CHARLES UNIVERSITY
FACULTY OF SOCIAL SCIENCES
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Analysis of Migration and Crime: Evidence from the Czech Republic

Bachelor's thesis

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Study program: Ekonomické teorie

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Declaration of Authorship

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Prague, August 1, 2023

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Vít Kubů

Abstract

This bachelor's thesis studies the impact of the Ukrainian refugee wave in 2022 on the crime rate in the Czech Republic. There are many articles on the effect of migration on crime, but because migration waves differ in many circumstances (motives for migration, migrants' characteristics), it is necessary to examine each migration wave separately. To identify the effect, the thesis relies on geographical variations in migrants' destinations and on a Bartik shift-share instrument to address potential endogeneity concerns. Our findings show a small positive and statistically significant effect of the migration wave on the number of committed overall crimes, property crimes, violent crimes, and misdemeanors. When transformed to the crimes per capita, a more accurate measure of criminal activity, the effect remains statistically significant only for property and a total number of crimes, but the effect is again close enough to zero. Based on these results, it can be concluded that the Ukrainian refugee wave did not lead to a substantial increase in crime.

Abstrakt

Tato bakalářská práce zkoumá vliv ukrajinské uprchlické vlny v roce 2022 na kriminalitu v České republice. Na téma migrace a kriminality existuje řada článků, ale v důsledku odlišností migračních vln (migrační důvody, rysy migrantů) je potřeba zkoumat každou migrační vlnu zvlášť. Při identifikaci tohoto vlivu se práce opírá o geografické rozdíly v cílových destinacích migrantů a používá Bartikův instrument, který řeší obavy z potenciální endogenity. Naše výsledky ukazují, že migrační vlna měla malý pozitivní a statisticky významný vliv na celkový počet spáchaných trestných činů, majetkových trestných činů, násilných trestných činů a přestupků. Při transformaci na trestné činy per capita, což je přesnější ukazatel kriminality, dochází ke statistickému významu jen u majetkové a celkové kriminality, ale efekt je opět blízko nule. Na základě těchto výsledků můžeme konstatovat, že vlna ukrajinských uprchlíků nevedla k výraznému nárůstu kriminality.

Acknowledgments

I am grateful especially to Mgr. Michal Šoltés, M.A., Ph.D.for his willingness to help, patience and ideas. I would also like to dedicate this work to my grandfather and great-grandmother who played a huge role in my life and who passed away in recent years.

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Acronyms

LAU   Local Administrative Units

OLS   Ordinary Least Squares

IV   Instrumental Variable

UA   Ukraine

Un   Unemployment

Bachelor's Thesis Proposal

Author	Vít Kubů
Supervisor	Mgr. Michal Šoltés, M.A., Ph.D.
Proposed topic	Analysis of Migration and Crime: Evidence from the Czech Republic

Research question and motivation Since the Russian invasion of Ukraine in February 2022, approximately 400 thousand refugees have come to the Czech Republic. Refugees are often perceived with negative connotations and fear of the unknown. One particular concern is that refugees (or immigrants) increase crime. According to the public survey conducted in 2018 by STEM agency, 71% of respondents (selected from a representative sample of the Czech population aged 18 years and over) are afraid of the immigrants. In March 2022, 66% of the Czech respondents in an online survey said that we should accept only a certain number of refugees (online survey from Gallup International Association), which signifies the uncertainty. My research question is: Did the wave of refugees from Ukraine increase crime in the Czech Republic?

Methodology To identify the effect of Ukrainian refugees on crime, I plan to rely on geographical variation in the numbers of incoming refugees. To address endogeneity concerns, I will use the so-called Bartik shift-share instrument (for more details see Jaeger et. al (2018)), using the geographical distribution of Ukrainians already living in the Czech Republic. The argument follows the fact that many Ukrainian refugees settle where their family members and acquaintances live. The data source is the annual informative table of the number of foreigners from the Ministry of the Interior of the Czech Republic and statistical summaries of crime by the Police of the Czech Republic.

Contribution The literature covering migration and crime exists in abundance, but it is a never-ending topic that differs case from case. We cannot compare refugees leaving their country for economic reasons to those fleeing their country because of

war, whose behavior in a new country is often filled with gratitude. Bell et al. (2013) studied the impact of the immigrant waves to the U.K. in the late 1990s/early 2000s (asylum seekers) and the post-2004 inflow from EU accession countries. They found that the first wave caused a slight but significant increase in property crime and the second one had just a minor detrimental effect suggesting that answer to my research question could result in the same effect after the first immigration wave to the United Kingdom.

Outline

1. Introduction

2. Literature review

3. Data and methodology

4. Results and discussion

5. Conclusion

Core bibliography

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Author   Supervisor

Chapter 1

Introduction

Since the Russian invasion of Ukraine in February 2022, approximately 400,000 refugees have come to the Czech Republic. Refugees are often perceived with negative connotations and fear of the unknown. One particular concern is that refugees (or immigrants[1]) increase crime. The existing literature does not establish a direct relationship between migration and crime, however, some studies suggest that immigration leads to higher crime rates, mainly for property crime. Nevertheless, many of the studies indicating an increase in property crime in relation to migration also emphasize that the effect is rather marginal.

Ukrainian refugees in the Czech Republic are the target of hatred from a variety of sources, primarily from pro-Russian residents and pro-Russian political parties. In public spaces or media, there are often repeated phrases suggesting that refugees should engage in fighting in Ukraine rather than seeking refuge in the Czech Republic. Similarly, it is often suggested that they should not rely on financial aid from the state, as this would burden the Czech population. However, with the current trend of declining birth rates in the European Union, refugees can enrich Czech society. At the same time, the Czech Republic needs a significant number of doctors and other university-educated individuals, many of whom are among the refugees.

In this thesis, the author would like to present credible evidence that refugees or immigrants do not necessarily have to be associated with negative connotations and to provide an analysis of refugee criminal behavior in a new environment. Thus, the main research question of this thesis is whether the migration wave of Ukrainian refugees in 2022 increased crime in the Czech Republic and if it did, which types of crime were affected by the migration flow.

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[1]To improve readability, sometimes the term immigrant is used instead of refugee, although definitions are slightly different.

To identify the effect of Ukrainian refugees on crime, we relied on the geographical variation in the number of incoming refugees. To address endogeneity concerns, because the settlement is not random, we applied the so-called Bartik shift-share instrument, using the geographical distribution of Ukrainians already living in the Czech Republic. The argument follows the fact that many Ukrainian refugees settle where their family members and acquaintances live.

We discovered that the migration wave is a significant variable in explaining the number of committed property, violent and total crimes, and misdemeanors. An increase in crime caused by one additional refugee ranges from 0.003% to 0.013%, most notably for property crime. In per capita measure, which is generally considered a better measure for studying the consequences of migrants, the migration wave is significant to only property and total crime. One additional refugee increases property crime by 0.01% and by 0.008% for total crime. The effect is negligible and we can rule out that the Ukrainian flow led to a substantial increase in crime. Our results are consistent with most of the literature and we believe that they can also be relevant to the situation in Poland due to the similarities in the migration wave and the social economic factors between the Czech Republic and Poland.

The thesis is divided into theoretical and practical parts. In the theoretical part, the existing literature on the perception of immigration by natives and the motivation of migrants to commit a crime is examined. Also, the consequences of restrictive policies are introduced. Last but not least, the thesis contains evidence from the history of the immigrant waves and our contribution.

The practical part describes data from many state institutions of the Czech Republic used for our analysis and the methodology approach with a description of an instrumental variable, Bartik shift-share instrument, and models used for the thesis, including specification tests. Finally, the models are estimated and their results are evaluated with the subsection dedicated to limitations. The final part is devoted to the conclusion and to possible extensions of the thesis.

Chapter 2

Literature review

The consequences of migration are one of the most resonant topics in society. As migration has been increasing in recent years due to climate change, the economic situation in poorer countries, and war, it is necessary to work with data on this topic and to counteract any prevailing myths and disinformation that exist in society to prevent the rise of far-right political ideologies.

There is a lot of concern about immigrants and their impact on locals. The main concerns include the lack of education of immigrants, their insufficient financial capital and dependence on the welfare system, the transmission of different cultures, and fear of an increase in crime, which will be the subject of this research.

In this literature review, the author will discuss, on the basis of existing literature, the perception of immigrants by natives, the economic theory of criminal behavior, the options available to policymakers to prevent criminal activity, and finally provide evidence from studies of the impact of migration on crime from different countries to offer insights into strategies for addressing this issue.

2.1 The perception of immigrants by natives

The position and involvement of migrants in society is not only decided by the migrants themselves, but primarily by the domestic society. Recent economic literature shows that natives generally have inaccurate information about migrants. Typically, perceptions of immigrants are often distorted by fear of the unknown, leading people to misperception. People tend to overestimate the negative characteristics of migrants, such as their number or dependence on

the social system, and underestimate their education or economic potential. The research of Alesina *et al.* (2023) implies that narratives influence people's perceptions of immigration rather than facts. Further research showing the negative perception of migrants by locals was conducted by Nunziata (2015). He suggests that an increase in immigration leads to an increase in fear of crime, which is positively correlated with the residents' adverse perception of immigration.

One possible solution to change the image of migrants and misperceptions is by providing truthful information to the public. Grigorieff *et al.* (2020) emphasize that people with negative attitudes toward foreign-born people may become more supportive of immigrants after their misconceptions are corrected to match the actual characteristics of foreign-born people. Another perspective on immigration offers their contribution to society. As mentioned above, people underestimate their economic and social potential, but if sufficiently educated through information campaigns, some may become more inclined to accept immigrants (Facchini *et al.* 2022).

That is why it is important to work not only with immigrants but also with society in the context of policies. There will always be those who will reject the idea of incoming refugees or immigrants, but this group does not have to be the majority of society. With the right approach and education, misperceptions of immigrants can be countered.

2.2 Employment options as a motivation for criminal activity

One of the seminal articles in the field of crime and law enforcement is "Crime and Punishment" by Becker (1968). In this work, Becker proposes that decisions to commit a crime are based on rational calculations of utility maximization. In particular, the expected value $E[U]$ associated with committing an offense can be described as follows:

$$E[U] = pU[Y - f] + (1 - p)U[Y]$$

where p is the subjective probability of being caught and convinced, *U(.)*

is the individual's utility function, Y is the income from a criminal behavior and f is the monetary equivalent of punishment.

After this initial model, many modifications appeared. One of them provides Bell *et al.* (2013) who enlarges the model with the variable *U(W)* which is the utility from working at a legal wage *W*.

In this model, p is the probability of getting caught, $U(W_c)$ is the utility from committing a (successful) crime, *U(S)* is the monetary equivalent of punishment (if getting caught) and finally, *U(W)* is the utility coming from legal work at wage *W*. An individual decides to commit a crime if:

$$(1 - p)U(W_c) - pU(S) > U(W).$$

Therefore, it is in the interest of a state to provide legal permission to work and decent working conditions to deter the potential perpetrator of the offense from illegal activity. This conclusion is supported by Bell *et al.* (2013) who find a significant rise in aggregate property crime in British areas with high immigrant inflows who were legally prohibited from working. In the United States and Europe, undocumented individuals are prohibited from engaging in official employment or business. Consequently, they are limited to working within the informal economy, resulting in lower earning prospects than their legally authorized counterparts. Therefore, legalizing migrants could result in higher earnings and, thus, potentially reduce crime. This hypothesis was the subject of research by Pinotti (2017), who found that at a baseline crime rate of 1.1 percent, legalization leads to an average reduction of 0.6 percentage points in the crime rate of legalized immigrants. Hence, the legalization of migrants can be an effective tool in setting policies aimed at reducing crime.

Also, Freedman *et al.* (2018) advocate that policies restricting access to jobs for undocumented workers lead to higher crime. These findings are important because employer sanctions as an immigration-controlling policy in the U.S. are popular and believed by the public to be more effective than simplifying the process of obtaining legal status or enhancing border security.

2.3 The effect of deportation, incarceration and other punishments

Another option to deter an immigrant from committing a crime can lie in the punishment which occurs in case of conviction, mainly deportation. Butcher & Piehl (2007) emphasize that in addition to other penalties, immigrants face the possibility of deportation, which may serve as a potent deterrent to criminal activity. Many politicians pursue anti-immigration policies, leading to programs such as Secure Communities in the U.S. This program allows the federal government to check the immigration status of any arrestee by local police and take the arrested person immediately into custody for deportation proceedings. The research of Miles & Cox (2014) shows that the program had no significant effect on the overall crime rate, and in addition, Alsan & Yang (2022) propose that the program led to lesser participation by Hispanics in programs to support low-income families in the grocery budget (Supplemental Nutrition Assistance Program) and in the affordable healthcare program (Affordable Care Act). This could stem from the fear that their involvement in the programs could potentially expose non-citizens within their community to immigration authorities. Thus, an incorrectly set policy can even be a threat to society.

Furthermore, the policies of one state can negatively affect the situation in another state. Kalsi (2018) proposes that the American policy of deportation caused economic instability in El Salvador as a result of the U.S. gang's exposure to local people. Deportation can be a strong instrument for one country, but criminal activities can be easily transferred to another state. Therefore deportation may not be the best solution because it only shifts the problem with crime but does not solve it.

Policymakers should also take into account social connectedness. Stuart & Taylor (2021) suggest that an increase in social connectedness reduces the occurrence of murders, motor vehicle thefts, rapes, robberies, assaults, and burglaries. Their findings also imply that social network and community-disturbing policies, such as mass incarceration, may have more severe and pervasive negative effects than previously believed.

The conclusion of this section is that punishment must be chosen with due deliberation, the social structures among immigrants must be taken into account, and the most draconian punishment is not always the solution.

2.4 Evidence from the history of the immigrant waves

The evidence concerning the relationship between migration and crime is not straightforward because every migration wave has different characteristics and every migrant-receiving country has more or less strict policies towards immigrants which influence their subsequent behavior. Many studies conclude that immigration leads to a minimal or even insignificant increase in property crime. Some find a positive effect on violent crime.

One of the first empirical studies was conducted by Butcher & Piehl (1998) addressing the relationship between crime and immigration in cities in the United States of America during the 1980s. The first finding was that there is a cross-sectional relationship between cities with high crime rates and a large number of immigrants. However, after controlling for city-level factors, they came to the conclusion that recent immigrants had no impact on crime rates.

Bell *et al.* (2013) studied the influence of two immigration waves in the United Kingdom during the late 1990s/early 2000s of asylum seekers and the "A8 wave" - a significant influx of employees from EU accession countries, which started in 2004. They found that the first wave caused a slight but significant increase in property crime while the second wave had no such impact.

Alonso-Borrego *et al.* (2012) conclude in their analysis of a large wave of immigration to Spain from 1999 to 2009 a significant relationship between crime and immigration. Nevertheless, the reason might be found in the distinctive traits of the various immigrant groups rather than in the number of immigrants.

The relationship between immigration and crime across Italian provinces during the period from 1990 to 2003 was described by Bianchi *et al.* (2012). This study indicates that immigration increases the incidence of robberies but not the overall crime. Robberies make up a negligible fraction of total criminal offences, hence their impact on the overall crime rate is negligible.

Several studies suggest that migration has a significant effect on crime. Using data from Germany, Piopiunik & Ruhose (2017) shows a significant increase in crime rates caused by the inflow of ethnic German allocated to regions of West Germany. Moreover, the study discovers that in regions with low unemployment, a rise in crime caused by immigration inflow does not occur, whereas, in regions with high unemployment, immigration leads to an increase in crime. Thus, favorable labor market conditions helped to mitigate crime. Note that

the migrants were immediately granted German citizenship so they lacked the threat of deportation. Another observation from Germany suggests that counties with minor refugee inflows follow identical time trends in crime as those with large inflows (Gehrsitz & Ungerer 2022). A slight increase in crime was detected in counties that accepted a larger number of immigrants.

Some authors find a relationship between migration and violent criminal activity. For example, Rojas Mullor (2019) indicates a significant and positive relationship between refugees' arrival to Sweden and violent crimes and crimes against persons, however, property crimes and crimes against the public are not significant.

The documented effects of migration on crime vary, depending on the country of immigration's policy settings and the characteristics of the migrating group, and therefore, the impact of migration on criminality has to be studied from case to case.

2.5   Our contribution

As already mentioned, migration waves flee their country under different circumstances and for different reasons. Therefore, any research in this area should be carefully interpreted within a broader context of socioeconomic and other factors. Most Ukrainians fled the country involuntarily and want to return after the war, so their behavior is specific and important to explore. There is no research for this particular wave and that should be the author's contribution to existing research.

Furthermore, social media are full of disinformation and chain emails with unsubstantiated information that has a single purpose - to stir up hatred towards Ukrainians. The information is afterward shared exponentially among others until it becomes believable. Being part of the academic sphere is to fact-check these rumors through research and try to stop the spread of unsubstantiated information. Hence, the contribution of this paper lies in an objective analysis that could dispel myths and help to improve the perception of migrants.

Finally, in the case of this research, the reason to migrate was the Russian invasion of Ukraine. The decision was not economical, it was necessary to save their own life. There are people who left their country with their whole life to cram into just one suitcase. If these people are not given adequate financial aid or integrated into the working process, the lack of finances culminates in an

extreme emergency, which can lead to an increase in crime. Thus, the results of this study can be used as a recommendation for the state policy of dealing with these immigrants. For example, whether the current amount of financial aid or policies integrating Ukrainians into Czech society are sufficient incentives to deter crime.

Chapter 3

Data

The dataset contains data from the 76 Czech districts ("okres") and 10 city districts of Prague. Criminal statistics and unemployment rates are from 2022, while data about residents and Ukrainians are from 2009, 2021, and 2022. Data from 2022 are often preliminary and requested by the Freedom of Access to Information Act ("Zákon č. 106/1999 Sb.") from Czech institutions because the official data are published during the second half of 2023.

3.1 Crime data

The crime data stems from the interactive map of criminality, created by the Police of the Czech Republic, where every reported or registered criminal activity committed on the territory of the Czech Republic is recorded. The user of the map can select different levels of the territory unit and for the purpose of the thesis, the author chooses districts (LAU 1). The best choice would be the smallest possible unit, which is the municipalities, but due to their large number (more than 6,000), it would be difficult to extract data from the map and collect other relevant data. Districts, therefore, represent the best compromise between unit size and data availability.

Reported crimes are divided into several groups - violent crimes (such as bodily harm, murder, robbery, etc.), fires and explosions, burglaries, thefts, frauds, other property crimes, generally dangerous crimes, traffic accidents, drug crimes, unauthorized arming, extremism, and misdemeanors. A misdemeanor is a socially harmful unlawful act that does not fulfill the characteristics of a criminal offence and thus has a lower social harmfulness. Therefore, it is almost ten times more frequent in the median than the sum of all crimes. Ac-

cording to the Ministry of Transport of the Czech Republic (2023), the most frequently committed misdemeanors in 2022 in the Czech Republic were speeding, holding a phone while driving, or not wearing a seatbelt.

Burglaries, thefts, frauds, and other property crimes are for the research united into a common group of property crimes which should be the most important to study according to the literature review. Furthermore, violent crimes, total crimes, and misdemeanors are subject to this research.

Table 3.1: Summary of crime data

Type of crime	Min.	Median	Mean	Max.
Violent crimes	38	130.5	155.34	700
Property crimes	212	1008.5	1435.67	7687
Total crimes	460	1398	1893.38	8950
Misdemeanors	4351	12722.5	14528.79	41979

Notes: Summary of the number of crimes committed by group and misdemeanors in Czech districts. From the median values, we can see that property crimes make up the majority of total crimes committed. Also, misdemeanors are almost ten times more frequent than total crimes.

The district with the highest total criminal activity in table 3.1 is Brno-město. This follows the fact that it is the largest entity by the number of residents in the dataset. The district with the lowest number of committed crimes is Jeseník which is the region with the second lowest population. These observations are not surprising as the population and the number of committed crimes are positively correlated, however, a more interesting role serves the number of committed crimes per capita, which is calculated by dividing the number of crimes committed in the region by the number of residents of the region multiplied by 100,000 for better illustration.

Table 3.2: Summary of crime data per capita

| Type of crime per capita	Min.	Median	Mean	Max.
Violent crimes	48.04	102.97	128.65	795.68
Property crimes	389.43	844.73	1142.75	13030.33
Total crimes	646.22	1217.60	1529.77	14695.09
Misdemeanors	5173.79	11328.76	11827.57	40303.59

Notes: Summary of the number of crimes committed by group and misdemeanors in Czech districts transformed to per capita terms and multiplied by 100,000 for better illustration.

In per capita measures, the region with the highest total criminal activity is Praha 1 and the district with the lowest total criminal activity is Žďár nad Sázavou.

3.2 Data about Ukrainian people in the Czech Republic

The foreigners living in the Czech Republic are registered by the Directorate of Foreign Police Service. As we can see in Figure 3.1, the Ukrainian nationality has long been the most common among foreigners in the Czech Republic.

Figure 3.1: Foreigners in the Czech Republic
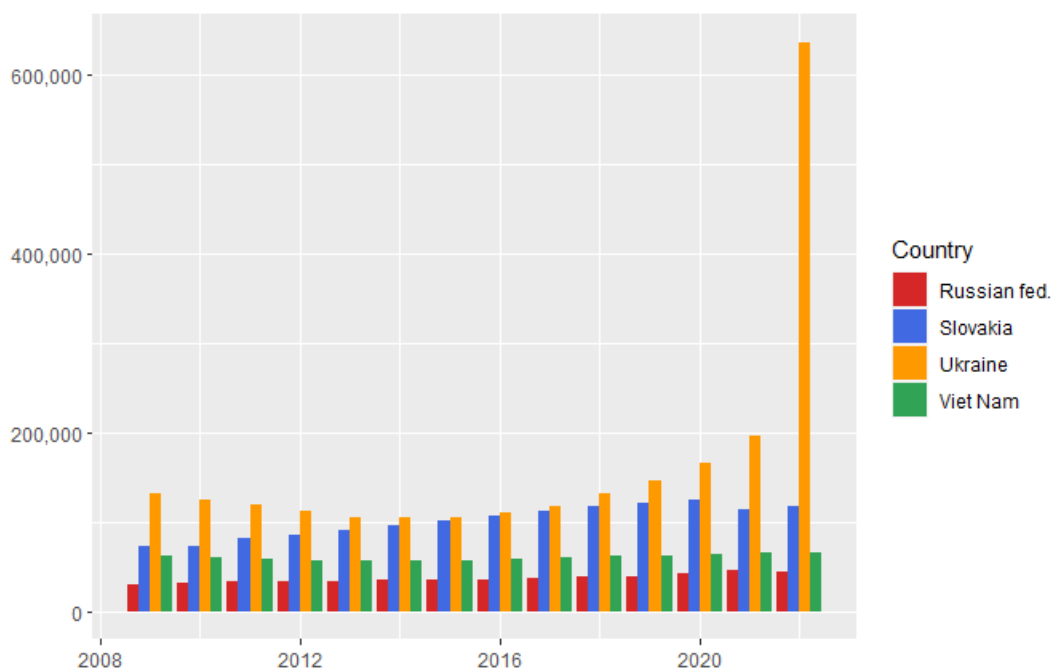
Notes: The graphical representation of the population of the four most common foreign nationalities (Ukrainian, Slovak, Vietnamese and Russian) living in the Czech Republic. The plot contains data from 2009 to 2022 by country and year and most foreigners are from Ukraine.

After the Russian invasion, the number of Ukrainians in the Czech Republic more than tripled compared to the previous year, which can be justified mainly for two reasons. First, the Czech Republic is geographically close to Ukraine, therefore, it is expected that Ukrainians decide to flee from their home to one of the nearest possible safe countries. Second, many refugees tend to settle where

their family members and acquaintances live. To underpin this assumption, a graphical comparison of the residence of Ukrainian nationals in the Czech Republic before the war in Ukraine, specifically in 2009 (Figure 3.2), and after the invasion (Figure 3.3) is constructed.

Figure 3.2: The distribution of Ukraine residents in the Czech districts in 2009
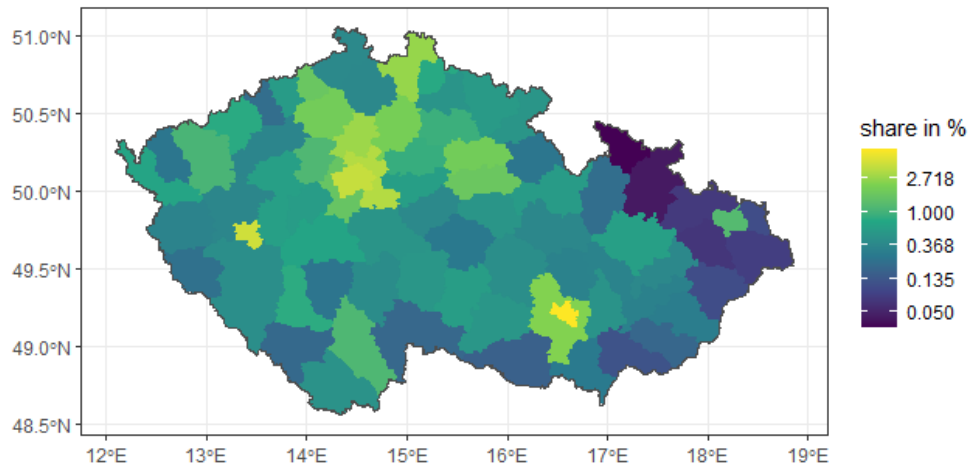
Figure 3.3: The distribution of Ukraine residents in the Czech districts in 2022
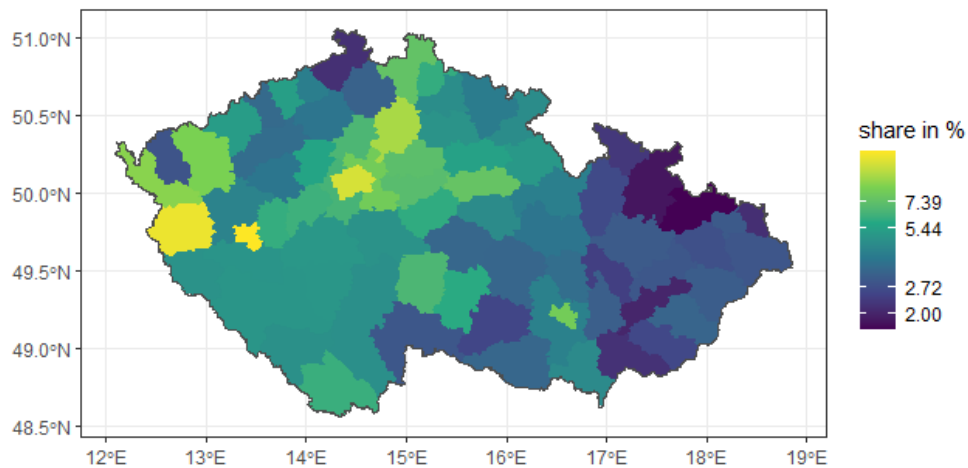
Notes: The graphical representation of the share of Ukrainians in Czech districts in 2009 and 2022. The comparison confirms that the newly arrived refugees registered in the districts where more of their compatriots live.

Districts that had the highest representation of Ukrainians among residents in 2009, such as Plzeň, Praha, or Karlovy Vary, were more exposed to the immigration flow in 2022. This confirms that the newly arrived refugees registered

in the districts where more of their compatriots live. The only exception is the Tachov district, which has one of the highest shares of Ukrainians in 2022. According to the Seznam Zprávy (2023), this is caused by the large concentration of employment agencies providing accommodation, making this region more attractive to Ukrainians.

At the same time, the Moravian districts, with the exception of Brno, were not much exposed to Ukrainian nationality before the invasion, and this situation did not change even after the invasion, in accordance with our assumption.

Note that the flow of Ukrainian refugees has affected all districts and there is not a single one without a positive change in the number of Ukrainian residents between 2021 and 2022.

Table 3.3: Summary of the change in Ukraine residents between 2021 and 2022 in Czech districts

Min.	Median	Mean	Max.
799	3530.5	5086.3	22804

Notes: Year-on-year change in the number of people of Ukrainian nationality in the districts in 2021 and 2022. The biggest change occurred in the Brno-City district and the smallest in the Jeseník district.

3.3 Other variables

Other district-level data are unemployment rates provided by the Ministry of Labour and Social Affairs of the Czech Republic. The unemployment rate is calculated as the number of unemployed residents of a certain region looking for a job divided by the total labor force in the region where the value is converted to a percentage. The highest unemployment rate is registered in the north-east district Karviná and the lowest rate is in the district Praha-východ. The high unemployment rate in the Karviná district is distorted by the fact that many former miners, who receive monetary compensation for a work-related injury or occupational disease, are registered at the Labour Office. As a result of these revenues, they are financially secure and lack the incentive to look for work.

The last data is the population in each district from the Czech Statistical Office. These data are crucial for the calculation of the per capita crime variables and are also used for the instrumental variable which will be introduced

in Chapter 4 of this thesis. The largest number of residents is located in the Brno-město district. The smallest number of people resides in Praha 1.

Table 3.4: Summary of unemployment rate and population in Czech districts

Variable	Min.	Median	Mean	Max.
Unemployment rate	1.3	3	3.33	8.3
Residents	34059	113090.5	128574.31	403196

Notes: Summary of the control variable unemployment rate (stated in percent) and auxiliary variable residents in Czech districts. The largest number of residents is located in the Brno-město district. The smallest number of people resides in Praha 1.

Chapter 4

Methodology

4.1 Instrumental variable

The distribution of Ukrainian immigrants in the regions of the Czech Republic is suspected to be endogenous in our model because immigrants tend to locate in better-performing regions thus the model could be suffering from omitted variable bias. When an explanatory variable is endogenous, the OLS estimator yields generally biased and inconsistent results.

To overcome the endogeneity problem, the possible solution is to use the instrumental variable approach. The methodology is described briefly below.

Let the linear regression model be:

$$y_i = \beta_0 + \beta_1 x_i + u_i,$$

where $i = 1, \ldots, n$ and $Cov(x_i, u_i) \neq 0$. The variable x_i is endogenous, and the OLS estimator is inconsistent. Estimation by instrumental variable uses another variable z_i to isolate the part of x_i that is not correlated with u_i to consistently estimate regression parameters.

The instrument z_i has to satisfy two conditions. The first one is the relevance of the instrument:

$$Cov(z_i, x_i) \neq 0, \tag{4.1}$$

which is tested by a simple regression $x_i = \pi_0 + \pi_1 z_i + v_i$. The condition holds if and only if $\pi_1 \neq 0$.

The other condition is that variable z_i has to be exogenous, i.e.:

$$Cov(z_i, u_i) = 0, \tag{4.2}$$

which can never be tested and relies only on economic theory, arguments, and intuition.

Therefore, it is necessary to identify an instrumental variable that has an impact on the decision regarding immigration destination but does not directly affect the local crime rate.

4.2 Bartik shift-share instrument

For the instrumental variable, the author chooses the Bartik shift-share instrument, which is an econometric technique used to estimate the contribution of various factors to the growth or decline of a particular economic sector or region. It is often used in labor economics to estimate the influence of the policies on local economic outcomes.

In this thesis, the instrument uses national inflows of migrants by country of origin with the historical geographic distribution of their compatriots. Its name, shift-share instrument, origins from the fact, that the instrument consists of two parts - the weighted average of national migration inflow from country o, i.e. shift, with weights depending on the previous distribution of foreigners, i.e. share.

Bartel (1989) suggests that immigrants tend to settle in regions where their natives live, thus, the settlement is not random. The same conclusion concerning regions of the Czech Republic is made in part 3.2 of this thesis. Following Card (2001), Jaeger *et al.* (2018) and Goldsmith-Pinkham *et al.* (2020), definition of the shift-share instrument is:

$$\tilde{m}_{jt} = \sum_o \frac{M_{ojt^0}}{M_{ot^0}} \frac{\Delta M_{ot}}{L_{jt-1}},$$

where M_{ojt^0}/M_{ot^0} is the share of foreigners from country o in the region j at time t^0, ΔM_{ot} is the number of incoming migrants at time t at the national level and finally L_{jt-1} is the number of residents of the region j at time $t - 1$.

The relevance of the instrument is tested by regressing the instrument on the variable m_{jt} representing the endogenous share of foreigners:

$$m_{jt} = \pi_{10} + \pi_{11}\tilde{m}_{jt} + u_{jt},$$

concluding $\pi_1 \neq 0$, therefore, the instrument is relevant.

The second assumption is based on the exogeneity of the instrument. The

author chooses for the base time period t^0 for the share of foreigners of the Bartik shift-share instrument the year 2009, believing that thirteen years should be a sufficiently long time to assume the exogeneity of the distribution of Ukrainians in 2009 and the errors resulting from the model explaining the crime committed in 2022 in the Czech Republic.

4.3 Models

To estimate how the refugee wave of Ukrainians to the Czech Republic, caused by the Russian invasion of Ukraine in 2022, cross-sectional data from 2022 are used for the model:

$$log(Crime_j) = \beta_0 + \beta_1 UA\_flow_j + \beta_2 Unemployment_j + \eta_j,$$

where *Crime* refers to the number of committed crimes in the region j categorized as mentioned in part 3.1 of this thesis, *UA_flow* is the number of incoming Ukrainians to the region j in 2022, i.e. the difference between the number of people with Ukrainian nationality in 2021 and 2022, *Unemployment* is an unemployment rate expressed as a percentage and η is an error term.

The UA_flow variable is expected to be endogenous and therefore the Bartik shift-share instrument is used as an IV to overcome the endogeneity problem. *Unemployment* is used as a control variable and assumed to be exogenous.

Some regions may exhibit higher incidences of crime, potentially due to factors such as the economic situation, which can make them behave as outliers in the analysis. Therefore, the logarithmic transformation is used to curtail the effects of those outliers.

For a comprehensive analysis, another model is evaluated using per capita terms:

$$log(Crime\_cap_j) = \beta_0 + \beta_1 UA\_flow_j + \beta_2 Unemployment_j + \eta_j,$$

where *Crime_cap* is the number of crimes committed in the region j divided by the number of residents of that region. This model can provide a new perspective as the per capita transformation is a more accurate indicator of crime.

4.4 Specification tests

As mentioned before, the endogeneity problem could occur. In the absence of endogeneity in the model, both OLS and IV are consistent, but OLS is more efficient. In the presence of endogeneity, only IV is consistent. The Wu-Hausman test with the null hypothesis $H_0 : Cov(x, u) = 0$ is used to indicate the presence of endogeneity. Rejecting the null hypothesis of this test means the existence of endogeneity, and thus instrumental variable is needed. This test will be individually examined in Chapter 5 of this thesis.

Another obstacle could be a weak instrument suggesting an insufficiently strong relationship between the instrument and the explanatory variable. Rejecting the null hypothesis of a weak instrument test signifies a strong relationship. From the results of the test for weak instruments, we can conclude that Bartik shift-share instrument is a sufficiently strong instrument for the flow of Ukrainian people to the Czech regions in 2022.

Table 4.1: Weak instruments test

Endogenous variable	UA flow
p-value	< 0.05

Notes: Results of the Weak instruments test rejecting the null hypothesis that our instrument is weak for the endogenous variable, i.e. our instrument is strong.

Chapter 5

Results

In this section, we evaluate the impact of the Ukrainian refugee wave on particular types of crime. We start by assessing the impact on total crime, then focus on property crime, which is expected to be most affected, followed by violent crime and misdemeanors.

5.1 Total crime

First, we estimate the OLS and IV models and run the Wu-Hausman test to test for endogeneity. The Wu-Hausman test does not reject the null hypothesis of the test, i.e. p-value is higher than 0.05, for the first model using the number of committed total crimes as a dependent variable, suggesting exogeneity. However, it does reject the null hypothesis of the test for the second model using the number of total crimes per capita, therefore we are dealing with an endogeneity problem.

Table 5.1: Wu-Hausman test

Dependent variable	logTot22	logTot22cap
p-value	0.976	< 0.05

Notes: Results of the Wu-Hausman test for endogeneity suggesting exogeneity for the model using the logarithm of the number of total crimes committed in 2022 as a dependent variable and endogeneity for the model using the logarithm of the number of total crimes per capita committed in 2022 as a dependent variable.

Although OLS is more efficient in the presence of exogeneity, we choose to use the IV method to evaluate the results of both models because we believe

that the migration wave of Ukrainians is more likely to be endogenous despite the test result. Also, in the models, where the exogeneity occurs, the values of the beta coefficients of the OLS and IV models are almost the same. For models containing an endogenous variable, we use the instrumental variable method for estimation. Robust standard errors are calculated because they are less sensitive to outliers present in our data.

The variable UA_flow is statistically significant at the 1% level for every specification. One additional Ukrainian in the wave leads to a 0.011% increase in the number of total committed crimes and a 0.008% increase in the total crime per capita due to the log-level transformation. We can see that in the presence of endogeneity, the OLS method underestimates the influence of UA_flow. The effect of the unemployment rate on total crime is also significant at the 1% level and more noticeable. An increase by 1 leads to an increase by 17.8% in the number of total crimes and a 13.6% increase in total crimes per capita (see more in Table 5.2).

We can see that the migration wave of Ukrainians increased crime in the Czech Republic in 2022, but this increase is not substantial. Therefore there is no reason to be highly concerned about the impact of the migration wave on crime and call for a stricter anti-immigration policy.

Table 5.2: Summary of the models for total crime

	Dependent variable:			
	logTot22		logTot22cap	
	OLS	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)
UA_flow	0.0001***	0.0001***	0.00004***	0.00008***
	(0.00001)	(0.00002)	(0.00001)	(0.00002)
Unemployment	0.178***	0.178***	0.123***	0.136***
	(0.031)	(0.030)	(0.026)	(0.031)
Constant	6.164***	6.166***	−4.933***	−5.199***
	(0.137)	(0.137)	(0.128)	(0.157)
Observations	86	86	86	86
R^2	0.641	0.641	0.225	0.055
Adjusted R^2	0.632	0.632	0.206	0.033
Res. Std. Error (df = 83)	0.383	0.383	0.397	0.438
F Statistic (df = 2; 83)	73.979***		12.057***	

Notes: Summary of models using total crime and total crime per capita as the dependent variable. The model is first estimated through the OLS method and then using Bartik shift-share instrument as an IV. Significance levels (robust standard errors in parentheses): *p<0.1; **p<0.05; ***p<0.01.

5.2   Property crime

We estimate the Wu-Hausman test concluding exogeneity in the first model and endogeneity problem in the second model. Again, despite the exogeneity and thus greater efficiency of the OLS method, we use the IV results to evaluate the influence of the migration wave of Ukrainians on property crime for the reason stated in section 5.1. Furthermore, robust standard errors are calculated.

Table 5.3: Wu-Hausman test

Dependent variable	logProp22	logProp22cap
p-value	0.609	< 0.05

Notes: Results of the Wu-Hausman test for endogeneity suggesting exogeneity for the model using the logarithm of the number of property crimes committed in 2022 as a dependent variable and endogeneity for the model using the logarithm of the number of property crimes per capita committed in 2022 as a dependent variable.

The Ukrainian flow is significant at a 1% level for property crimes using all specifications. Due to the log-level transformation, the interpretation is that an increase by 1 in the Ukrainian flow leads to a 0.013% increase in the number of property crimes and a 0.01% increase in property crimes per capita. The unemployment rate is also significant at the 1% level. An increase of the unemployment rate by 1 leads to an 18.9% increase in the number of committed property crimes and a 14.8% increase in property crimes per capita (see more in Table 5.4). The similarity in the impact of UA_flow on the property and total crime is due to the fact that property crimes make up the majority of total crimes. We can also note again the underestimation of the influence of explanatory variables when using the OLS method in the presence of endogeneity.

For property crime, the effect should have been the most noticeable according to the literature review, and indeed this is the case in our research. After the Russian invasion, Ukrainians had to leave their homes as quickly as possible, leaving behind everything they could not take with them. Their most valuable property remained in Ukraine, and they had to rely only on the reserves in their financial accounts. Although the Czech Republic provides financial assistance to Ukrainians to prevent incidents of extreme poverty, not all Ukrainians may have been informed of this aid. This extreme situation may have led some to find an alternative source of income, which may be theft and other property

crimes. However, the increase is not high enough to pose a major threat to the system.

Table 5.4: Summary of the models for property crime

	Dependent variable:			
	logProp22		logProp22cap	
	OLS	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)
UA_flow	0.0001***	0.0001***	0.00005***	0.0001***
	(0.00001)	(0.00001)	(0.00001)	(0.00002)
Unemployment	0.187***	0.189***	0.132***	0.148***
	(0.037)	(0.035)	(0.028)	(0.033)
Constant	5.698***	5.659***	−5.399***	−5.706***
	(0.158)	(0.157)	(0.141)	(0.180)
Observations	86	86	86	86
R^2	0.638	0.636	0.281	0.113
Adjusted R^2	0.629	0.628	0.263	0.092
Res. Std. Error (df = 83)	0.439	0.440	0.445	0.494
F Statistic (df = 2; 83)	73.084***		16.184***	

Notes: Summary of models using property crime and property crime per capita as the dependent variable. The model is first estimated through the OLS method and then using Bartik shift-share instrument as an IV. Significance levels (robust standard errors in parentheses): *p<0.1; **p<0.05; ***p<0.01.

5.3   Violent crime

In the case of violent crime, the model explaining the number of committed violent crimes contains an endogenous variable and the model explaining violent crimes per capita contains an exogenous explanatory variable. However, again, we prefer IV results. Robust standard errors are also calculated to mitigate the effect of outliers.

Table 5.5: Wu-Hausman test

Dependent variable	logVio22	logVio22cap
p-value	< 0.05	0.0896

Notes: Results of the Wu-Hausman test for endogeneity suggesting endogeneity for the model using the logarithm of the number of violent crimes committed in 2022 as a dependent variable and endogeneity for the model using the logarithm of the number of violent crimes per capita committed in 2022 as a dependent variable.

The migration flow of Ukrainians is statistically significant for the variable $logVio22$ at a 1% level. An increase of migrants by 1 culminates in a 0.005% increase in the number of violent crimes committed. For the violent crimes per capita, the UA_flow is not significant at any level. The variable $Unemployment$ is significant at 1% level and its effect is stronger than for the other dependent variables. An increase by 1 of the unemployment rate leads to an increase by 23.7% for violent crimes and by 19.5% for violent crimes per capita (see more in Table 5.6).

The increase in violent crime may be caused by disputes between Ukrainians and Czech citizens, who are unwilling to accept Ukrainians into society. These disagreements can then lead to a conflict in which the most frequent violent crime, bodily harm, is caused. A larger increase would require a reinforced police presence on the streets. Hence, the minimal effect of the migration wave on the number of violent crimes committed and the insignificant effect for violent crimes per capita is a positive finding both for Ukrainians and the image of Czech society.

Table 5.6: Summary of the models for violent crime

	Dependent variable:			
	logVio22		logVio22cap	
	OLS	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)
UA_flow	0.0001***	0.00005***	−0.00000	0.00002
	(0.00001)	(0.00001)	(0.00001)	(0.00002)
Unemployment	0.244***	0.237***	0.189***	0.195***
	(0.028)	(0.030)	(0.036)	(0.037)
Constant	3.701***	3.856***	−7.396***	−7.509***
	(0.131)	(0.147)	(0.142)	(0.148)
Observations	86	86	86	86
R^2	0.528	0.491	0.276	0.244
Adjusted R^2	0.516	0.479	0.258	0.226
Res. Std. Error (df = 83)	0.391	0.406	0.378	0.386
F Statistic (df = 2; 83)	46.382***		15.788***	

Notes: Summary of models using violent crime and violent crime per capita as the dependent variable. The model is first estimated through the OLS method and then using Bartik shift-share instrument as an IV. Significance levels (robust standard errors in parentheses): *p<0.1; **p<0.05; ***p<0.01.

5.4 Misdemeanors

The last dependent variables are the number of committed misdemeanors and misdemeanors per capita. For the model using misdemeanors, the Wu-Hausman test indicates endogeneity. In the model with per capita terms, the exogeneity is present.

Table 5.7: Wu-Hausman test

Dependent variable	logMis22	logMis22cap
p-value	< 0.05	0.387

Notes: Results of the Wu-Hausman test for endogeneity suggesting endogeneity for the model using the logarithm of the number of misdemeanors committed in 2022 as a dependent variable and endogeneity for the model using the logarithm of the number of misdemeanors per capita committed in 2022 as a dependent variable.

By removing $Unemployment$ from the model explaining misdemeanors, the UA_flow would become insignificant, and that is why we keep it in the model despite its insignificance. The variable UA_flow is statistically significant at the 10% level in the model using IV, which we prefer for the reasons already mentioned, for the number of committed misdemeanors but not significant for misdemeanors per capita. An increase by 1 immigrant increases the number of committed misdemeanors by 0.003% (see more in Table 5.8).

Misdemeanors are often committed due to ignorance or recklessness of laws and regulations. For refugees, it may be challenging to promptly learn the rules of a new country and that could be the justification for the increase in the number of committed misdemeanors. At the same time, the social harm of this increase, which is almost negligible, is not very high.

Table 5.8: Summary of the models for misdemeanors

	Dependent variable:			
	logMis22		logMis22cap	
	OLS	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)
UA_flow	0.0001***	0.00003*	−0.00001	0.00000
	(0.00001)	(0.00002)	(0.00001)	(0.00001)
Unemployment	0.058	0.047	0.003	0.006
	(0.038)	(0.042)	(0.022)	(0.022)
Constant	8.934***	9.154***	−2.164***	−2.211***
	(0.142)	(0.174)	(0.088)	(0.099)
Observations	86	86	86	86
R^2	0.367	0.264	0.008	−0.003
Adjusted R^2	0.352	0.246	−0.016	−0.027
Res. Std. Error (df = 83)	0.382	0.412	0.310	0.311
F Statistic (df = 2; 83)	24.044***		0.350	

Notes: Summary of models using misdemeanors and misdemeanors per capita as the dependent variable. The model is first estimated through the OLS method and then using Bartik shift-share instrument as an IV. Significance levels (robust standard errors in parentheses):*p<0.1; **p<0.05; ***p<0.01.

5.5 Limitations

It is important to mention that not every crime registered by the Police will result in an indictment, or worse, in a conviction. A police report is only a suspicion that a crime has been committed by a particular person, but not a finding of guilt, which belongs only to the court. Therefore, the possible limitation could be the ethnic bias concerning crime reporting and the police clearance of criminal incidents. Detailed data from court verdicts would be needed to determine whether these suspicions lead to guilty verdicts and imposing punishment, and thus whether migrants are truly dangerous. Furthermore, as mentioned earlier, we often rely on preliminary data and the final data from the Czech authorities may differ.

Another limitation may be crimes committed against Ukrainians, whether ethnically motivated or simply due to population growth. Although the migrant wave may lead to an increase in crime, we cannot blame Ukrainians for these consequences because they are only victims, not perpetrators.

Finally, this refugee wave was atypical because men were conscripted and hence the majority of the incoming people were women and children. In general, the most common perpetrator of crime is an uneducated man between 20 and 30 years old, and it is this group that has remained to fight in Ukraine. Therefore, the results cannot be generalizable to the Ukrainian population for future immigration policies.

Chapter 6

Conclusion

The Russian invasion of Ukraine in 2022 has unleashed a massive refugee wave into the Czech Republic. This country was the target of migration because of its proximity and also because immigrants tend to move to regions where their fellow citizens reside. The migration is often connected with the fear of the unknown, especially with concerns about criminal behavior. There is no economic theory regarding the direct relationship between crime and migration, however, some researches suggest that foreigners have a significant influence on crime.

The main objective of this thesis was to investigate whether the refugee wave of Ukrainians had an effect on crime in the Czech Republic to enrich the research on crime and migration, to prevent unjustified hatred and fear, and also to study the behavior of refugees.

We show that the flow of Ukrainians is a statistically significant variable and has a positive effect in explaining the number of committed property, violent and total crimes, and misdemeanors. Specifically, an increase in crime caused by one additional refugee ranges from 0.003% to 0.013%, most notably for property crime. However, the effect is almost negligible as it is close to zero.

When we transform the dependent variable to crime per capita, which is considered a more accurate indicator of crime, the flow of Ukrainians is significant only for property crime and total crime per capita. One additional refugee increases property crime by 0.01% and by 0.008% for total crime. Although the effect is positive, it is also close to zero, thus, we can conclude that Ukrainian flow in 2022 to the Czech Republic did not substantially increase crime.

We believe that our results may also inform discussion in neighboring Poland, the largest recipient of Ukrainian refugees. There are many similarities between

the countries in terms of their support for Ukraine in the war, financial aid for refugees, or the perception of refugees by locals, as well as similarities in the composition of the refugee wave. The differences, such as the labor market, are overshadowed by the numerous similarities, leading us to believe that the results can be relevant to the situation in Poland.

Although the migration wave caused a slight increase in crime, it is necessary to consider the situation under which Ukrainians had to leave their country. The Russian invasion caused people to leave their property in Ukraine and flee with almost nothing. A lack of financial resources can force people to commit acts of desperation, such as stealing, to survive. Also, adapting to a new society and learning its laws takes time and unintentional misdemeanors may be committed due to cultural differences. Therefore, it is necessary to show empathy and discretion in some cases because the effect in one year does not necessarily mean a trend for future years.

The thesis could be extended in the future by an analysis of long-term behavior after the invasion. Many Ukrainians want to return to Ukraine and some use the Czech Republic as a transfer station to Germany or another country with a good economic situation, so the short-term effect cannot be expected to be the same as the long-term effect. Also, Ukrainians are provided with financial aid which decreases the motivation to commit a crime, and therefore the thesis could be extended with an analysis of the change in the behavior of Ukrainians when the support ends.

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