An Analysis of Global Homicide Patterns

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May 2015

Abstract

Homicide rates, like all other crimes, historically suffer from underreporting biases and datasets lacking a wide enough range of countries. However, the UNODC's Global Study on Homicide have made strides in complete data collections as well as analyzing homicide patterns globally. This paper takes advantage of this dataset and information source to perform a cross-country, fixed-effects regression analysis in order to determine the kinds of factors that give the best explanatory power over global homicide rates. While this paper does not succeed in a complete representation of homicide rate determinants, the fixed effects regressions do find that variables related to inequality and instability—income inequality, organized crime, and democracy—prove better explanations than other variables.

I. Introduction

Homicide, as defined by the UN's Global Study on Homicide, is the intentional act of taking another person's life, not including killings that occur within warfare and other such conflicts, and is separated into three subcategories. The first subcategory is the homicide related to other criminal activities that generally include organized crime and local gangs, drug trafficking, and robberies. Interpersonal homicide is the second. This type of homicide occurs as a result of a strained relationship between persons, ranging from the killings between intimate partners and family members to the killings from property disputes as well as those motivated from revenge. Finally, the third subcategory is the socio-political homicide, the homicide typically involving an agenda or an attempt to influence and spread power. An example of a socio-political homicide is a killing due to an act of terror.

Furthermore, homicide along with other types of crime is a global phenomenon affecting just about every country. The global average in 2012 was a rate of 9.74 per 100,000 population, but rates between countries in that time varied widely, ranging from Honduras with a rate of 90.4 per 100,000 to Iceland with a rate of 0.3 per 100,000. Table 5 in the appendix further breaks down homicide rates by sub-regions. Long-term trends similarly vary by region. While Europe and Eastern Asia have been steadily decreasing homicide rates over the past five years, Central America has found their homicide rates increasing notably (Global Study on Homicide, 2014). The question is then what type of factors cause such great variance in homicide rates between countries and what leads Central America, for example, to have some of the highest homicide rates in the world while Eastern Asia consistently contains some of the world's lowest levels.

Theories on this question depend on the particular academic field. The field of criminal justice focuses on the motives of an individual and approaches this question more from a

sociocultural viewpoint. One broad theory is the General Strain Theory which attributes crime to the strain of failing to achieve goals, the contrast between expectation in relation to social norms and actual achievements, exposure to negative experiences in society, and a washing away of previous achievements. In other words, this theory focuses on varying types of inequality: inequality by race, income, and even the kind found in individual relationships (Criminal Justice 8th Edition, 2007). While this paper focuses from an economic point of view rather than a sociocultural one, this theory is still useful for context, and its themes on inequality and negative kinds of strain are general enough to parallel similarities to research from economic fields.

In Economics, crime is sometimes correlated with war and other conflicts. Thus, from the broadest sense, conflict theories in economic papers focus on perceptions, about the ability to uphold settlements as well as the perceptions of the strength or weakness of the other party and the probability of winning or losing (Hirshleifer, 1995). This theory applies much more to warfare than to crime. However, in committing a crime, an individual takes into account the probability of getting caught, and this theory can be applied in a broad sense to the individual and their perception of winning and losing in the sense of getting away with the crime versus getting caught. Much of the more specific literature on the intersection of crime and economics generally all agree upon an aspect of inequality and opportunity that goes into committing crime. Higher levels of inequality and lack of other opportunities increase motivation to commit crimes, and thus factors such as unemployment and urban cities are often linked of higher levels of crime (Burdett, Lagos and Wright, 2004; Glaeser and Sacerdote, 1999).

While these theories are all slightly different in viewpoint, certain factors can be taken from these to test their predictive power in a cross-country regression analysis. Namely, there is a common theme between criminal justice theories and economic theories highlighting the

importance of inequality as well as social, political, and economic stability in a society. This paper chooses to focus on an economic perspective rather than a sociocultural one, and the aim of this paper is to use these theories to test their implications upon a wide range of countries: whether economic factors can trace global homicide patterns, whether GDP or income inequality better predicts homicide, and whether factors cited on a subnational level such as urbanization and unemployment uphold as significant variables on a global stage.

Section 2 gives a more in-depth analysis of previous literature and how these influence variables tested within the regressions as well as hypotheses on which factors are expected to be significant. Section 3 focuses on data and methodology as well as the particular challenges involved, especially those with collecting data on crime. Section 4 reports the results from these regressions and discusses conclusions that can be taken alongside the limitations of this paper. Finally, section 5 summarizes the final conclusions.

II. Literature Review

In this section, the review of the literature is separated by variable, and each variable is broadly separated further into types. There are the variables that factor into ease of homicide such as urbanization, gun laws, and organized crime. Then there are the variables describing political, social, and economic inequality and instability such as income inequality, war, type of political regime, and ethnic fractionalization. Finally there are the variables strictly describing economic situations such as GDP and unemployment.

Urban areas in most parts of the world have higher levels of homicide than their rural neighbors. However, a few countries in Eastern Europe who sport an opposite relationship between

urban and rural areas demonstrates this pattern albeit common is not entirely universal (Global Study on Homicide, 2014). In general urban areas contain a mixture of factors that make them both better for crime and worse. The risk factors that typically win out, making urban areas pattern higher crime rates, include increased levels of income inequality, stronger existence of organized crime and local gangs, more anonymity that decreases probability of getting arrested, and differences in family structure from rural areas. Yet at the same time, cities benefit from an increased police force and better access to infrastructure and services such as education and health (Global Study on Homicide, 2014; Glaeser and Sacerdote, 1999).

While the benefits of city living outweigh the risks in the Eastern Europe region, this is not found to be as true in the rest of the world. Including the percentage of urban areas into the regression model would test whether urban areas themselves are a determinant of crime or whether it is the unique mixture of factors within cities that, for the most part, result in higher crime rates, and even if an urban variable only picks up on a mixture of risk factors, a significant p-value could signify missing variables.

H_1: Due to the higher anonymity with a denser population that decreases chances of arrest, a country with higher percentages of urban areas should suffer from higher crime levels, including homicide.

The method of murder, ranging from firearms to sharp objects to blunt force trauma, varies by region. Europe and the Oceania have the smallest portion of homicides committed by firearms in 2012 at 13% and 10% respectively while firearms cause a high of 66% of homicides in the Americas. Despite the difference between regions, firearms still make up the largest mechanism globally in 2012 at 41% (Global Study of Homicide, 2014). The huge gap in firearms as the mechanism of homicide between Europe and the Oceania and the Americas is also accompanied

by a similarly wide gap between overall homicide rates between the regions (Global Study of Homicide, 2014). Even though the availability of guns cannot be the only determinant between that gap, the similar existence of homicide and firearm usage gaps among the same regions smarks gun availability as a possible determinant of homicide rates.

H_2: Gun laws within a country can make guns easier to own and carry in public. Therefore, countries allowing open carry or having less prohibitive gun laws should have higher levels of homicides committed by firearms and correlate to higher homicide rates.

As stated in the Introduction, the Global Study on Homicide organizes homicides into three subcategories. While those caused by interpersonal relationships can be difficult to quantitate, the subcategory of homicides related to criminal activities involving robberies, drug trafficking, organized crime and local gangs can be quantified. Robbery only accounts for about 5% of homicides globally (Global Study of Homicide, 2014). The activities of organized crime and local gangs, however, tend to result in a greater share of homicides. In the Americas, for example, homicides related to organized crime and local gangs in 2013 account for up to an estimated 30% (Global Study of Homicide, 2014). A further support for organized crime's effect on homicide can be seen in the proportions between homicide victims' age ranges. The vast majority of homicide victims globally belong to males aged 15-29 and 30-44, of which the proportions for male victims aged 15-29 are even higher in regions suffering from greater levels of organized crime and local gangs (Global Study of Homicide, 2014).

H_3: A higher presence of organized crime in a country, due to the potential of its criminal activities to result in homicide, should see higher rates of homicide.

Income inequality is often cited as a determinant for crime. In the broadest sense, income inequality increases negative strain within relationships, especially between those of the individual versus society. The perceived notion within a society of lifestyle success in regards to wage and standard of living might be higher than what a board range of the population can achieve, incentivizing more to turn to crime to correct this (Criminal Justice, 8th Edition, 2007). On another level, higher levels of income inequality could also be correlated with a more unstable society. For example, Japan's low rates of homicide is attributed in part to its low levels of income inequality and a relatively long-term stable social and economic situation (Global Study of Homicide, 2014). Furthermore, previously mentioned variables, specifically urbanization, also cite income inequality as reasoning for the patterns seen above. Urban areas have higher levels of income inequality which puts those areas at greater risk for crime (Glaeser and Sacerdote, 1999).

H_4: Income inequality is an important determinant of crime, both potentially revealing a more unstable social and economic society and being a potential driver behind worldwide patterns of crime such as higher crime rates in urban areas. Thus, higher levels of income inequality should result in higher rates of homicide.

Although deaths that occur through war and conflict are counted as a type of murder separate from homicide, the instability that occurs during countries in conflict or through their post-conflict years are related to the Global Study of Homicide's definition of homicides from socio-political reasons (2014). Countries in conflict and post-conflict situations also suffer from weaker rule of law, and in times of weaker rule of law, the probability of arrest decreases. As one result, homicides by organized crime and interpersonal killings in conflict and post-conflict settings are found to increase (Global Study of Homicide, 2014). On many levels, war and related

conflicts influence crime rates and increase instability in more than one platform that in theory should increase the benefits of crime while decreasing the efficiency of legal and police institutions.

H_5: Because war can cause political, social, and economic instability that in turn weaken the institutions regulating justice, countries in wartime and in recent post-conflict situations should suffer from increased rates of homicide.

If both the stability of the political structure and the efficiency and strength of rule of law affect crime rates as stated in paragraphs above, it follows that the type of political institution might have an influence upon global trends of homicide rates. Democracy has been positively correlated to both GDP and education. Theory from Daron Acemonglu and James A. Robinson has shown a greater chance for a political institution to become a democracy in countries with lower levels of income inequality and that countries with higher levels income inequality are more likely to resist democratization (Roland, 2014). In addition to this, the lack of political freedoms g by political institutions other than democracies could be a point of contention between citizens and those in political power, creating political instability (Fearon and Laitin, 2003). Therefore, given all of these factors, we might expect that variables controlling for political institutions, such as democracy and anocracy, might also influence homicide rates.

H_6: A dummy for democracy should decrease homicide rates due to its positive correlations with GDP and higher education as well as its relationship with a stable rule of law and lower income inequality. On the other hand, a dummy for anocracy should increase homicide rates since an anocracy can be a potential sign of greater political instability.

Another factor to be taken into consideration is a measure of ethnic fractionalization. In the Fearon and Laitin (2003) analysis of predictors for civil war, one of their hypotheses was based on

the idea that there are barriers for upward mobility put into place by the dominant culture in a country and that higher levels of ethnic minorities would put a greater risk of state instability and higher risks of civil war. While this was proven untrue in their analysis, it remains a potential factor that increases social conflict (Esteban and Ray, 1999). In applying this more specifically to homicide, increased ethnic minorities discriminated against by the dominant culture could still increase political and social instability as well as lead ethnic minorities to be potentially more likely to start up local gangs and organized crime syndicates if there is an absence of effective rule of law.

H_7: More ethnic diversity in a country and measures quantifying it should increase risk of greater homicide rates in a country due to polarization between the dominant culture and ethnic minorities.

Unemployment within the economic literature is also a factor linked with higher levels of crime. The theory here goes that some crimes, such as robbery, are motivated by greed and that unemployment gives an increased incentive to commit a crime by reducing other viable economic opportunities. Committing a crime successfully while unemployed has an increased payoff (Burdett, Lagos, and Wright, 2004). Therefore, unemployment leads to numerous factors that theoretically should increase crime rates all around, including homicide. Additionally, homicide is not an isolated phenomenon. Roughly five percent of all homicides worldwide occurs as a consequence of a robbery (Global Study on Homicide, 2014). While this is not a very large percentage, an increase in robberies, which should fall under the umbrella of crime rates that increase with unemployment, should further see an increase in rates of homicide.

H_8: Unemployment decreases an individual's opportunities and provides increased incentives to commit crime, and thus, an increase in unemployment rates should see a similar increase in homicide rates.

Finally, higher income countries follow many of patterns stated above. Higher income countries tend to have less organized crime while increasing educational levels (Sung, 2004). More education should increase opportunities of males and should decrease the amount of male youths who turn to organized crime and local gangs for livelihood. Additionally higher income countries are also more stable socially, politically, and economically on the whole. Studies on the determinants of civil war have shown that countries with higher GDP per capita are less likely to experience civil war (Fearon and Laitin, 2003; Collier and Hoeffler, 2004). Higher GDP countries should imply a more stable political, economic, and social structure, a stronger rule of law, and a decrease in crime rates as a result.

H_9: Countries with higher GDP per capita should have lower homicide rates.

On one more final note, this paper draws inspiration and follows in the footsteps of studies by Fearon and Laitin (2003) as well as Collier and Hoeffler (2004) who have analyzed the predictors and determinants of civil wars, and many of the variables discussed above have already been analyzed by them through a similar methodology proposed in the next section. Both tested whether civil wars were better predicted by economic factors versus ethnic and religious grievances and found that economic factors relating to state weakness hold greater explanatory power than factors of perceived grievance. On the whole, both found that per capita income, politically instable states, large population, and countries with more exportable goods had higher explanatory power for civil war while factors such as democracy, income inequality, and ethnic and religious fractionalization did not (Fearon and Laitin, 2003; Collier and Hoeffler, 2004).

While specific factors predicting homicide are bound to be somewhat different than those for civil war, using these papers as a backdrop for previous research and methodology are still useful, especially regarding the interrelatedness between war-torn countries and higher rates of crime all around. Homicide does not exist in a vacuum, and so we should expect to see that at least some of the predictors for civil war should also be significant for predicting homicide. Furthermore, this paper gives a chance to analyze whether predicting homicide rates follows a similar pattern as predicting civil wars and whether, like civil war, economic factors are more important than perceived grievances.

III. A Description of Data, Model, and Their Limitations

a. Data and Limitations

Homicide rates were taken from the UN's Global Study on Homicide databank and are measured per 100,000 population. Geographic regions and country income ranking also came from the metadata belonging to this same dataset. GDP per capita is measured in $US and adjusted for inflation. The GDP per capita variable, % of urban areas within a country, and unemployment rate are all taken from the World Bank database. The measure of organized crime is from the World Economic Forum's Global Competitiveness Report and is an index from 1 to 7, 1 being the worst levels of organized crime and 7 being the best. The Gini coefficient for income inequality came from the CIA Factbook, information on current war data from Systemic Peace and include all current wars both international and intra with over 1000 dead, and finally all information on gun laws regarding open carry from the Gun Policy database. The dummy on open carry is a 1 for countries allowing any kind of open carry, be it with or without a permit. The ethnic

fractionalization index came from Alesina's 2003 analysis whose primary source was based on the Encyclopedia Britannica (2001). The information for democracies, anocracies, and autocracies came from the Polity IV database on Systemic Peace. The variable for democracy was a 1 if it ranged from 6 to 10 and a 0 otherwise. Anocracy was a 1 if the score ranged from -5 to 5 and a 0 otherwise.

Crime rates are a difficult data challenge, especially in a cross-country study. These crime rates are often underreported, and for some countries, not recorded and shared at all. Victimization surveys might be a better measure of crime rates and solve at least some of the underreporting problem. However, victimization surveys are also not necessarily available for a wide base of countries worldwide. The number of samples in the homicide rates dataset is 156. Taking the rates for assault and robbery from the same year and organization for instance, the rates for assault and robbery only have half as less samples at 71. Among the various crime rates recorded by the UNODC, homicide has the most complete dataset, and this in part influenced the focus of this study to homicide rather than a broad base of different crimes.

Many other variables also suffer from a lack of availability upon a broad country base. While I would have liked to include school enrollment as a factor in the regression, the data observations for the year 2012 was not enough to give an acceptable number of observations. Similarly the Gini coefficients in the World Bank dataset have coefficients for each year. However, like the variable measuring school enrollment, the Gini coefficients for 2012 was also severely limited in the number of observations, and during regressions, gave too low a number. More complete datasets for the Gini coefficient for income inequality all come from older years, but give enough data points to provide a valid number of observations for the regressions. I would have also liked to have included a variable counting the number of years since a country's last previous

war. However, most databanks do not count previous to 1945, also limiting the number of data observations too severely. Finally, the World Bank does not have an index for ethnic fractionalization, and complete indexes are also based on older years.

Table 1 gives some average homicide rates by variable. For some variables the average homicide rate follows what I would expect to see given the discussion from section 2. Among incomes levels, the lowest homicide rates are countries that are high income: nonOECD followed by high income: OECD with a wide margin, falling in line with the hypothesis that countries with higher GDPs would have lower homicide rates than countries with lower GDPs. Anocracy has the higher average homicide rates among the political regime types, again falling in line with the hypothesis that the more potentially instable anocracies might have higher homicide rates than stable democracies or even stable autocracies. Similarly war also has a higher average than

Table 1: *Averages of Homicide Rates for Various Factors*

	Average Homicide Rates	Sample Size
Total	9.74	156
Low Income	9.35	156
Lower Middle Income	12.77	156
Upper Middle Income	12.87	156
High Income: nonOECD	8.72	156
High Income: OECD	1.34	156
Africa	10.87	156
Americas	21.65	156
Asia	4.51	156
Europe	2.09	156
Oceania	4.05	156
Democracy	9.92	122
Anocracy	10.84	122
Autocracy	6.84	122
War	11.53	21
No War	9.46	134
Open Carry	8.69	122
No Open Carry	13.23	122

countries in no war. The only variable in Table 1 that does not fall in line with the hypotheses from section 2 is the open carry variable. Countries with laws prohibiting open carry actually have higher average homicide rates than countries allowing open carry, contradicting the hypothesis that a higher availability of guns would increase homicide. Whether laws allowing or prohibiting open carry actually affect homicide rates will be discussed with more detail in section 4 as will a regression analysis testing the statistical significance of these variables.

b. Methodology

As stated in the introduction and demonstrated in Table 1, homicide rates follow a general pattern among regions. Countries in the Americas and Africa typically average higher homicide rates than countries in Europe, Asia, and the Oceania. While there are further more specific variances by sub-regions that can be seen in Table 5 in the appendix, the regional variances hold enough to where any methodology analyzing determinants of homicide either need to fully describe variances between countries or include some kind of geographical dummy to control for these regional patterns. This paper uses the fixed effects methodology to control across regions.

Assuming for a moment that the regression only has one coefficient and that variable being tested is GDP per capita, the representation of a fixed effects regression is as followed:

$$Hom_i = \beta_0 + \beta_1 GDPPC_i + \gamma_2 D2_i + \gamma_3 D3_i + \gamma_4 D4_i + \gamma_5 D5_i + \mu_i \quad [1]$$

in which Hom_i stands for homicide rate for each country and D2 through D5 are the fixed effect geographical region dummies omitting Africa. D2 represents the Americas, D3 Asia, D4 Europe, and D5 the Oceania. The actual regressions used in this paper include more variables than just GDP per capita and would simply be accounted as further β_n coefficients.

Table 2: *Homicide Rates in 2012 for Selected Countries*

The Americas	Homicide Rates (2012)	Europe	Homicide Rates (2012)
Colombia	30.8	Austria	0.9
Ecuador	12.4	Finland	1.6
Guatemala	39.9	Ireland	1.2
Mexico	21.5	Romania	1.7

The fixed effects methodology is used when there are fixed entities among the observations that affect the dependent variable being tested. A fixed effects regression then takes into account the difference between fixed entities, in this case geographical regions, and serves to control for omitted variables that vary across geographical regions. Table 1 includes the average homicide rate across region. Each geographic region, except Asia and the Oceania, shows a varied difference in average homicide rates, demonstrating the existence of variables common to countries among the same region that led to higher homicide rates in one particular region over another. Table 2 gives a small snapshot of a few selected countries from Table 5 to briefly compare countries between regions. Like the regional averages, homicide rates in 2012 for countries in the Americas are typically much higher than countries in Europe, and similar patterns can be found within other regions and countries, more than the eight countries and two regions shown in Table 2.

Overall Tables 1, 2, and 5 demonstrate why a fixed effects regression is a justifiable methodology for the cross-country analysis of homicide rates in this paper. It is needed in order to take into account the differences among regions not expressed by the variables tested in this paper. Ideally the coefficients for the geographical regions should be zero. Any statistically significant coefficient within these dummies then control for an omitted variable and signify that the variables

tested do not completely and adequately describe the differences in homicide rates between regions and between countries.

IV. Empirical Analysis

a. *Results*

Tables 3 and 4 summarizes the results from the regression analysis. In order to account for the possibility of a nonlinear relationship, Table 3 uses a log measure of the homicide rates, GDP per capita, and the Gini coefficient while Table 4 uses the original measure of variables from datasets. In both tables, the Americas, Asia, Europe and Oceania dummies are the fixed effect entities. Their coefficients are shown here to understand which regional dummies are significant based on the variables included within the regression models and whether there is ever a model where the fixed effects are not significant.

For GDP per capita, section 2 hypothesized that countries with lower GDP per capita would be at a higher risk for homicides. While GDP per capita is significant and its coefficient negative as hypothesized in (1) and (8), it is no longer significant when other variables are included in the other regressions. Therefore it is difficult to say that GDP per capita by itself is a predictor of higher homicide rates. Countries with high GDP per capita might have common variables that decrease homicide, but without further models suggesting otherwise, GDP per capita alone does not have satisfactory explanatory power.

Contrary to the GDP per capita coefficient, the Gini coefficient for income inequality remains highly significant at a 1% level for regressions (1) through (7) and significant at the 5%

level for regressions (9), (10), and (12) no matter which variables are included. The Gini coefficient is only insignificant in regression (11) with the inclusion of the organized crime index using homicide rates rather than a log(homicide rates). However, even in (11), the Gini coefficient would

Table 3: *Fixed Effects Regression Using Log(homicide rates) from 2012*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(GDPPC)	-0.32**	-0.19	-0.20	-0.18	-0.18	-0.17	-0.059
	(0.11)	(0.13)	(0.14)	(0.15)	(0.13)	(0.13)	(0.16)
Log(Gini)	1.98**	2.04**	1.99**	2.13**	1.67**	1.82**	1.83**
	(0.58)	(0.58)	(0.59)	(0.61)	(0.62)	(0.60)	(0.63)
Gun Laws	-0.39	-0.38	-0.38	-0.38	-0.32	-0.30	-0.30
	(0.23)	(0.22)	(0.22)	(0.23)	(0.21)	(0.21)	(0.21)
War	0.58*	0.59*	0.61*	0.61*	0.32	0.33	0.34
	(0.30)	(0.27)	(0.28)	(0.28)	(0.29)	(0.28)	(0.29)
EFI				-0.15		-0.58	-0.43
				(0.45)		(0.44)	(0.46)
Unemployment			0.0076	0.0033			0.0041
			(0.013)	(0.013)			(0.013)
% Urban		-0.0099	-0.01	-0.01			-0.009
		(0.0006)	(0.0065)	(0.0068)			(0.0062)
Organized Crime					-0.31*	-0.33*	-0.32*
					(0.14)	(0.14)	(0.14)
Democracy	-0.85*	-0.77*	-0.75*	-0.76*	-0.77	-0.70*	-0.62*
	(0.36)	(0.32)	(0.31)	(0.31)	(0.43)	(0.34)	(0.31)
Anocracy	-0.81*	-0.67	-0.64	-0.64	-0.75	-0.66	-0.51
	(0.40)	(0.36)	(0.34)	(0.35)	(0.49)	(0.42)	(0.38)
Americas	1.14**	1.23**	1.28**	1.23**	0.53	0.41	0.54
	(0.29)	(0.28)	(0.30)	(0.30)	(0.34)	(0.36)	(0.36)
Asia	-0.70	-0.67	-0.64	-0.69*	-0.80*	-0.96**	-0.88*
	(0.33)	(0.36)	(0.30)	(0.33)	(0.32)	(0.35)	(0.34)
Europe	0.04	0.03	0.023	0.034	-0.38	-0.57	-0.54
	(0.41)	(0.41)	(0.41)	(0.42)	(0.44)	(0.48)	(0.49)
Oceania	-0.56	-0.51	-0.45	-0.52	-0.72	-0.88	-0.76
	(0.54)	(0.54)	(0.55)	(0.55)	(0.50)	(0.50)	(0.53)
Constant	-2.05	-2.92	-2.77	-3.24	-0.39	-0.68	-1.45
	(2.72)	(2.72)	(2.75)	(2.84)	(2.95)	(2.94)	(2.93)
No	82	82	82	81	77	76	76
F-Statistic	28.94	26.63	24.27	26.64	35.46	42.78	37.52

*: significant at 5%; **: significant at 1%

Table 4: *Fixed Effect Regression Models Using Homicide Rates from 2012*

	(8)	(9)	(10)	(11)	(12)
GDPPC	-0.00013**	-0.00011	-0.000028	0.000067	-0.00013
	(0.00004)	(0.000054)	(0.000086)	(0.000071)	(0.00010)
Gini		0.5*	0.59*	0.31	0.52*
		(0.2)	(0.24)	(0.19)	(0.22)
Gun Laws		-5.76	-6.15		-4.6
		(4.01)	(4.09)		(3.27)
War		0.5	3.14	-2.63	-2.08
		(2.3)	(2.87)	(3.08)	(3.14)
EFI			-11.79		-17.32*
			(8.23)		(8.21)
Unemployment			0.014		0.089
			(0.19)		(0.17)
% Urban			-0.1		-0.032
			(0.098)		(0.079)
Organized Crime				-6.06**	-6.8**
				(1.97)	(2.25)
Democracy			-7.05		-4.88
			(3.69)		(4.02)
Anocracy			-4.35		-3.19
			(3.21)		(3.73)
Americas	12.68**	13.02**	15.07**	3.14	2.58
	(3.48)	(4.72)	(4.79)	(3.21)	(4.11)
Asia	-5.01**	-2.8	-6.76	-4.67	-8.66*
	(1.39)	(2.25)	(3.51)	(2.37)	(3.49)
Europe	-5.74**	-0.29	0.0098	-3.15	-6.98
	(1.54)	(3.51)	(4.63)	(3.57)	(4.64)
Oceania	-6.16**	-3.47	-4.11	1.11	-8.26
	(1.3)	(5.03)	(5.49)	(4.01)	(6.24)
Constant	11.28**	-6.71	5.95	27.21*	40.21**
	(1.3)	(9.09)	(9.07)	(10.67)	(14.25)
No	145	85	81	90	76
F-Statistic	18.75	9.63	9.7	9.29	9.5

*: significant at 5%; **: significant at 1%

be significant had a 10% level been included within this paper. Furthermore, the coefficient is always positive in the direction expected. Higher levels of income inequality in a country increases the risk of higher rates of homicide. Unlike the variable for GDP per capita, income inequality has the potential to be a strong predictor of global homicide patterns, and based on the regressions from Tables 3 and 4, has some explanatory power over homicide rates.

The variable, gun laws, is a 1 if open carry is allowed and a 0 if prohibited. The US in not included in these observations because whether or not open carry is allowed depends on the state and is not uniform in federal law. The coefficient for the gun law variable goes in the opposite sign as expected and postulated from hypothesis 4, and moreover, none of the coefficients in any of the models are significant. Whether a country does or does not allow open carry does not seem to have significant explanatory power or influence over homicide rates. I also included a measure for possession rate in a country, which is the estimated number of firearms owned both legally and illegally per 100 population, in a separate regression not included in Tables 3 or 4, and the coefficient for this similarly was insignificant. Thus, this implies that, contrary to the hypothesis, H_2, the availability of guns is not a proper determinant for homicide rates in a country. Perhaps part of what makes this variable insignificant is that homicide methodologies is not limited to gun usage and include many other factors such as blunt and sharp objects, poisons, and precedence of alcohol and illegal drugs. In the absence of guns, perhaps homicide methodology simply changes, and prohibiting open carry at the very least does not necessarily influence homicide rates.

The coefficient for war is significant and positive as expected in regressions (1) through (4). However, this becomes insignificant and stays insignificant when an organized crime index is added. While war might not be a great determinant of higher homicide rates alone, there might be another variable missing common to countries involved in war and countries with higher

prevalence of organized crime. H_5 stipulated that war as a variable might be significant in increasing homicide rates in a country due to the weaker rule of law and greater state instability, and perhaps the significant coefficient in regressions (1) through (4) might be picking up on these underlying variables omitted in these models. Thus, it might be beneficial for future studies on determinants of homicide to include an index for both rule of law and state stability.

The ethnic fractionalization index is only significant for regression (12), and is close to being significant in (10). However, the coefficient for ethnic fractionalization is not close to significance in Table 3. This gives mixed results for ethnic fractionalization, but this does not completely disprove that ethnic fractionalization has some kind of explanatory power for homicide rates while simultaneously not proving it either. If anything this variable gives evidence to further explore the influence of ethnic fractionalization on homicide rates in future studies.

When included, the coefficient for unemployment is always insignificant. While it does goes in the positive direction as expected, the coefficient is so small that, even if it was significant, it wouldn't hold much economic significance either way. Contrary to H_8, even if unemployment does have some kind of effect on an individual subnational level, the regressions from Tables 3 and 4 support no evidence of a direct effect on a cross-country level, and unemployment as an explanatory variable for varying homicide rates falls short.

Just like the coefficient for unemployment, the coefficient for percent of urban areas in a country is also insignificant and close to zero. Controlling for urban areas alone does not seem like a significant explanatory variable for homicide rates. Perhaps what would be more important in future regressions would be taking in the varying mixture of factors within cities thought to either benefit or harm committing a crime, such as increased police or educational and health services.

Organized crime, which is related to a significant amount of homicides in the Americas (The Global Study of Homicide, 2014), is included in regressions (5) through (7) and (11) through (12). As expected, the coefficient of organized crime is both negative and significant at an at least 5% level in each regression. The negative coefficient makes sense since countries falling towards a 1 on the organized crime index have higher levels of organized crime than countries nearing a 7, and thus, the negative coefficient reaffirms that countries with higher levels of organized crime are more at risk for higher homicide rates. Along a similar line to the coefficient for war, it would be interesting to test that, if a variable measuring for rule of law were included, whether for coefficient for organized crime would still be significant.

Democracy is almost always significant at a 5% level and negative as expected. Being a dummy variable, a negative coefficient indeed shows that being a democracy decreases homicide rates. However, the dummy for anocracy is almost always insignificant, showing no effect on homicide rates. These two facts lead to a possibility that democracy itself might have underlying variables that lead to less homicides that an anocracy might lack. Either way, within these models from Tables 3 and 4, the coefficient for democracy satisfies as an explanatory variable for homicide rates on some level whereas the coefficient for anocracy does not.

There exists at least one significant regional fixed effect for every regression except (11). For regressions (1) through (4) and (8) through (10), this is the Americas at less than a 1% significance level, but this significance goes away in regressions (5) through (7) and (11) through (12) when an index for organized crime is included. However, the inclusion of the organized crime index also makes the Asia regional dummy significant through regressions (5) through (7) and (12). While organized crime seems to take care of regional variances in the Americas, its inclusion seems to reduce explanation for the on average lower homicide rates in Asian countries. If anything

the presence of significant coefficients for the regional fixed effects proves that the regression models are still missing important variables and as of yet do not completely explain cross-country differences in homicide rates.

Among the hypotheses postulated in section 2, the most promising variables in explaining variances in homicide rates between countries are the Gini coefficient, democracy, an index for organized crime, and potentially ethnic fractionalization. The significances for the other variables either do not hold when included with these variables or are never significant. This is particularly interesting, considering these results are relatively different than the predictive factors found by studies on civil war. In fact income inequality and democracy at least were both factors those papers labelled as measures of potential grievances and were both factors that did not have much significance in their regression models (Fearon and Laitin, 2003; Collier and Hoeffler, 2004). For instance, in modelling variances in homicide rates between countries, income inequality seems to be a more important determinant than GDP per capita whereas this relationship was inverted among civil war determinants.

b. Limitations

Before any further conclusions from the empirical analysis can be discussed, this section must first mention the limitations of the regressions, further robustness checks that could have been implemented to strength the conclusions, and most of all what this analysis is not. This paper aimed to take inspiration from the works testing predicators of civil war and apply similar hypotheses to homicide, whether homicide, like civil wars, could be determined by some set of economic predictors of opportunity. Since homicide is a type of conflict separate from civil war, this study took into account the unique patterns of homicide and several wide hypotheses regarding

crime alone, separate from civil wars and separate from other conflicts. This study never assumed to discover an empirically perfect regression model explaining global homicide rates. Instead this study took previous theory to see how well they applied past a sub-regional and subnational picture onto a global stage.

While this study finds evidence to support that some variables are not a good enough explanation to determine the sources of variance between homicide rates globally, it does not test a wide enough net of variables to find a complete regression model of homicide determinants. Instead this study only breaks the surface of a complete analysis of determinants for homicide rates across countries. The regressions find support for a few variables, none for others, and potential common underlying factors that could be tested in the future.

Secondly, as stated in section 3.a. Data and Limitations, some of the variables tested used older years previous to 2012—namely, the Gini coefficient and the ethnic fractionalization index. In a perfectly robust study, the Gini and the ethnic fractionalization both would have been taken from additional sources and used in a separate regression to test whether other data sources for these variables would result in the same coefficient signs and p-value significance. This paper only takes one data source for these variables, and so I cannot rule out that other either more complete or more modern datasets might not change the results in a future empirical analysis of homicide.

In a similar vein, other variables could have benefited from more in-depth datasets covering a wider range of countries globally. For example, this paper could not include measures of secondary school enrollment and years since previous war for this reason. Neither variable covered a w-ide enough range of countries to give enough validity and significance to the regressions nor other variables included. Even variables that were included in Tables 3 and 4 such as the Gini coefficient could have also benefited from a broader range of countries.

Thirdly, as mentioned earlier in section 3, any dataset on crime rates runs the risk of the underreporting bias, the bias that crime rates are never completely or 100% accurately recorded. A cross-country analysis on homicide rates run the further risk of not having a universal amount that is underreported and runs the risk that certain countries are more likely than others to have a stronger problem regarding underreporting. While it is hoped that this risk is hedged by the geographical fixed effects among other dummies, it cannot completely be ruled out that the homicide rates themselves are difficult to regress in a country-country analysis and even worse potentially biased to different degrees. It is here where victimization surveys could eventually be used in lieu of the UNODC database to check the results in Tables 3 and 4.

Keeping these limitations in mind, the significant variables found in Tables 3 and 4 suggest that future studies should take note of at least two factors. First, homicide rates from 2012 are highly correlated with organized crime at a rate of -0.6483. This along with the findings from regressions including organized crime suggest that homicide is not always an isolated act. Thus, homicide is multifaceted in the activities leading up to it on an individual level, and any regression analysis of determinants of homicide should consider its relationship with other criminal activities. Second, the significance of democracy, war, and organized crime suggest that an underlying variable common to each is a factor of political stability and rule of law. Future regressions might find an inclusion of quantitative measures of political stability and rule of law beneficial in determining the differences in homicide rates among countries worldwide.

In summary, despite all limitations mentioned, a viewpoint of predictors of homicide found in Tables 3 and 4 focus on measures related to political stability and rule of law rather than pure economic conditions. Higher income inequality could put a greater strain on political and economic stability than countries with lower levels of the same measure. Countries with

democracies might be on average more politically stable than countries with anocracies although a movement of Polity IV scores from year to year close to 2012 might be even more illuminating for that end. Finally the higher prevalence of organized crime in a country could signify a weaker rule of law than countries who have low problems with organized crime.

V. Conclusion

This paper used existing literature to determine which kind of factors held the greatest power in explaining the differences in homicide rates around the world. Previous studies on predictors of civil wars have found economic factors such as GDP per capita and commodities to give better explanatory power than ethnic and civil rights grievances (Fearon and Laitin, 2003; Collier and Hoeffler, 2004). Factors influencing homicide can be grouped into similar categories and tested with some of these categories in mind. There were the economic situational factors such as GDP per capita and unemployment, the factors measuring inequality and instability such as income inequality, ethnic fractionalization, war, and democracies and anocracies, and lastly the factors that represent global homicide patterns such as gun laws, organized crime, and urbanization.

This paper found little evidence to support that purely economic factors such as GDP per capita and unemployment and factors representing global homicide patterns such as gun laws and urbanization can explain the variances between global homicide rates. Evidence instead supported conditions that worsen the political and social stability and weaken rule of law as better predictors of homicide variances. While basic data patterns show that high income OECD countries have on average much lower homicide rates than lower income countries and that lower income regions such as Africa have a higher average homicide rate than higher income regions such as Europe,

these higher income countries also are less prone to war, more likely to be stable democracies, and score higher on the index for organized crime, meaning organized crime is less prevalent. Thus, while the hypotheses and data would suggest higher income countries might have lower homicide rates, empirical analysis shows more specific factors common among high income countries separate from a purely economic approach explain these data trends better.

Furthermore, the inclusion and subsequent significance of the organized crime index serves as a reminder that indeed homicide is multifaceted and can be separated into the three subcategories mentioned in the introduction. Any further study on homicide should take these into account and consider determinants for each of these subcategories. It would be interesting to see as well which of the subcategories (criminal activities, interpersonal, and socio-political) holds the greatest variance across countries.

In conclusion, this paper find that conditions weakening or strengthening rule of law and increasing political, social, and economic stability hold the strongest explanatory power over variances in homicide rates. However, if the significance that remains upon the regional fixed effects in nearly each regression in Tables 3 and 4 prove anything, it is that the factors included do not alone explain these variances. While the income inequality, democracy, and organized crime seem to be important in determining some of the variance in homicide rates, they do not succeed in completely explaining cross-country patterns of homicide.

VI. References

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat, and Romain Wacziarg (2003). "Fractionalization." *Journal of Economic Growth* 8 (June): 155-194.

Burdett, K., Lagos, R. and Wright R. (2004). "An On-the-Job Search Model of Crime, Inequality, and Unemployment." *International Economic Review* 45 (3), 681-706.

Center for Systemic Peace (2014). *Major Episodes of Political Violence 1946-2013.* Retrieved from http://www.systemicpeace.org/warlist.htm

Center for Systemic Peace (2014). *Polity IV Project: Political Regime Characteristics and Transitions 1800-2013.* Retrieved from http://www.systemicpeace.org/polity/polity4.htm

Collier Paul, and Anke Hoeffler (2004). "Greed and Grievance in Civil War." *Oxford Economic Papers* 56 (4), 563-595.

Esteban, J.-M. and Ray, D (1999). "Conflict and distribution." *Journal of Economic Theory,* 87: 379-415.

Fearon James D., and David D. Laitin (2003). "Ethnicity, Insurgency, and Civil War." *The American Political Science Review,* 97 (1): 75-90.

Glaeser, Edward, and Bruce Sacerdote (1999). "Why is There More Crime in Cities?" *Journal of Political Economy* 107: S225-58.

GunPolicy.org (2015). *Carrying Guns Openly in Public.* Retrieved from http://www.gunpolicy.org/firearms/compare/194/carrying_guns_openly_in_public

Hirshleifer, J. (1995). 'Theorizing about conflict', in K. Hartley and T. Sandler (eds), *Handbook of Defense Economics*, Vol. 1, Elsevier Science, Amsterdam, 165-89.

Inciardi, James A. (2007). *Criminal Justice* (8). New York, NY: McGraw-Hill.

Roland, Gérard (2014). *Development Economics.* New Jersey: Pearson Education, Inc.

Sung, Hung-En (2004). "State Failure, Economic Failure, and Predatory Organized Crime: A Comparative Analysis." *Journal of Research in Crime and Delinquency* 41 (2): 111-130.

United Nations Office on Drugs and Crime (2014). *Global Study on Homicide 2013: Trends, Contexts, Data.* United Nations publication, Sales No. 14.IV.1.

World Economic Forum (2014). *Global Competitiveness Report.* Retrieved from http://reports.weforum.org/global-competitiveness-report-2014-2015/downloads/

VII. Appendix

Table 5: *Homicide Rates Separated by Region*

Region	Africa		
	Sub-Regions	Homicide Rates	Average by Sub-Region
Burundi	Eastern	8	10.77
Comoros	Eastern	10	
Djibouti	Eastern	10.1	
Eritrea	Eastern	12	
Ethiopia	Eastern	12	
Kenya	Eastern	6.4	
Madagascar	Eastern	11.1	
Malawi	Eastern	1.8	
Mozambique	Eastern	12.4	
Rwanda	Eastern	23.1	
Seychelles	Eastern	9.5	
Somalia	Eastern	8	
South Sudan	Eastern	13.9	
United Republic of Tanzania	Eastern	12.7	
Zambia	Eastern	10.7	
Zimbabwe	Eastern	10.6	
Angola	Middle	10	13.24
Cameroon	Middle	7.6	
Central African Republic	Middle	11.8	
Chad	Middle	7.3	
Congo	Middle	12.5	
Democratic Republic of the Congo	Middle	28.3	
Equatorial Guinea	Middle	19.3	
Gabon	Middle	9.1	
Libya	Northern	1.7	4.33
Morocco	Northern	2.2	
Sudan	Northern	11.2	
Tunisia	Northern	2.2	
Botswana	Southern	18.4	25.1
Namibia	Southern	17.2	
South Africa	Southern	31	
Swaziland	Southern	33.8	
Benin	Western	8.4	7.86
Burkina Faso	Western	8	
Cape Verde	Western	10.3	

Cote d'Ivoire	Western	13.6	
Gambia	Western	10.2	
Ghana	Western	6.1	
Guinea	Western	8.9	
Guinea-Bissau	Western	8.4	
Liberia	Western	3.2	
Mali	Western	3.9	
Mauritania	Western	5	
Niger	Western	4.7	
Nigeria	Western	20	
Senegal	Western	2.8	
Sierra Leone	Western	1.9	
Togo	Western	10.3	
Averages Total			10.87

Region	Americas		
	Sub-Regions	Homicide Rates	Average by Sub-Region
Antigua and Barbuda	Caribbean	11.2	21.65
Bahamas	Caribbean	29.8	
Barbados	Caribbean	7.4	
Cuba	Caribbean	4.2	
Dominican Republic	Caribbean	22.1	
Haiti	Caribbean	10.2	
Jamaica	Caribbean	39.3	
Puerto Rico	Caribbean	26.5	
Saint Kitts and Nevis	Caribbean	33.6	
Saint Lucia	Caribbean	21.6	
Saint Vincent and the Grenadines	Caribbean	25.6	
Trinidad and Tobago	Caribbean	28.3	
Belize	Central	44.7	34.34
Costa Rica	Central	8.5	
El Salvador	Central	41.2	
Guatemala	Central	39.9	
Honduras	Central	90.4	
Mexico*	Central	21.5	
Nicaragua	Central	11.3	
Panama	Central	17.2	
Bermuda	Northern	7.7	4.67
Canada	Northern	1.6	
United States of America	Northern	4.7	

Bolivia	Southern	12.1	17.05
Brazil	Southern	25.2	
Chile	Southern	3.1	
Colombia	Southern	30.8	
Ecuador	Southern	12.4	
Guyana	Southern	17	
Paraguay	Southern	9.7	
Peru	Southern	9.6	
Suriname	Southern	6.1	
Uruguay	Southern	7.9	
Venezuela	Southern	53.7	
Averages Total			21.65

Region	Asia		
	Sub-Regions	Homicide Rates	Average by Sub-Region
Kazakhstan	Central	7.8	8.1
Turkmenistan	Central	12.8	
Uzbekistan	Central	3.7	
Democratic People's Republic of Korea	Eastern	5.2	2.8
Hong Kong Special Administrative Region of China	Eastern	0.4	
Brunei Darussalam	South-Eastern	2	4.98
Cambodia	South-Eastern	6.5	
Indonesia	South-Eastern	0.6	
Lao People's Democratic Republic	South-Eastern	5.9	
Malaysia	South-Eastern	2.3	
Myanmar	South-Eastern	15.2	
Philippines	South-Eastern	8.8	
Singapore	South-Eastern	0.2	
Viet Nam	South-Eastern	3.3	
Afghanistan	Southern	6.5	5.33
Bangladesh	Southern	2.7	
India	Southern	3.5	

Iran (Islamic Republic of)	Southern	4.1	
Maldives	Southern	7.5	
Pakistan	Southern	7.7	
Armenia	Western	1.8	2.67
Cyprus	Western	2	
Iraq	Western	8	
Israel	Western	1.8	
Kuwait	Western	0.4	
Qatar	Western	1.1	
Saudi Arabia	Western	0.8	
State of Palestine	Western	7.4	
United Arab Emirates	Western	0.7	
Averages Total			4.51

Region	Europe		
	Sub-Regions	Homicide Rates	Average by Sub-Region
Bulgaria	Eastern	1.9	3.29
Czech Republic	Eastern	1	
Hungary	Eastern	1.3	
Republic of Moldova	Eastern	6.5	
Romania	Eastern	1.7	
Russian Federation	Eastern	9.2	
Slovakia	Eastern	1.4	
Denmark	Northern	0.8	2.29
Finland	Northern	1.6	
Iceland	Northern	0.3	
Ireland	Northern	1.2	
Latvia	Northern	4.7	
Lithuania	Northern	6.7	
Sweden	Northern	0.7	
Albania	Southern	5	1.72
Croatia	Southern	1.2	
Italy	Southern	0.9	
Malta*	Southern	2.8	
Montenegro	Southern	2.7	
Portugal	Southern	1.2	
San Marino	Southern	0.7	
Serbia	Southern	1.2	
Slovenia	Southern	0.7	
Spain	Southern	0.8	
Austria	Western	0.9	0.88
Belgium	Western	1.6	

France	Western	1	
Liechtenstein	Western	0	
Netherlands*	Western	0.9	
Averages Total			2.09

Region	Oceania		
	Sub-Regions	Homicide Rates	Average by Sub-Region
Australia	Australia and New Zealand	1.1	1
New Zealand	Australia and New Zealand	0.9	
Fiji	Melanesia	4	3.733333333
Solomon Islands	Melanesia	4.3	
Vanuatu	Melanesia	2.9	
Guam	Micronesia	13.3	5.866666667
Kiribati	Micronesia	8.2	
Marshall Islands	Micronesia	4.7	
Micronesia (Federated States of)	Micronesia	4.6	
Nauru	Micronesia	1.3	
Palau	Micronesia	3.1	
Niue	Polynesia	3.6	3.1
Samoa	Polynesia	3.6	
Tonga	Polynesia	1	
Tuvalu	Polynesia	4.2	
Averages Total			4.05