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The Relevance of Homicide Rate Convergence to Public Policy in the United States

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Abstract

Many studies have explored the association between the homicide rate and transitory economic conditions. This study emphasizes the long term trends – convergence of homicide rates towards the national average. Using statewide annual homicide-rate data obtained from the Centers for Disease Control and Prevention (CDC) over the past half-century (1968-2019), our model estimates provide evidence of convergence of homicide rates toward the national average in the contiguous United States. The speed of convergence seems to be highest in the West, followed by the Midwest, and the South, but no statistically significant evidence of convergence is found in the Northeast. The findings have important policy implications for homicide intervention in the United States.

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1. Introduction

Homicide takes the lives of thousands of people each year in the United States. According to data from the Centers for Disease Control and Prevention (CDC), the number of homicides was highest in early 1990s (refer to Figure 1), and the three states with the highest numbers were California, Texas, and New York (see Figure 2). Since then, a smorgasbord of approaches that had been embarked by the police and community together, including but not limited to economic growth, high incarceration rate, changes in alcohol intake and drug markets, tougher gun control laws, better policing strategies, has led to the nation-wide decline in violence in general and homicides in particular (Levitt, 2004). However, the coronavirus pandemic contributed to the reduction or disruption of countless public and social services that were believed to have preventive impacts on violence. For instance, lockdowns and physical distancing measures meant less interaction of police with the community, disadvantaged communities lost trust and confidence in policing, and several stimulus payments and expanded unemployment benefits could have impacted the supply side of weapons that were ultimately used in homicides. This perhaps contributed to a recent surge in homicides throughout the nation.

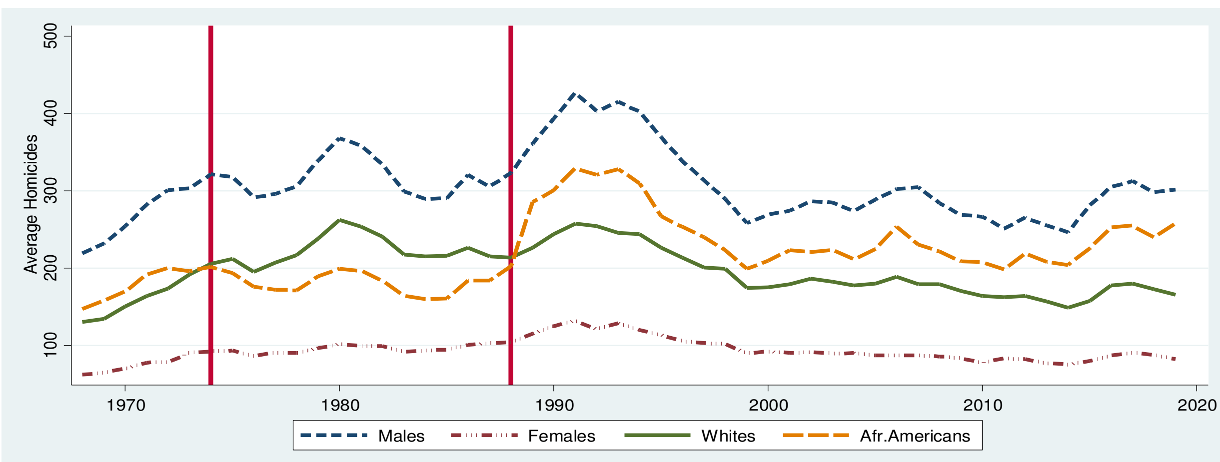

Figure 1. Average Number of Homicides by Sex and Race in the U.S. during 1968-2019

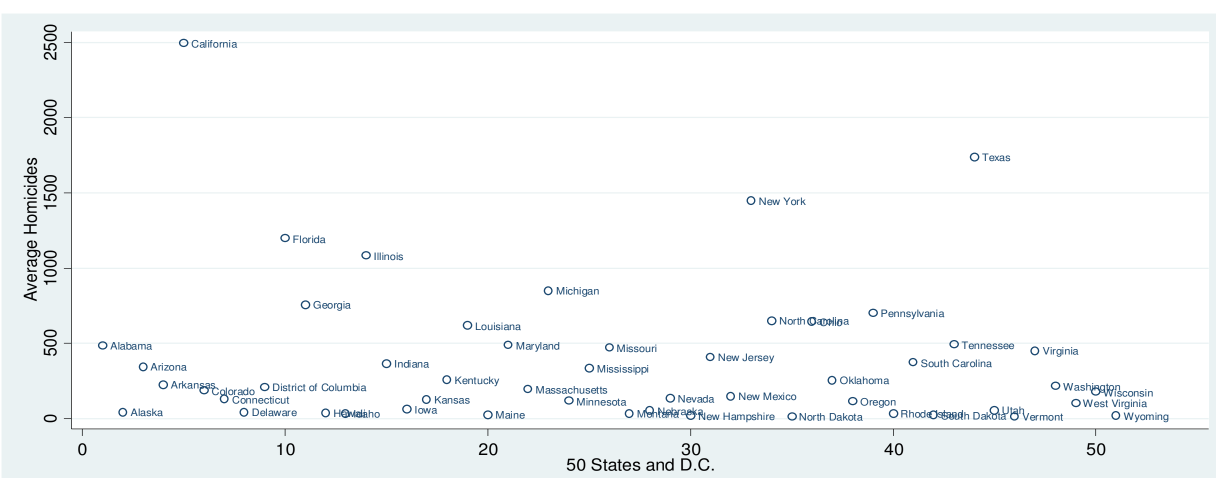

Figure 2. Average Number of Homicides by State during 1968-2019

Empirical literature has looked at homicide rate and its association with social and economic factors (Kegler et al., 2021; Stansfield et al., 2021). In economics, the majority of the research is concentrated on the association between homicide and unemployment rates where there is evidence of positive (Andresen, 2015), negative (Gonzalez and Quast, 2010), and mixed (Fallahi and Rodriguez, 2014; Phillips and Land, 2012) associations between the two. This study explores homicide rate in the United States from a novel perspective – the convergence of statewide homicide rates to the national average over the past half-century. This idea originates the literature on income convergence which dates back to the theoretical work of Solow (1956) and the analytically testable approach of Kuznets (1955). A simple and pragmatic approach to income convergence is suggested by Baumol (1986), Barro (1991), Barro and Sala-i-Martin (1992), and others.[1] Recently, however, scholars have applied its methodology to topics such as the law of one price (Parsley and Wei, 1996), convergence in global fertility rate (Dorius, 2008), convergence of obesity rate in the United States (Li and Wang, 2016), convergence of crime (Cook and Winfield, 2013), convergence of mortality due to suicide (Kitenge et al., 2019), convergence of mortality due to lung cancer (Sameem, 2020), and convergence of mortality across the African American population (Naghshpour and Sameem, 2019).

The study of convergence provides important policy implications. First, such analysis determines how states are doing with regard to the prevention of homicides compared to their previous levels. Convergence in homicide rates occurs in one of two ways. Either the homicide rates are increasing in states that had low homicide rates in the past or the rates are decreasing in the states with previously high rates. While the latter is an improvement in homicide prevention, the former indicates a problem in need of a solution. The opposite holds for divergence in homicide rates. Second, convergence could also show how states are doing with respect to homicide prevention as compared to other states. In this study, the cross sectional average homicide rate is used as the benchmark for comparison of the states over time. Depending on whether this benchmark is rising or falling, the results could indicate good or bad news. If the benchmark is falling while there is convergence in homicide rates across states, one can infer that states are trending towards a lower rate of homicide – an indication of improvement. However, if the benchmark is rising, it is an alarming implication that states are getting worse in terms of preventing or reducing the homicide rates.

Our findings indicate ample evidence of convergence of homicide rates in the contiguous United States for all people, males and female, Whites and African Americans, and various age groups. On average, the gap between homicide rates and their cross sectional means has decreased by 22.2% for the entire population. The gap has declined by 18.3% for males, 39.9% for females, 30% for Whites, and 17.1% for African Americans. The decline ranges from 18% to almost 60% for different age groups. The speed of convergence for the total population is the highest in the West (47.3%), followed by the Midwest (28.1%), and the South (16.1%), but no statistically significant evidence of convergence is found in the Northeast.

[1] For literature on income growth convergence, see Johnson and Papageorgiou (2020) and Durlauf et al., (2009).

The remainder of the paper is organized as follows: Section 2 explains data and the empirical methodology. Section 3 presents graphical and descriptive analyses of the data. Section 4 provides explanation of the results and policy implications. Section 5 concludes.

2. Data and Methodology

Merging a collection of series over time towards a uniform path is known as convergence. There are different types of convergence such as beta convergence, sigma convergence, stochastic convergence, and club convergence. Beta convergence occurs when a series with a lower starting value faces faster growth than a series with a higher starting value. Sigma convergence occurs when the dispersion of a series, as measured by the coefficient of variation or standard deviation, decreases over time. Stochastic convergence involves structural breaks utilizing unit roots and cointegration approach whereas club convergence explores the possibility of multiple convergences to different values without ever getting closer to each other. For its simplicity, the formal model of analysis here is beta convergence. Following Barro and Sala-i-Martin (1992) and Parsley and Wei (1996), we use the following dynamic panel data model with fixed effects in order to explore the possibility of convergence for homicide rates in the United States.

$$\Delta h_{it} = \alpha_i + \delta_t + \beta h_{it-1} + \gamma \sum_{i=1}^{s(k)} \Delta h_{it-1} + \epsilon_{it} \quad (1)$$

The dependent variable is the difference (Δ) in the natural logarithm of the ratio of homicide rate at time t in state i (Hit) to the benchmark – the cross sectional average homicide rate at time t ($\overline{Ht}$). Mathematically, $h_{it} = \ln(Hit/\overline{Ht})$ where the difference can be interpreted as the growth rate. Model (1) regresses that growth rate on the previous levels of state i homicide rates (h_{it-1}) and the lag values of the dependent variable (Δh_{it-1}), plus the state (α_i) and time (δ_t) fixed effects. $s(k)$ represents the number of lags included in our model to control for serial correlation. Based on Akaike Information criterion for the best fit of the model, one lag seems sufficient in most of our estimates.[2] The main coefficient of interest is β. A negative and statistically significant β with an absolute value between 0 and 1 indicates the presence of beta convergence in homicide rates. When dealing with panel data, model errors in different time periods for a given cluster (state) may be correlated, while model errors for different clusters are assumed to be uncorrelated. Cameron and Miller (2015) and Cameron et al., (2008) argue that failing to control for the within-cluster error correlation can lead to diminished standard errors, large t-statistics, and consequently misleading inferences. Therefore, model (1) is estimated using clustered standard errors at the state level in order to control for any possible geographical correlation between homicide rates. Model (1) is first estimated for the entire United States and then for the four major regions (Northeast, Midwest, South, and West), separately.

This study uses data on homicide rates in the contiguous United States, excluding Alaska, Hawaii, and Washington D.C.[3] The data sample covers over five decades (52 years), from 1968

[2] Table III in the Appendix displays the number of lags used in all of the estimates.

[3] Alaska and Hawaii are excluded from the analysis due to their substantial geographical distances from the contiguous United States as well as due to variation in their population demographics and related public policies whereas Washington D.C. is excluded because it is not a state. Also, the

through 2019. The main source of data is the Compact Mortality Files (CMF) of the CDC that reports details of demographics and mortality rates of the United States population by age, race, sex, location, and cause of death.[4] The CDC combines the population data from the Census Bureau with the mortality files in order to calculate crude mortality rates. All rates are calculated as the number of homicides per 100,000 people. The CDC marks death rates "unreliable" when the death count is less than 20, and "suppressed" when the death count is less than 10.[5] All such "unreliable" and "suppressed" rates are excluded from this study.

3. Graphical and Descriptive Analyses

Before explaining the estimations, let us have a look at the progression and dispersion of homicide rates over the sample period graphically. Figure 3 illustrates the trend of homicide rates in the United States for general population. The average homicide rate oscillates between 7 and 10 per 100,000 people from the start of the sample until early 1990s, followed by a continuous decline post-2000 reaching to as low as 5 per 100,000 people, with some upward ticks in the most recent years. In general, the graph shows a cyclical pattern, especially between 1970 and 1995, where roughly every five years there is a peak and a trough. The downturn of the 1990s, unlike the previous cycles, extends to 2014, with much more moderate fluctuations and a clear downward trend. This pattern is helpful in establishing convergence, if one were to focus on this time period alone. It is also in alliance with the bars in Figure 3 that indicate cross sectional standard errors as their decline in magnitude around the turn of the century indicates the presence of sigma convergence.

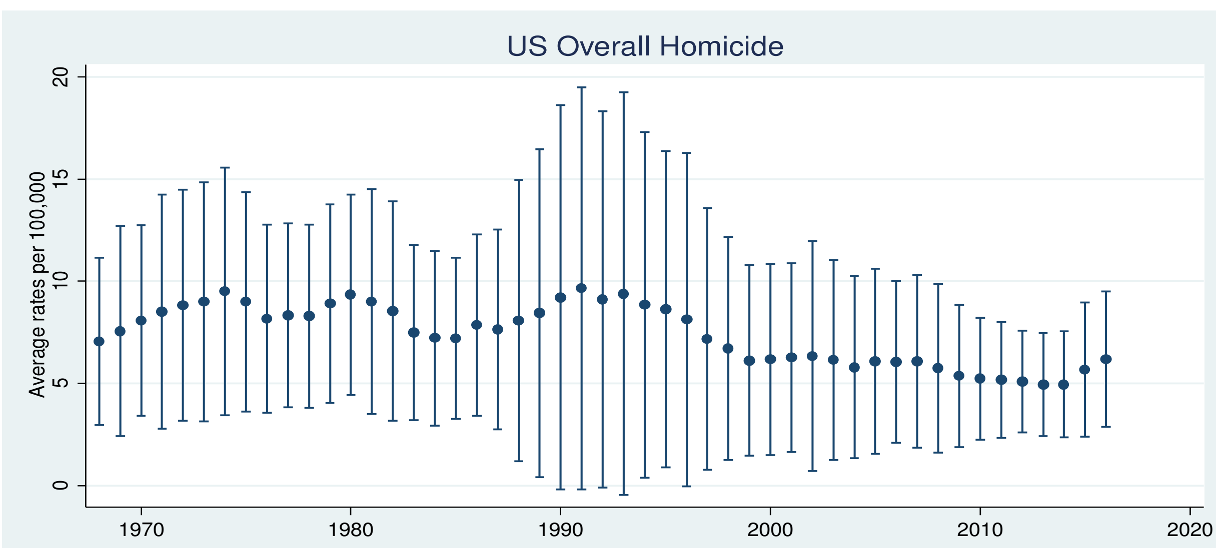

Figure 3. Average Homicide Rates Across the U.S. (The vertical bars are standard errors.)

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sample duration drops dramatically by including Alaska and Hawaii due to the limited availability of data for these states.

[4] Data link: http://wonder.cdc.gov/mortsql.html

[5] CDC, 2017. https://wonder.cdc.gov/wonder/help/cmf.html#Age Group

Figure 4 shows homicide trends by sex. It supports a well-documented reality that the average male homicide rate is many times higher than that of females. While both men and women demonstrate a steady downward trend in their respective rates, the declining trend is more pronounced for the latter. The fact that homicide rates for both groups demonstrates a similar pattern of increase-decline during about the same period indicates that the male and female behaviors, at least with regard to homicide, are governed by the same factors.

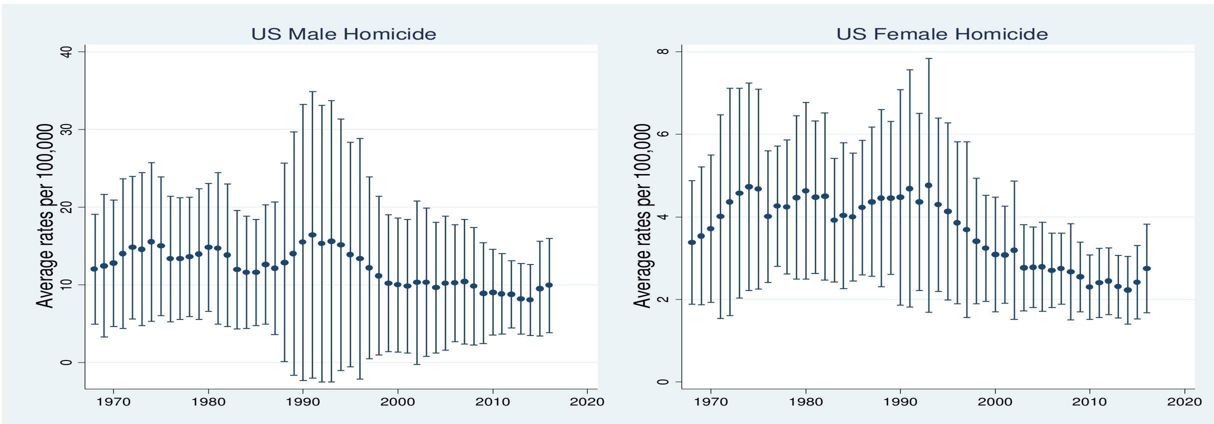

Figure 4. Average Homicide Rates by Sex (The vertical bars are standard errors.)

Figure 5 compares homicide trends between Whites and African Americans. Based on race, the average homicide rate in the latter group is more than seven times larger than that of the Whites.[6] However, the similarity of post-2000 trends in homicide rates between the Whites and African Americans is further evidence of the fact that explanatory forces between ups and downs of the homicide affect different sectors of the population in the same way. A noticeable difference between the two groups is the larger variance for the homicide rate of African Americans, throughout the study period.

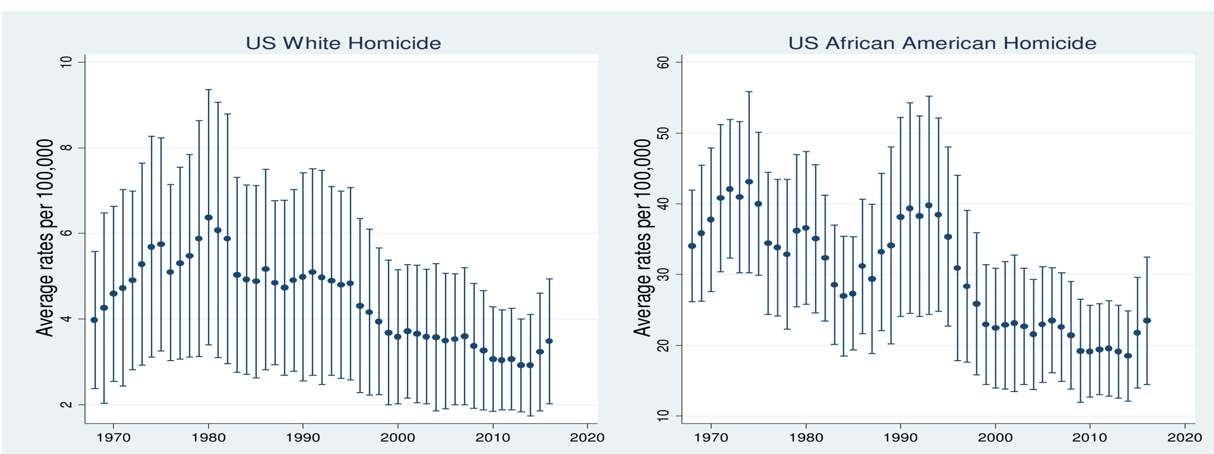

Figure 5. Average Homicide Rates by Race (The vertical bars are standard errors.)

[6] It is worth noting that the two bars in Figure 1 show that between 1974 and 1988, the average number of homicides among Whites were higher than those among African Americans.

Finally, Figure 6 provides a comparison in homicide rates based on age. Following the literature, we divide the population into four age groups – (a) below 20 year-olds, (b) 20-44 year-olds, (c) 45-64 year-olds, and (d) above 65 year-olds.[7] The age groups here are referred to as teens, young age, middle age, and old age, respectively. Figure 6 reveals a very important fact. The homicide rate of the teenage population seems to be cycle free. It demonstrates a very mild growth rate from 1970s, suddenly picks in early 1990s and declines ever since, except in recent few years. The homicide rate of the young age adults has the second smallest amplitude and one can actually detect a very gradual downward trend. Comparatively, this is the age group with the highest average homicide rate, as shown in Table I. The homicide rates of the middle aged and the older population definitely demonstrate a downward trend since the mid-70s. It would be prudent to study the homicide rate for different age groups, separately. It is apparent that the declines in the overall, male, female, White, and African American homicide rates can be explained by the decline in the rates of the middle-aged and older populations while the cyclical patterns are more influenced by the race as well as the young age adults.

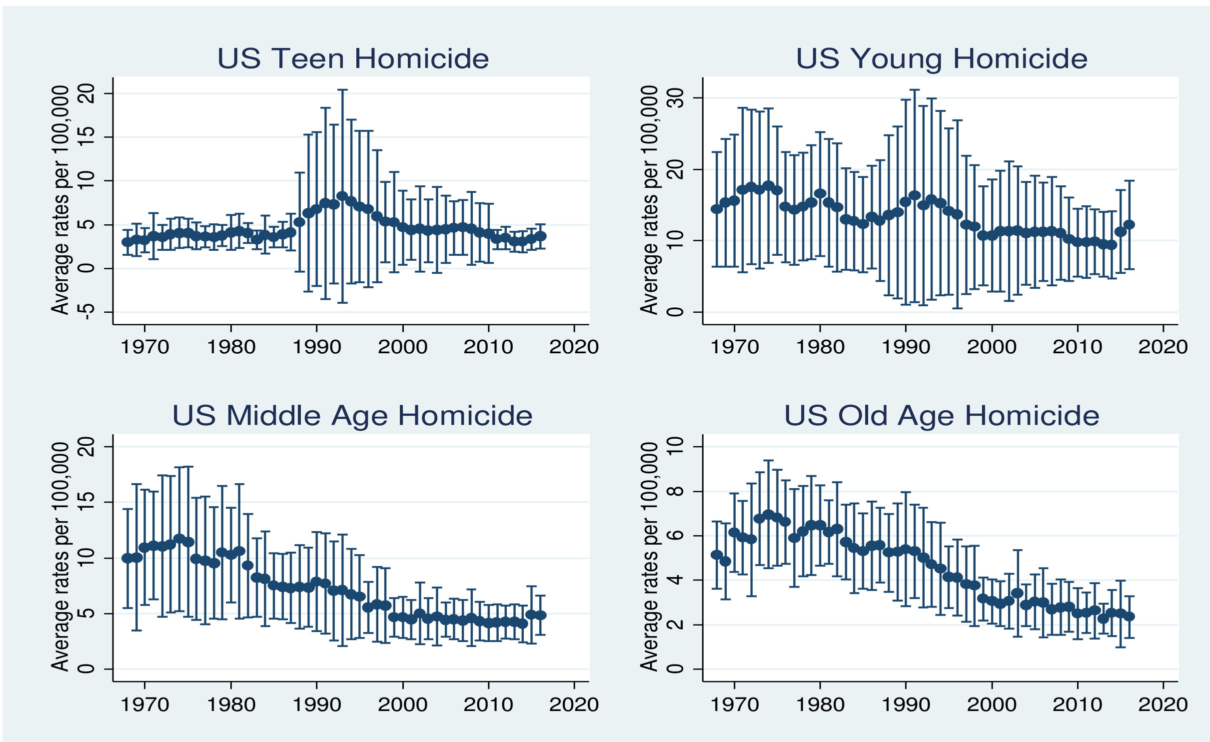

Figure 6. Average Homicide Rates by Age (The vertical bars are standard errors.)

It is also a good idea to have a glimpse at some descriptive statistics about the homicide rates in the United States. Table I provides the average homicide rates in the entire nation and across the four major regions for different demographics such as total population, men, women, Whites, African Americans, and the four age groups. Overall, there are, on average, about 7 homicides per 100,000 people across the country, and the rate is the highest in the South (9.4) and lowest in the Northeast (4.5). As compared to men, the homicide rate of women is about 3 times

[7] In the last three years of the sample (2017-2019), the teen group includes those below 24 year-olds whereas the young age group consists of those between 25 and 44 year-olds.

lower. There is a striking difference in homicide rates based on race. Not only is the average homicide rate higher for the African American population as compared to the Whites, it is also higher in the West and the Midwest as compared to the other demographic groups, in which case the South has the highest rate.

Table I: Average Homicide Rates in the United States

	United States	Northeast	Midwest	South	West
All	6.8	4.5	5.4	9.4	5.9
	(3.6)	(2.4)	(2.8)	(3.4)	(3.0)
Males	11.1	7.9	8.5	15.0	9.1
	(6.0)	(4.1)	(4.9)	(5.7)	(4.9)
Females	3.4	2.2	2.8	4.3	3.4
	(1.5)	(0.9)	(1.0)	(1.4)	(1.5)
Whites	4.3	2.9	2.9	5.4	5.1
	(2.1)	(1.3)	(1.1)	(1.8)	(2.5)
African Americans	28.9	23.9	35.3	26.7	29.8
	(11.7)	(9.9)	(12.7)	(9.0)	(13.8)
Teens	4.2	3.3	4.0	4.6	4.2
	(1.9)	(1.3)	(1.9)	(1.9)	(1.7)
Young Age	12.4	8.9	9.6	16.6	10.1
	(6.5)	(4.2)	(5.1)	(6.3)	(5.1)
Middle Age	6.7	3.8	5.0	8.6	5.9
	(3.8)	(1.9)	(2.4)	(4.0)	(3.0)
Old Age	4.5	2.8	3.7	5.5	4.0
	(2.3)	(1.3)	(1.6)	(2.4)	(1.9)

Notes: The rates are the number of deaths per 100,000 people. Standard deviations are in parentheses.

4. Results and Implications

This section provides the main estimation results and their importance for policy considerations. Table II displays beta coefficients of model (1) for all the demographic groups considered in the United States (column 1) and across the four regions (columns 2 through 5). Looking at column 1, as all the beta coefficients are negative, statistically significant, and between 0 and 1, they are consistent with the model specification, hence, indicating the presence of beta convergence for the homicide rates across the nation during the sample period 1968-2019. This implies that homicide rates are reverting to their cross sectional means used as the benchmarks in our analysis. In other words, on average, the gap between homicide rates and their cross sectional means has decreased by 22.2% for the entire population, 18.3% for males, 39.9% for females, 30% for Whites, and 17.1% for African Americans. The decline ranges from 18% to almost 60% for different age groups with the highest speed of convergence, as measured by the magnitude of beta coefficients, being observed for the old age and middle age populations.

Due to the established demographic and socio-economic variations among the regions in the United States, regional analysis of convergence in homicide rates seems warranted. Therefore, looking at columns 2 through 5 of Table II, we provide estimation results from model (1) for the four regions – Northeast, Midwest, South, and West. Except for Northeast, all other beta coefficients are consistent with the model specification, indicating beta convergence for homicide rates in the Midwest, South, and West. The speed of convergence is the highest in the West (47.3%), followed by the Midwest (28.1%) and the South (16.1%). The beta coefficients for various demographic groups among the regions follow similar pattern as those for the entire nation, which indicate higher speed of convergence for females and Whites as compared to their counterparts, respectively.

Table II: Beta Convergence of Homicide Rates in the United States

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	United States	Northeast	Midwest	South	West
All	-0.222***	-0.192	-0.281***	-0.161***	-0.473***
	(0.039)	(0.136)	(0.083)	(0.043)	(0.114)
Males	-0.183***	-0.108	-0.243***	-0.149***	-0.386***
	(0.032)	(0.088)	(0.062)	(0.040)	(0.092)
Females	-0.399***	-0.383	-0.478**	-0.348***	-0.579***
	(0.051)	(0.194)	(0.144)	(0.052)	(0.143)
Whites	-0.300***	-0.210	-0.392***	-0.248***	-0.475***
	(0.052)	(0.130)	(0.096)	(0.043)	(0.108)
African Americans	-0.171***	-0.157	-0.181***	-0.153***	-0.456***
	(0.025)	(0.078)	(0.034)	(0.036)	(0.109)
Teens	-0.308***	-0.218	-0.303**	-0.350***	-0.663***
	(0.050)	(0.138)	(0.091)	(0.076)	(0.168)
Young Age	-0.184***	-0.092	-0.285***	-0.140***	-0.423***
	(0.036)	(0.079)	(0.068)	(0.046)	(0.129)
Middle Age	-0.325***	-0.156	-0.330***	-0.335***	-0.537***
	(0.055)	(0.115)	(0.075)	(0.067)	(0.144)
Old Age	-0.594***	-0.426	-0.595***	-0.654***	-0.806***
	(0.066)	(0.247)	(0.062)	(0.079)	(0.076)

Notes: Cross sectional average rate of mortality is used as the benchmark. All regressions contain state and year fixed effects. Sample period is 1968-2019. Clustered standard errors at the state level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Homicide is one of those external causes of death that makes news headlines, almost on a daily basis, and one that could be avoided or reduced using an amalgam of public policies. The findings indicate how the states are doing with respect to homicide prevention compared to their previous levels and/or compared to other states. Depending on whether the cross sectional average homicide rates are increasing or decreasing, the evidence of convergence in homicide rates could imply improvement or deterioration in states' performance regarding the prevention/reduction of homicide rates. The various figures on trends of homicide rates (Figures 3-6) show that the average homicide rates across the states are generally high and oscillating during the early period of the study sample. However, such rates are declining after mid-90s in which case the presence of convergence would imply that some states with higher homicide rates in the past are catching up with those having lower rates more recently, therefore, showing an improvement in states' performance in terms of curbing the homicide rates at least during the last two decades of our sample period.

In addition, the stronger prevalence of convergence in a particular demographic group such as females or Whites as well as in a particular region such as the West reflects faster diffusion of information within that group or region, which could help public policy makers investigate what internal factors might be causing such a strong convergence as well as guide them in allocating resources where the channels of information are not well-connected. For instance, the stronger prevalence of convergence in the West would reflect a smoother application of crime-prevention policies in that region perhaps because of better networking whereas no evidence of convergence in the Northeast would require a multitude of public policies, hence higher costs of allocation of resources, for curbing homicide in that region.

5. Conclusion

Homicide is a negative reality of humanity. No society condones homicide, and throughout history we have strived to eliminate it through punishment, education, or religious condemnation. A reduction in homicide would signal a triumph of good over evil. It is worth exploring whether states or sub-groups of the population are converging to the same rate of homicide, which would indicate the country as a whole is becoming more uniform in its effectiveness against homicide, or lack thereof. Applying the analysis of convergence to the trends of homicide rates, this study finds the evidence of beta convergence in the entire United States. Using state level annual data on homicide rates during 1968-2019, the results suggest that homicide rates are reverting to their cross sectional means (benchmark). Since the homicide rates are trending downward after mid-90s in the nation as a whole, the presence of such a convergence would imply that some states that have not been as successful in prevention/controlling homicide rates in the past (states with homicide rates higher than the benchmark) are actually catching up to the states that have been more effective (states with homicide rates lower than the benchmark), at least within the last couple of decades. Regionally, the evidence of convergence is more prevalent in the West, with no significant evidence in the Northeast.

This study is not free from limitations. First, it uses the data at the state level within the United States. The analysis could be extended by using county level data that could provide more nuanced results because the degree of within-county variation is likely to be smaller than within-state variation allowing for less heterogeneity within the unit of analysis. Even more appropriate might be using city level or zip code based data as most of the crime incidents seem to occur within specific "hot spot" locations. Second, this study has not considered the effect of a specific public policy or factors that might have a direct or indirect effect on homicide rates. For instance, the decline in homicide rate since the 1990s could be attributed to (a) the stronger economy making legitimate labor market opportunities more attractive (Becker, 1968), (b) the sharp rise in incarceration for drug-related offences and severe sentences for those convicted of crimes (Kuziemko and Levitt, 2004), (c) the increase in the number of police force (Marvell and Moody, 1996), (d) demographic factors such as aging of baby-boomers (Perkins, 1997), (e) urban-rural differences in the diffusion of homicide (Zeoli et al., 2014), to name a few.[8] Lastly, the benchmark for comparison in this study is the cross sectional means. Supported by theoretical explanation, one can also use other benchmarks such as median or a particular state or region in future works.

[8] For an extensive literature review on the association between homicide and various socio-environmental determinants, see Wanzinack et al., (2018).

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Appendix

Table III displays beta coefficients obtained in Table II with different number of lags based on Akaike information criterion.

Table III: Beta Coefficients and Number of Lags

	(1)		(2)		(3)		(4)		(5)	
	United States	#Lag	Northeast	#Lag	Midwest	#Lag	South	#Lag	West	#Lag
All	-0.222***	1	-0.192	1	-0.281***	1	-0.161***	1	-0.473***	1
	(0.039)		(0.136)		(0.083)		(0.043)		(0.114)	
Males	-0.183***	1	-0.108	1	-0.243***	1	-0.149***	1	-0.386***	1
	(0.032)		(0.088)		(0.062)		(0.040)		(0.092)	
Females	-0.399***	1	-0.383	3	-0.478**	1	-0.348***	1	-0.579***	1
	(0.051)		(0.194)		(0.144)		(0.052)		(0.143)	
Whites	-0.300***	1	-0.210	1	-0.392***	1	-0.248***	1	-0.475***	1
	(0.052)		(0.130)		(0.096)		(0.043)		(0.108)	
Afr.Americans	-0.171***	1	-0.157	4	-0.181***	1	-0.153***	1	-0.456***	3
	(0.025)		(0.078)		(0.034)		(0.036)		(0.109)	
Teens	-0.308***	1	-0.218	4	-0.303**	1	-0.350***	1	-0.663***	4
	(0.050)		(0.138)		(0.091)		(0.076)		(0.168)	
Young Age	-0.184***	1	-0.092	1	-0.285***	1	-0.140***	1	-0.423***	1
	(0.036)		(0.079)		(0.068)		(0.046)		(0.129)	
Middle Age	-0.325***	1	-0.156	1	-0.330***	1	-0.335***	1	-0.537***	1
	(0.055)		(0.115)		(0.075)		(0.067)		(0.144)	
Old Age	-0.594***	1	-0.426	4	-0.595***	1	-0.654***	1	-0.806***	2
	(0.066)		(0.247)		(0.062)		(0.079)		(0.076)	

Notes: Cross sectional average rate of mortality is used as the benchmark. All regressions contain state and year fixed effects. Sample period is 1968-2019. Clustered standard errors at the state level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$