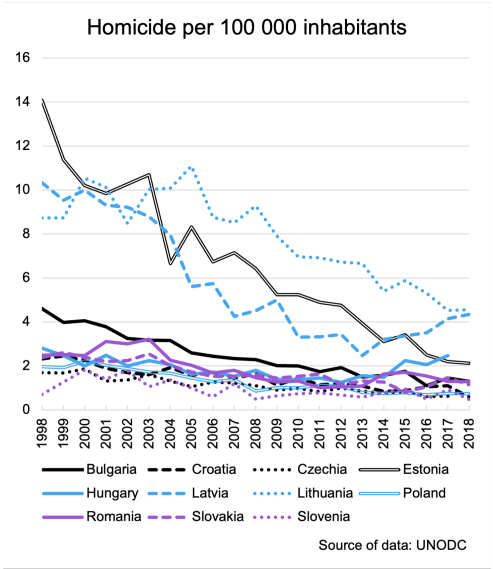
Source: Eurostat (2021).

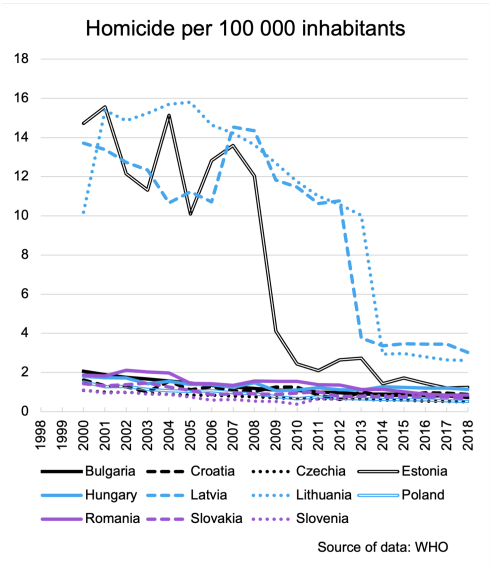
Appendix C

Crime rates in graphs

Figure C.1: Homicide in Eastern Europe







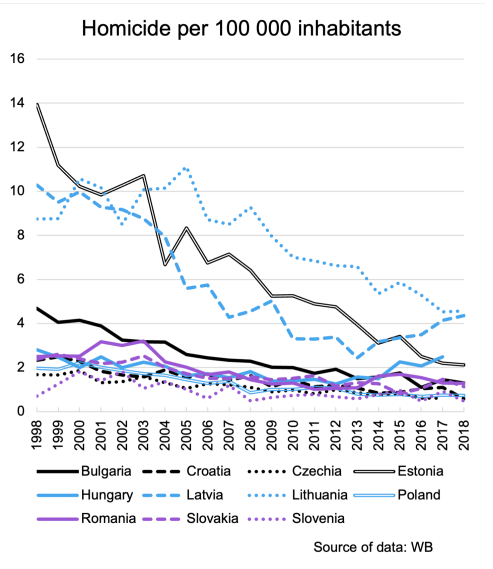
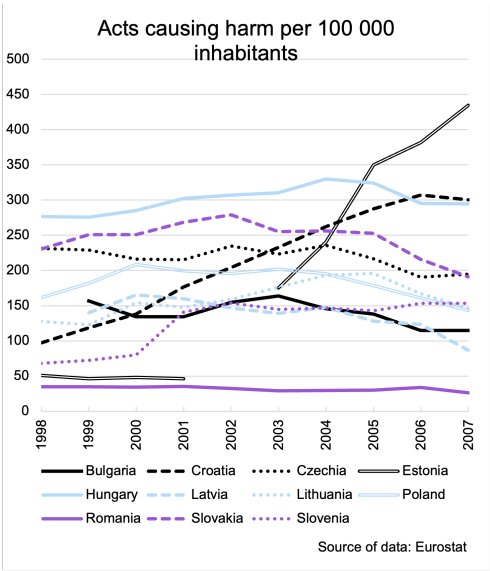
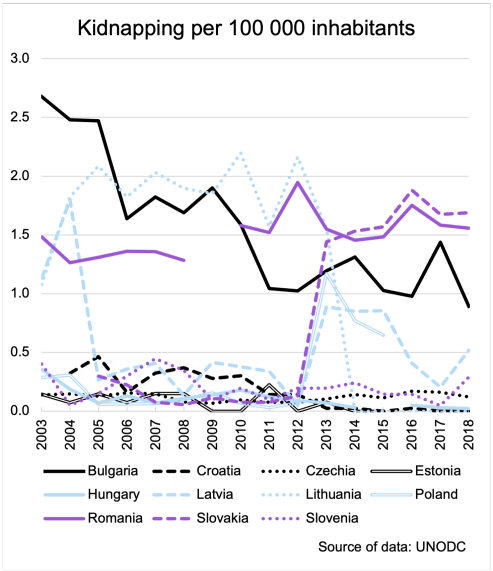
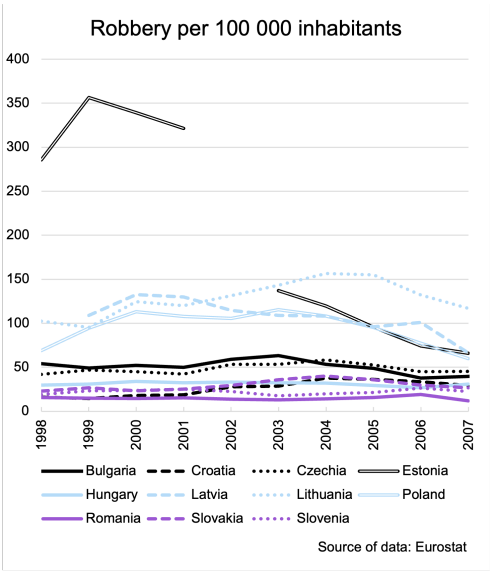
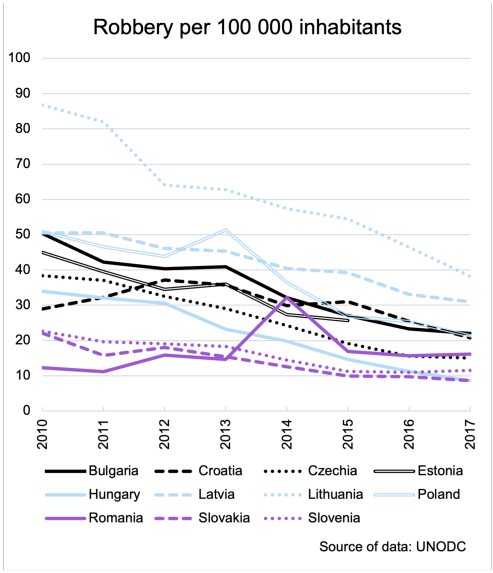


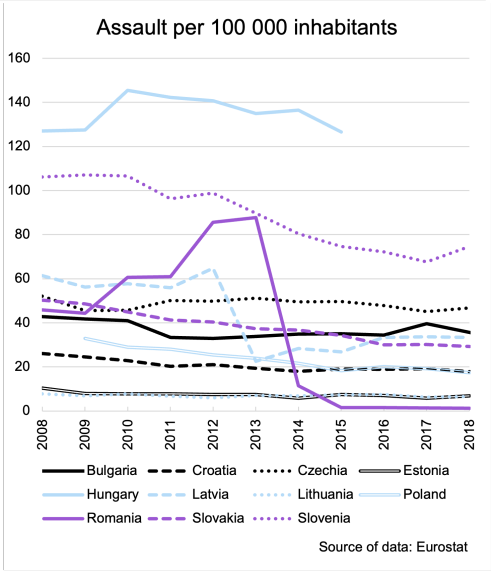
Figure C.2: Violent crime in Eastern Europe











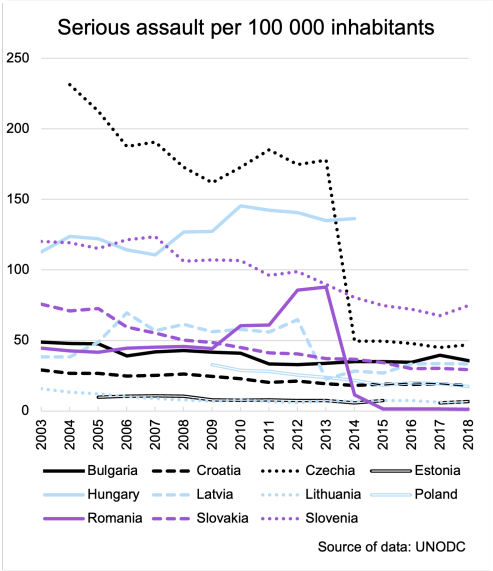
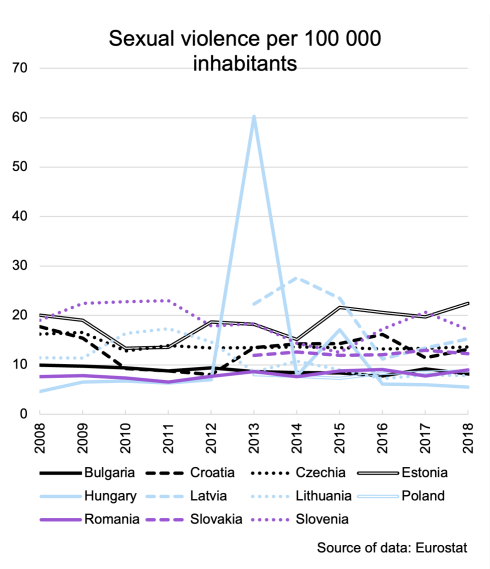
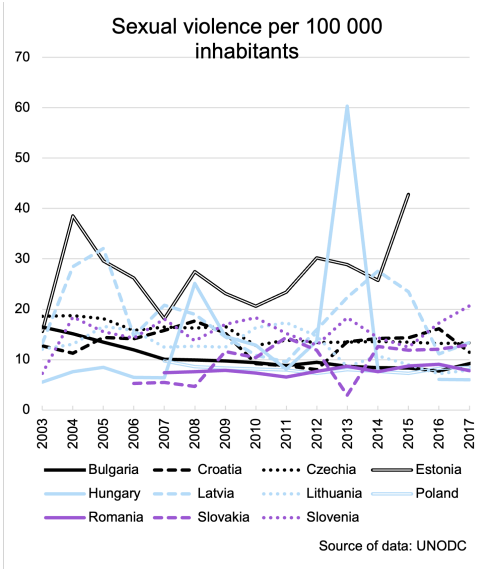
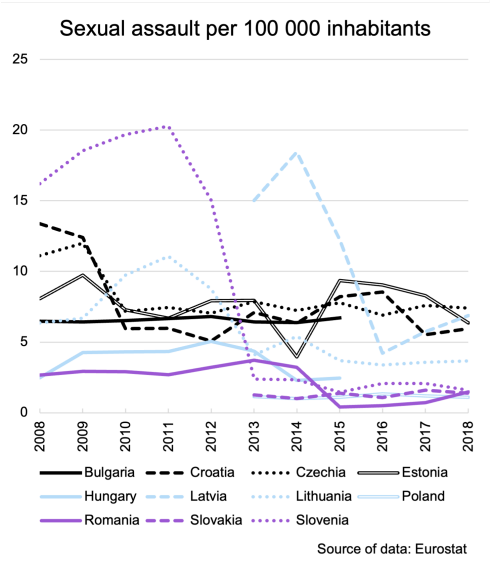


Figure C.3: Sexual crime in Eastern Europe







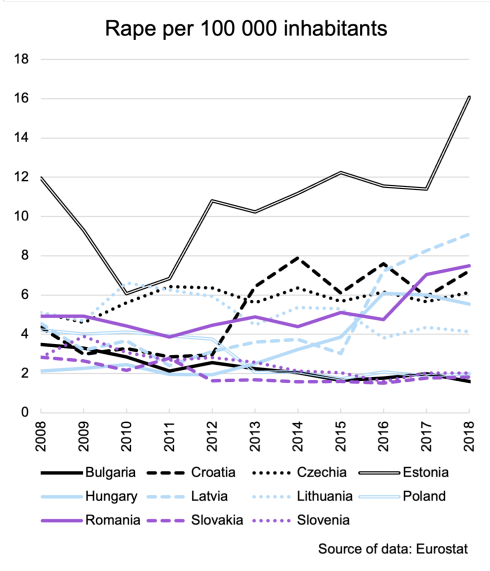


Figure C.4: Property crime in Eastern Europe