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Brittany Lowe
University of Louisville, brittany.lowe@louisville.edu

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Violence and Development: The Cost Countries Pay for High Rates of Homicide

Brittany Lowe[1]
[1] The University of Louisville, Louisville, KY, USA

ABSTRACT

Violence is one of the largest and most persistent humanitarian crises across the globe. Understanding violence's role in economic costs and losses is crucial to informing and guiding decision makers. This study uses international panel data to conduct a log-linear regression with time and country fixed effects. It focuses on studying the causal effects of violent crime on GDP at an aggregate, international level. The results find that the homicide rate has a statistically significant, negative effect on GDP per capita. Acts of violence come not just at a humanitarian cost, but also at the cost of economic progress and growth. From these results, recommendations of further investigation into this relationship as well as spending allocation at a country-level are made.

INTRODUCTION

In 2000, the United Nations established eight Millennium Development Goals (MDGs), international targets agreed upon by all nations and institutions to ensure a peaceful and prosperous world. The MDGs, that were set at a target year of 2015, ranged from eradicating poverty to combating HIV/AIDs. They led to the 2010 Geneva Declaration on Armed Violence and Development, an initiative signed by over 100 countries aimed at addressing the relationship of violence and its ensuing burden on humans.

These goals and declarations inspired a deep breadth of literature focused on health and development. While many nations progressed towards these goals with the assistance and guidance of this research, by 2015, many of the MDGs were not met. Thus, there was need for newer targets and further research. Seventeen Sustainable Development Goals (SDGs) were established as the MDGs successors. One of the SDG goals focuses on peaceful societies, access to justice, and accountable institutions.

This goal was formed with an understanding that violence is an overwhelming, multifaceted issue that has plagued society since the beginning of time - it often costs what humans value most precious, life itself - and therefore, needs a multifaceted approach from different fields and institutions to work towards its end. However, while there is a clear humanitarian development cost from violence, violence also presents costs to other areas of society as well, such as the economy.

Violence's impact on an economy is important to measure for several reasons. Firstly, violence presents direct costs to an economy in the form of medical bills, property damage, salaries of public servants involved (i.e. police officers, judges, etc.), and other tangible costs that members of the society pay (Shapiro 1999). Society also must bear the economic cost of programs implemented at the public and institutional level to reduce violence.

If violence negatively impacts an economy, it also can indirectly impact an economy by hindering needed productivity and growth which helps raise individual's well-being (Stevenson Wolfers 2008). Should an economy's development be slowed or even halted due to violence, it could cause other indirect issues such as economic instability within communities which are already suffering from the ramifications of the violence itself.

Thus, understanding violence's role in economic costs and losses at a country-level is crucial. In their review of the literature on violent conflict and economics, Humphreys states, "No study however has yet measured the aggregate costs that arise from all these different channels [of conflict]" (2003). This research adds to the literature by indicating a clear and precise economic cost of violence at a country-level, meant to inform and guide decision makers on how much funding to allocate towards violence prevention, in order to assist with violence reduction and economic development. In this study, homicide rates will be used as a measure of violence and GDP per capita will be used as a measure of economic development.

LITERATURE REVIEW

The preliminary findings of the Geneva Declaration used a regression analysis to look for the relationship between homicide rates and the Human Development Index (HDI), a statistical ranking of countries based on health,

education, and income. Researchers found that when homicide rates increased by one, the HDI decreased by .116. This showed a statistically significant, negative relationship between the two variables (Geneva Declaration on Armed Violence and Development 2010). While the HDI index is not solely an economic measure, it has economic factors used to calculate it. Violence's impact on HDI, therefore, is not a perfect indicator of the impact on GDP per capita; however, this literature contributes to the belief that violence will negatively impact GDP per capita.

Another study looked at the impact of political violence on economic growth. Using panel regression modeling, authors Bodea and Elbadawi found that organized political violence, such as riots or coups, significantly lowers long-term economic growth. Their statistically significant findings specify that all types of political violence increasing by one unite decreases the GDP per capita by at least 2%. Using Sudan as an example, they use their regression findings to calculate that long-duration conflict has costed the country $46 billion (Bodea & Elbadawi 2008). While political violence is a different category than criminal violence, such as the homicide rate, this study contributes to the belief that violence, in general, has a negative affect on an economy's growth and development, especially measured by GPD per capita. It also serves as an example of how to use a regression to measure the economic costs of violence.

Lastly, studies with smaller scopes help to inform the relationship between violence and economics. Several studies in the US seek to find the economic costs of violent, criminal activity. For example, Cohen uses cost-benefit analysis to find that fatal crime, including homicide, costs the US nearly $3 million in both tangible and quality of life costs (2000). That dollar value was expressed in 1993 USD, which would inflate to a higher price now. Similarly, after a report found that 40% of homicides in New Zealand arose from domestic disputes, a study was commissioned to investigate the economic costs of family violence. It found that family violence, such as child or intimate partner abuse, cost the country over $1.3 million (Snively 1994). While these studies may have a narrower scope of focus or may not use the same methodological analysis as a regression, they serve as contributions to the literature on how violence negatively effects a country's economy.

DATA AND METHODOLOGY

The dataset used to conduct this study includes 136 countries over 27 years, from 1991 to 2017.

The dataset for the independent variable of interest, the homicide rate, is sourced from the United Nations Office on Drugs and Crime (UNODC 2019). The variable is defined as homicide rates per 100,000 people. In this dataset, for a crime to be considered a homicide, three criteria must be met: intentional, unlawful, and causing the death of a person. The sources the dataset is gathered from include "...official data from governments as provided through the UN Survey of Crime Trends and Operations of Criminal Justice Systems... and officially published information from governments... UN agencies and international organizations" (UNODC 2019). This is a combination of reports of police or authorities investigating crimes as well as health officials confirming the deaths.

This dataset may prove to be biased due to reporting errors. Countries, especially those that are under-developed, have little infrastructure for homicide reporting on such scales, and often underreport the actual rates. However, the UNODC acknowledges that homicide reporting has improved by explaining why they used reported number instead of estimates, "This is due to improvements in the coverage of homicide data produced at country level… when meeting minimal quality criteria, and to increase transparency of the validation and publication process of homicide data published by UNODC" (UNODC 2019).

The dataset that will be used to measure the dependent variable, GDP per capita, is from the World Bank national accounts data, and OECD National Accounts data files. This dataset provides countries' GDP per capita in current USD. GDP per capita in this dataset is defined as, "...gross domestic product divided by midyear population" and gross domestic product is defined as "...the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products" (The World Bank Group 2019). The variable is aggregated through weighted average and collected annually. The log of this data was taken in STATA in order to perform the regression and interpret results as a percentage change of the dependent variable.

GDP measures can be biased by the availability of resources and information to the statisticians who calculate it. As such, there is almost always a difficulty in measuring the output of government and other financial sectors in some countries (World Economics). However, GDP is still one of the most widely used economic indicators of countries, allowing trust in the dataset despite these limitations.

Mapping the first two datasets over time allows insight into their relationship. Figure 1 and Figure 2 show the trend of each variable plotted in a line graph.

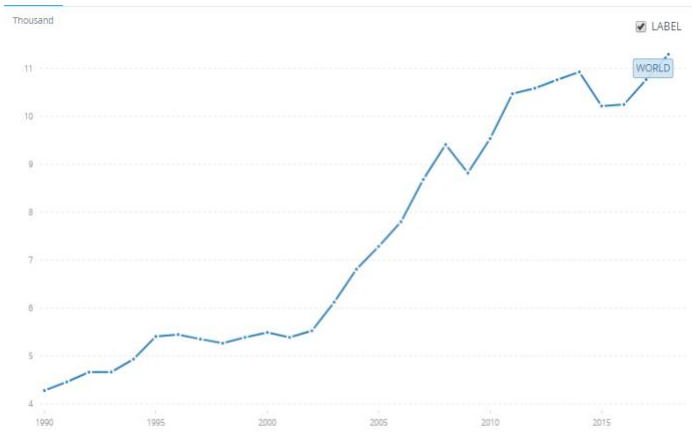

Figure 1. *Yearly Trend of World Average GDP per capita (in USD)*

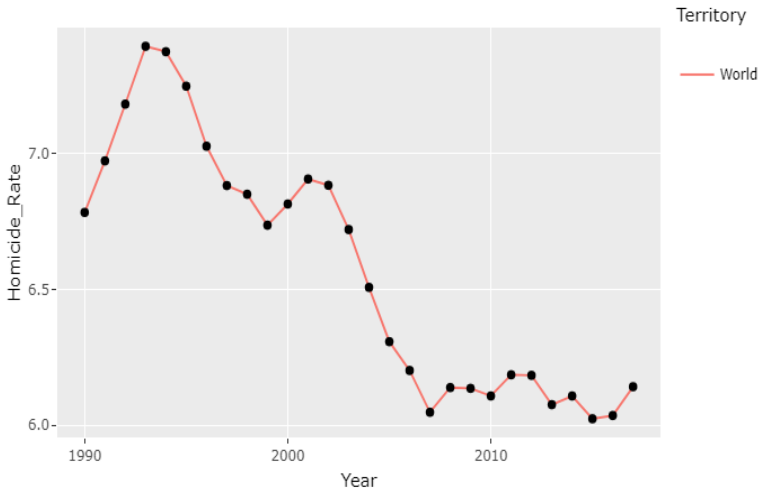

Figure 2. *Yearly Trend of World Average Homicide Rates*

During the time frame of the dataset, GDP per capita had consistently grown on average throughout the world, especially in the early- to mid-2000's. Likewise, homicide rates had decreased on average across the world, noting an especially large downturn in the early- to mid-2000's. This indicates an inverse correlation between the two variables. While this is not a causal relationship, it supports the literature and leads to hypothesizing that homicide rates with have a negative coefficient in relation to GDP per capita.

The dataset that will be used to measure an independent control variable, the unemployment rate, is retrieved from the World Bank Group and originally sourced from the International Labour Organization ILOSTAT database. Unemployment is defined as "...the share of the labor force that is without work but available for and seeking employment" (The World Bank Group 2019).

Biases in this variable could include misreporting due to the ability to measure unemployment in certain sectors. For example, agriculture is a difficult field of work to measure unemployment in because of consistent seasonal unemployment. The timing of the survey could maximize this seasonal unemployment, overreporting the unemployment rate. Another example is informal employment, which is hard to quantify and track due to the lack of regulations and reporting.

The dataset used to measure another independent control variable, the percent of urban population, is taken from The World Bank and United Nations Population Division. The percentage of urban population is defined as "...the numbers of persons residing in an area defined as 'urban' per 100 total population" (The World Bank 2019). The indicator is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects.

Biases within the dataset are present due to the perception of what is "urban" from country to country. There is no universal, consistent standard for distinguishing between rural and urban areas. While some countries may define urban based on proximity to certain infrastructure and services, others designate urban areas based on administrative arrangements (The World Bank 2019). Caution will be used in interpretation of the variable due to the biases.

The summary statistics of these variables are listed in Table 1.

The number of observations vary in each data set due to the completeness of each dataset. While three of the datasets begin in the year 1990 and include every country, they are not balanced panels, meaning there are data missing for some countries in certain years. The unemployment rate data also include every country but starts in the year 1991 rather than 1990; and it is also not a balanced panel. Therefore, summary statistics using only observations reported in the final regression (4) from Table 3 are also included below to show differences from the overall datasets to the sample selection. Overall, the means of every variable increase, most likely due to the year 1990 not being included, where the variables were most likely less on average. Likewise, most missing data from the panel dataset are from years closer to 1991 in which the variables were also lesser.

To test the research question, the following log-linear regression with time and country fixed effects will be used:

$$Log\ of\ GDP\ per\ Capita_{it} = \beta_0 + \beta_1\ Homicide\ Rate_{it} + \beta_2\ Unemployment\ Rate_{it} + \beta_3\ Urban\ Percentage_{it} + \alpha_i + £_t + \epsilon_{it}$$

Table 1. *Summary Statistics of Variables*

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	Mean	SD	Min	Max
Log of GDP per Capita	7,030	1,1032.64	18377.87	95.19	18,9170.9
Homicide Rate	3,766	7.9	12.14	0	142.2
Unemployment Rate	6,757	7.91	5.79	.14	37.94
Percentage of Population in Urban Areas	7,562	55.6	23.55	5.41	100

Table 2. *Summary Statistics of Variables included in Final Regression*

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	Mean	SD	Min	Max
Log of GDP per Capita	2,611	13,386.56	17,888.23	137.17	118,823.6
Homicide Rate	2,611	8.13	13.07	0	142.2
Unemployment Rate	2,611	8.13	5.86	.19	37.27
Percentage of Population in Urban Areas	2,611	60.56	22.03	10.12	100

In this model, the β_1 coefficient will show the causal effect of the homicide rate on the log of GDP per capita. β_2 will show the causal effect of the unemployment rate on the log of GDP per capita, and β_3 will show the causal effect of the percentage of urban population on the log of GDP per capita. α and £ are the country and time fixed effects variables used to control for omitted variable bias. β_0 is a constant and ϵ is an error.

The log of GDP per capita was used as the dependent variable for several reasons. When measuring an economy's development, GDP is one of the best and most widely used indicators a country's economic well-being (Bergh 2009). GDP per capita is a more realistic look at the economy's well-being compared to the population and is most often used as a measure of growth. For example, if Russia and Liberia produced the same GDP, it would still indicate differences in development levels because one country has a very large population while the other's is comparatively small. GDP per capita adjusts for this. The log of GDP per capita was taken and used as the dependent variable in order to get more interpretable results. While the variable measures all countries' GDPs in US dollars, that is harder to interpret because a one US dollar increase in the US is less significant than a one US dollar increase in Kenya. Taking the log of this variable allows interpretation to be a percentage change in the dependent variable rather than a hard US dollar amount.

When considering how to measure violence, the homicide rate was decided to be used as the independent variable of interest because it is one of the most widely recorded and most severe measures of violent crime. Reporting of this variable has grown more accurate and standardized over time.

A scatter plot between the dependent and independent variable of interest is shown in Figure 3 in order to show the non-causal relationship between the two variables within this particular dataset.

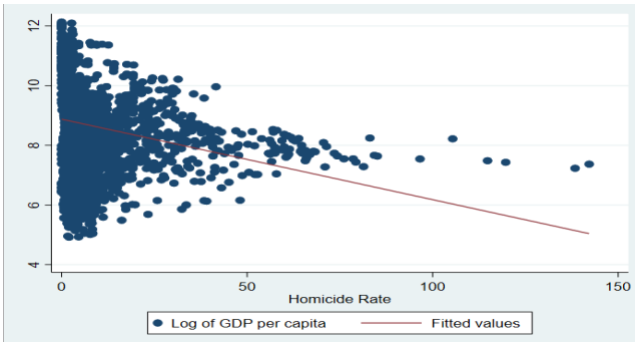

Figure 3. *Scatter Plot and Line of Fit between Natural Log of GDP Per Capita and Homicide Rate*

The unemployment rate was included as an independent control variable in the regression to ensure the homicide rate variable was unbiased. This variable is commonly used as a control variable in economic studies that use GDP per capita as a dependent variable because of its consistently proven, inverse relationship with the dependent variable (Farsio & Quade 2003). To be an accurate control variable, it must also be related to the independent variable of interest. In this case, the unemployment rate is positively correlated with the homicide rate, often explained in the literature that higher homicide rates occur in places of higher unemployment (Yang & Lester 1995). Without this control variable, the variable of interest would most likely be overstated.

The percentage of urban population was also included to increase the accuracy of the estimator for the independent variable of interest. Crime rates, including homicide rates, tend to be highly concentrated within urban areas (Glaeser & Sacerdote 1999). Including this measure helps to ensure that the independent variable of interest is not overstated. It is another commonly used control variable due to its positive relationship with GDP per capita, as urbanization is a contributer to economic growth (Moomaw & Shatter 1996). The more people that live in cities, the more market exchange that is available and occurring in order to spur the economy.

Lastly, year and country fixed effects were included in this regression. These were included to control for any omitted variable bias in a certain country during multiple years or across multiple countries in one year that could not otherwise be measured. It's especially important to control for these factors when doing an international study where there is so much variability. Economies for entire countries are complex, relying on many interwoven factors that determine the end result of a macroeconomic number such as GDP; some of these factors are difficult to capture in data. Time and country fixed effects assist with controlling for these factors. For example, the time fixed effect could be useful when thinking of unrest in a certain region. If wars and unstable governments affected multiple countries in a time period, then it could have hurt GDP while also increasing the homicide rate. Likewise, for country fixed effects, in one country, a law may have been passed; for example, a law that restricted gun usage and decreased homicide could also affect GDP. These fixed effects will not be reported in the final regression, as the coefficients themselves are not of interest but rather their ability to help create an unbiased estimator is of interest.

When considering control variables to include to ensure the independent variable of interest was unbiased, the Corruption Perceptions Index (CPI), a measure of the level of corruption within the public sector of a country, was considered. However, the Index was reworked in 2012 in order to be comparable from year to year, so only the data from 2012 onward would be valid. This would have limited the dataset immensely, excluding years of massive average growth in GDP and decline in the homicide rate such as the early- to mid-2000's seen in Figure 1 and 2.

RESULTS

The chosen model was conducted using clustered standard errors over countries in order to prevent autocorrelation within the panel dataset. Several regressions were used with different inclusions of the independent variables in order to see their effect on each other when included versus excluded. The results were compiled into Table 3 with standard errors displayed in the parenthesis. Inferences are drawn based on the coefficients, their relations to each other, and their relation to the dependent variable given that they are statistically significant.

The first regression (1) includes only the homicide rate as the independent variable and the log of GDP per capita as the dependent variable. The coefficient of homicide rate is statistically significant at the 95% level. This coefficient means for every one unit increase in the homicide rate, there is a 0.7% decrease in the GDP per capita. This is along the lines with the economic prediction made based on other literature and economic intuition; however, this regression does not account for any omitted variable bias beyond that of time and country fixed effects.

The second regression (2) includes both homicide rate and unemployment rate in the independent variables. The coefficient of the homicide rate decreased when the unemployment rate was included, indicating there was omitted variable bias without it. Though it is still negative, the homicide rate coefficient is now only significant at the 90% level. The coefficient of the unemployment rate indicates that a one unit increase in the unemployment rate, decreases GDP per capita by 2%. As predicted, unemployment rate coefficient was negative statistically significant at the 99% level. The measure of fit increased overall when including the unemployment rate as well.

The third regression (3) includes only the urban percentage and homicide rate as the independent variables. The coefficient of homicide rate neither decreased nor changed significance when accounting for the urban percentage. The coefficient of the urban percentage was positive as predicted; however, it was not statistically significant. However, the total measure of fit did slightly increase when accounting for the urban percentage.

Table 3. *Fixed Effects Log-Linear Regression of Log GDP per capita*

	(1) Log of GDP per Capita	(2) Log of GDP per Capita	(3) Log of GDP per Capita	(4) Log of GDP per Capita
Homicide Rate	-0.007**	-0.006*	-0.007**	-0.006*
	(0.00)	(0.00)	(0.00)	(0.00)
Unemployment Rate		-0.020***		-0.020***
		(0.01)		(0.01)
Urban Percentage			0.006	0.003
			(0.01)	(0.01)
r2	0.9777	0.9779	0.9778	0.9779
N	2933	2611	2933	2611

* p<.1, ** p<.05, *** p<.01
Time and Country fixed effects
Errors clustered by country

Table 4. *Log-Linear Regression of Log GDP per capita without Fixed Effects*

	(1) Log of GDP per Capita	(2) Log of GDP per Capita	(3) Log of GDP per Capita	(4) Log of GDP per Capita
Homicide Rate	-0.027***	-0.025***	-0.020***	-0.017***
	(0.01)	(0.01)	(0.00)	(0.00)
Unemployment Rate		0.004		0.000
		(0.02)		(0.01)
Urban Percentage			0.046***	0.050***
			(0.00)	(0.00)
r2	0.0487	0.0478	0.4993	0.5848
N	2933	2611	2933	2611

* p<.1, ** p<.05, *** p<.01
Errors clustered by country

The final regression (4) was conducted using all of the independent variables in order to mitigate bias as much as possible. The coefficient of the variable of interest decreased from the first regression (1) when accounting for other variables. Overall, a one unit increase in the homicide rate, an increase in overall homicides per 100,000 people, decreases GDP per capita by .6%, or decreases the percentage change of GDP per the population. Though it is a small effect, it is still statistically significant, and negatively impacting GDP per capita. The unemployment rate still had a statistically significant negative effect on GDP per capita; and the urban percentage still had a positive effect on the dependent variable, though it decreased when including the unemployment rate and still is not statistically significant. The measure of fit has also slightly increased,

explaining a large amount of the regression when including for all variables.

As a robustness check, the same regressions were run without the time and country fixed effects and compiled in Table 4. This was done to ensure the fixed effects created a more precise estimator in regard to the dependent variable of interest.

Without fixed effects, the coefficient of the variable of interest, homicide rate was much greater and statistically significant at a 99% confidence level. While the coefficient indicates a one unit increase in the homicide rate determines a in 1.7% decrease in GDP per capita in this regression, when controlling for time and country fixed effects it only determines a .6% decrease. Though it is statically significant using this regression, there is a large amount of bias. It also shows that the unemployment rate positively or does not affect GDP, which indicates there is bias within that estimator as well. Due to the robustness check, it is ensured time and country fixed effects greatly helped decrease omitted variable bias.

An alternative model to the log-linear fixed effects regression could be to use the hard dollar amount of GDP per capita in a linear regression rather than a log-linear. A further model could include using a dummy variable for 'high' versus 'low' independent, homicide rate variables and running a linear or log-linear regression based on that instead of a continuous homicide rate.

CONCLUSION

There are no doubts about the clear harm that violence has on a society and its people. However, the importance in understanding the economic costs of violence is not to put a dollar amount on inhumane issues. Instead, this critical question and following research is to incentivize decision makers to take into account how violence harms both individuals and larger communities in more than one way and to guide decision makers in allocating an effective and efficient amount towards violence prevention.

Decision makers should use the results of the model in this study in order to find the direct cost of decreasing violence on their country's economy, and then allocate the correct amount of spending to address it. For example, GDP per capita in 2018 was $62,641 in the United States. A one unit decrease in the homicide rate would cause GDP per capita to increase by $3,758. With a population of 323,156,000 in 2018, the total increase of GDP would have been over $1 trillion.

With updated information, decision makers can understand the urgent need to reallocate or increase funds to address and decrease violence because of the higher payback to society than the cost to implement a program. Action is needed in order to decrease violence in their communities and boost their economies to create a safer and more prosperous society for their citizens.

As with any study with internationally collected data, caution should be taken with results. Data availability and accuracy may vary from country to country. Moving forward, international agencies should press for standardizations across countries for calculations in order to estimate results that are more unbiased and helpful.

This study also opens a call for further investigation into this dependence of GDP per capita on violence in future economic studies. Rather than an international outlook, observing a singular country would be helpful literature as a case study. Country level data would be a more reliable source as it is consistent in how it is calculated and more thorough and comparable, addressing some of the limitations in this study.

Likewise, other forms of violence may be explored, based on varying degree of violence. For example, does aggravated assault have a greater effect on GDP than simple assault? This can narrow the scope down even further for funding recommendations. Lastly, it opens up questions about what other economic measures depend on violence. Rather than GDP, perhaps using GINI, a gauge of economic inequality, could be used as a dependent variable to indicate development. Other estimators may still measure development, but not be as complex as GDP, addressing that fault in the current study.

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