

Studying murdering and slaughtering in (cor)relation

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ABSTRACT

This paper suggests that the extent and development of animal production may impact homicide rates. To test this bold hypothesis, a sample of 78 countries with high-quality data standards was used. The analysis, covering the period between 1990 and 2021 and based on World Bank data, shows that the murder rate in a country can be explained not only by GDP per capita and time but also by the development of livestock for male victims and both livestock development and the extent of aquaculture for female victims. In the discussion, the well-established connection between domestic violence and animal cruelty is cited as evidence that these correlations may not be as spurious as they initially seem.

Keywords: killing, human behavior, intentional homicides, animal production, GDP

1. INTRODUCTION

Veganism and the protest against killing farmed animals arguably is one of the most significant movements of our age (Bertuzzi, 2017; Linzey and Linzey, 2018; Gheiman, 2021). While there are health-related (Dinu et al., 2017; Radnitz et al., 2020; Marrone et al., 2021) and environmental (Chai et al., 2019; Rabes et al., 2020; Choreziak and Rzymiski, 2025) arguments for veganism, ethicists make compelling cases against the legitimacy of killing sentient beings such as chicken, pigs and cows. Particularly rights-based scholars like Cochrane (2012), Baranzke (2016) and de Oliveira et al. (2025) often depart from the human right to life and demonstrate coercive reasons to extend this right to other sentient beings.

This claim has not permeated mainstream society. There is no single country in the world in which the killing of farmed animals is outlawed, and at the same time there is no single country where the killing of humans by individuals is allowed except in cases of self-defence or wartime actions by military personnel. This fundamental difference in the legal judgement stems from deeply rooted perceptions about the difference whether humans or other animals are killed. This distinction even extends to language, where killing humans is typically referred to as "murder," whereas killing non-human animals is commonly called "slaughter." As a result, the entire literature on homicides is totally decoupled from the literature of the so-called value chain for animals. Accepted factors for predicting the rate of homicides in a society are inequality and poverty (Norris, 2025), but also variables like financial inclusion (Gazilas, 2024), divorce rates (Tcherni, 2011), educational attainment (Crocì and Gomez, 2024) and government effectiveness (Chainey et al., 2021).

Nevertheless, this paper hypothesises that the level of animals slaughtered for human consumption, describing varying levels of tolerating violence, may contribute to explaining the level of homicides in a society. In 1973, Singer began his seminal book "Animal Liberation" by the remark that "‘animal liberation’ may sound more like a parody of other liberation movements than a serious objective". Today, the claim that the number of farmed animals killed may contribute to explain the level of violence against humans in a country may also sound like a parody on the vegan movement. But what if there is an underlying variable that reflects how we respect the lives of others? Is it so absurd to think that societies whose citizens kill animals with modesty and care are also more cautious about killing other people? And that countries in which the consumption of a steak is unburdened by ethical considerations may also be more willing to "solve" conflicts through murder?

This paper approaches these questions empirically. The data to use is described in Section 2, the methods are outlined in Section 3. Results will be presented in Section 4 and Section 5 concludes.

2. DATA

To assess our hypothesis, livestock production and intentional homicides in all available countries were analysed using the most widely known publicly available socioeconomic data source: the World Bank (2025). The range of indicators used for our calculations is presented in Table 1.

While it would have been easy to aggregate the rate of male and female homicides to an overall murder rate, most scholars agree that the murder by gender follow markedly different patterns (Fridel and Fox, 2019; Karakasi et al., 2022; Ventura et al., 2022). Therefore, it is crucial to check whether both categories of murder respond equally to changes in animal production.

Table 1: Variable description

Symbol	Indicator [WorldBank ID, id]	WorldBank Glossary
y_{male}	Intentional homicides, male (per 100,000 male) [VC.IHR.PSRC.MA.P5]	Intentional homicides, male are estimates of unlawful male homicides purposely inflicted as a result of domestic disputes, interpersonal violence, violent conflicts over land resources, intergang violence over turf or control, and predatory violence and killing by armed groups. Intentional homicide does not include all intentional killing; the difference is usually in the organisation of the killing. Individuals or small groups usually commit homicide, whereas killing in armed conflict is usually committed by fairly cohesive groups of up to several hundred members and is thus usually excluded.
y_{female}	Intentional homicides, female (per 100,000 female) [VC.IHR.PSRC.FE.P5]	Intentional homicides, female are estimates of unlawful female homicides purposely inflicted as a result of domestic disputes, interpersonal violence, violent conflicts over land resources, intergang violence over turf or control, and predatory violence and killing by armed groups. Intentional homicide does not include all intentional killing; the difference is usually in the organisation of the killing. Individuals or small groups usually commit homicide, whereas killing in armed conflict is usually committed by fairly cohesive groups of up to several hundred members and is thus usually excluded.
x_{land}	Livestock production index (2014-2016 = 100) [AG.PRD.LVSK.XD]	Livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins.
x_{water}	Aquaculture production (metric tons) [ER.FSH.AQUA.MT]	Aquaculture is understood to mean the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Aquaculture production specifically refers to output from aquaculture activities, which are designated for final harvest for consumption.
x_{GDP}	GDP per capita (constant 2015 US\$) [NY.GDP.PCAP.KD]	GDP per capita is gross domestic product divided by midyear population. GDP is 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. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2015 U.S. dollars.
S	GDP, current LCU [NY.GDP.MKTP.SACN]	GDP at purchaser's prices is 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. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in the current local currency.
t	Year	Year
i	Country	Country

Note. GDP stands for Gross Domestic Product. LCU stands for Local Currency Unit - national currency of a specific country. US\$ stands for United States Dollar.

Regarding the independent variables, two different realms of animal production were used. Regarding the x_{land} variable that depicts the World Bank's Livestock Production Index, a relative measure was opted for, suggesting that the development of animal production in a society might influence the rate of homicides. However, this index only describes the level of animal production on the land. The level of animal production in the water, through aquaculture, is equally associated with violence (Lam, 2016; Elder, 2018; Cooper et al., 2023). Given the rapid development of aquaculture over recent years (Naylor et al., 2023; Xiong et al., 2023), an absolute index for aquaculture was included in this analysis.

Finally, two essential control variables were used. As noted earlier, poverty is an important predictor for homicides, and GDP per capita is often found to be a suitable indicator (Ouimet, 2012; Gazilas, 2024; Rasvanis, 2024). To account for time trends, which have also been found to be significant by Baumer & Wolff (2014) and Trägårdh et al. (2016), the number of years was included as a variable in all equations.

For the indicators (id) listed in Table 1, two linear transformations were performed: a 1 to each value was added to prevent the loss of zero observations and to ensure a smooth transition from values in levels to values under logarithm (see Loginova & Mann, 2022). Formally, for each value ($\hat{c}$) of an indicator of interest id in levels for each country (i) at year $t \in (1990 \dots 2021)$, logarithms (c) were calculated as follows:

$$c_{i,id,t} = \ln(\hat{c}_{i,id,t} + 1) \quad (1)$$

To ensure reliable observations and sufficient variation for correlation analysis, all combinations of country (i) and year (t) with at least one missing value in any of the variables in Table 1 were excluded. These data preparations ensured the quality of the data for correlation analysis and resulted in a dataset with 1496 observations across 78 countries from 1990 onward. It is important to note that GDP in current LCU did not participate in further calculations and has not been available online at the World Bank since 2021. However, this indicator was included in the bulk data downloaded using the “wbstats” package [R Core Team, 2025; wbstats (2025)] and served as a strong filter for high-quality observations. This indicator was a turning point in this paper's calculations: without filtering out missing values for this indicator, many significant results cannot be obtained. Thus, it also acted as a classifier or as a filter: the results are only relevant for the countries and years for which this indicator was available.

Figure 1, displaying the countries' homicide rates and livestock development for 2021, does not show a clear pattern. A comparison between Bosnia and Herzegovina and Nicaragua might confirm the hypothesis, whereas a comparison between Singapore and Ecuador would suggest the opposite.

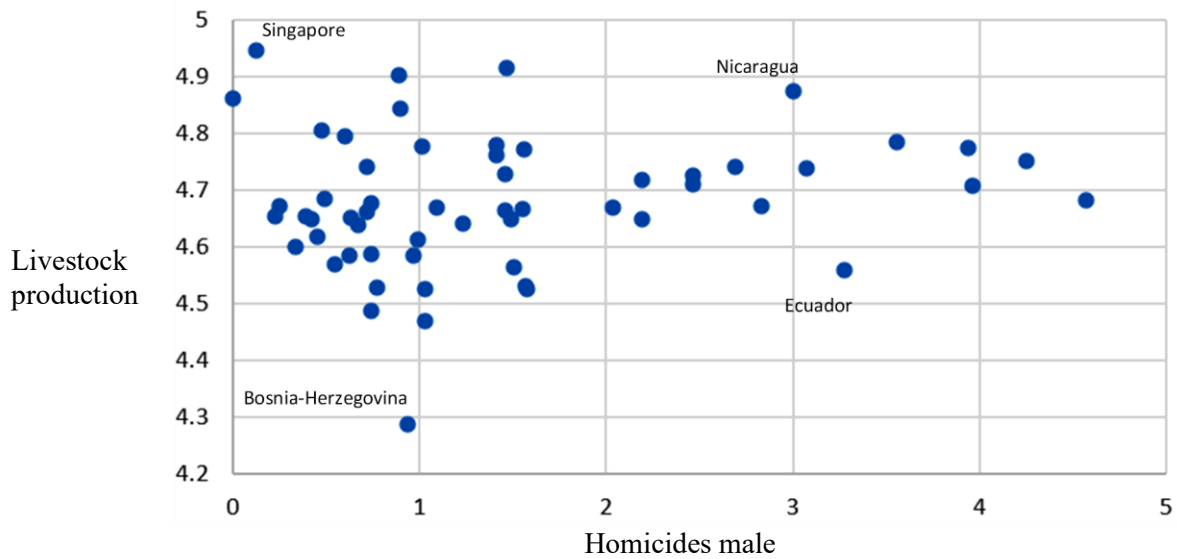


Figure 1: The connection between homicides on male persons and livestock production in 2021

3. METHOD

After the data had been selected, a preregistration was carried out at the Open Science Framework on June 23rd, 2025 (available at: <https://osf.io/m7dz5/overview>).

Table 2, which displays correlation coefficients over the entire period, provides a clearer picture. It is foreseeable that homicides among men and women correlate strongly. However, correlations between three other phenomena are less predictable. First, the development of livestock production is rather independent of the extent of aquaculture in a country. While the business models of the two sectors are similar, their development is not. Second, there is a weak positive correlation between aquaculture and homicides. Third, there is a strong negative correlation between livestock production and homicides.

Table 2: Correlation table between the variables of homicides and animal production

	y_{male}	y_{female}	x_{land}	x_{water}
y_{male}	1			
y_{female}	0.90	1		
x_{land}	-0.23	-0.19	1	
x_{water}	0.09	0.05	-0.03	1

This finding should at least raise skepticism regarding the part of our hypothesis related to animal production on land. On the other hand, one should remain open to the possibility that the background variable of material welfare has an overwhelming influence: once societies become wealthier, homicides tend to decrease, but animal production (due to the growing demand for meat) increases. However, this does not appear to apply to aquaculture.

The regressions that allow testing the hypothesis were the following:

$$\ln(y_{male,i,t}) = \alpha_{0,i} + \alpha_1 t + \alpha_2 \ln(y_{female,i,t}) + \alpha_3 \ln(x_{land,i,t}) + \alpha_4 \ln(x_{water,i,t}) + \alpha_5 \ln(x_{GDP,i,t}) + \varepsilon_{i,t} \quad (2)$$

$$\ln(y_{female,i,t}) = \beta_{0,i} + \beta_1 t + \beta_2 \ln(y_{male,i,t}) + \beta_3 \ln(x_{land,i,t}) + \beta_4 \ln(x_{water,i,t}) + \beta_5 \ln(x_{GDP,i,t}) + \xi_{i,t} \quad (3)$$

where $\alpha_{0,i}$ and $\beta_{0,i}$ are constants for each country (i), i.e. analogs of country fixed effects, and other $\alpha_j, \beta_j \ j \in (1 \dots 4)$ are the coefficients quantifying the associations between the studied indicators. $\varepsilon_{i,t}$ and $\xi_{i,t}$ are the error terms. This means that our final equations are multiplications of the associated factors with our estimations as corresponding degrees.

4. RESULTS AND DISCUSSION

Table 3 presents the five equations explaining the two dependent variables. The development of livestock production is consistently a significant predictor for homicides. The situation is more complex for aquaculture. The amount of aquaculture fish production in a country contributes to explain femicides, but not male murders, sometimes labelled as masculicides (Rollat-Farnier, 2014). This leads to another (first) equation in which the amount of aquaculture in the explanation of masculicides is omitted.

The control variables contribute strongly to the equations. It is obvious that the rate of femicides (y_{female}) contributes strongly to explaining the rate of homicide (y_{male}) and vice versa. It is also very understandable that per-capita GDP contributes strongly to explaining homicide rates. Finally, the most optimistic result of our regression is that the number of homicides, for both genders, has been decreasing over time.

Table 3: Results of the mixed-effects model

Dependent	Explanatories						Adj. R-Squared
	y_{male}	y_{female}	x_{land}	x_{water}	x_{GDP}	T	
y_{male}			0.216 (0.046) ***		-0.583 (0.054) ***	-0.011 (0.001) ***	0.9556
y_{male}			0.2121 (0.048) ***	0.004 0.012	-0.590 (0.057) ***	-0.011 (0.001) ***	0.9556
y_{male}		0.726 (0.031) ***	0.107 (0.041) **	-0.013 (0.01)	-0.222 (0.051) ***	-0.007 (0.001) ***	0.9677
y_{female}			0.143 (0.034) ***	0.023 (0.008) **	-0.506 (0.041) ***	-0.005 (0.001) ***	0.9078
y_{female}	0.375 (0.016) ***		0.064 (0.029) *	0.022 (0.007) **	-0.284 (0.036) ***	-0.001 (0.001)	0.933

Note. Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘.’ 1. All models account for country fixed effects. All models pass tests on model significance.

It is necessary to acknowledge that these results can be interpreted in different ways. There is a potential claim that, to quote a proverb by Ronald Coase, the data was tortured until it confesses. Under such a view, the narrative would emerge that for an arbitrary sample of countries, a dynamic variable (development of livestock) and a stationary variable (amount of aquaculture) show, after being transformed accordingly, some spurious, probably random significance for femicides and, partly, masculicides. Kuncze et al. (1975) were among the first to show how random variables could show highly significant correlations. Couldn’t this also be the case for any imagined connection between animal production and homicide?

A more optimistic reading of the results is also possible. This does not only require readers to accept the availability of variable S (see Table 1) as a national indicator for statistics of high quality. It also necessitates recognizing that the authors are not the first who contextualise violence against humans and violence against other animals. Bègue et al. (2025), for example, raise the question about determinants of intentional harm against animals. They find that a climate of violence in a subject’s family is among the main influencing factors. This is only the latest publication in a series of studies showing the strong connection between domestic violence and cruelties to animals (Bentovim, 2002; DeGue and DiLillo, 2008; Genc et al. 2017; Arkow, 2019). Other scholars found high correlations between child abuse and animal abuse (Ascione and Arkow, 1999) or graduations from animal cruelty to serial murder (Wright and Hensley, 2003).

It is, of course, much more intuitive that boys being beaten by their fathers are likely to beat dogs and cats, than to think that eating a Frankfurter sausage increases the probability of killing one's neighbour. This is precisely why research about the first connection has been carried out, but not about the second. Therefore, it is worthwhile to identify some core differences and parallels between our research question and the transfer from domestic violence to animal mistreatment. The main difference is, of course, that the meat industry and retailers work hard to conceal the violent background of animal product consumption. Even staff in slaughterhouses sometimes manage to suppress the violent aspect of their work (Ben-Yonatan, 2021; Pastrana-Camacho et al., 2023). However, consumers of animal products are usually aware that their consumption involves the killing of a sentient being. The obvious parallel between the two transfers—from domestic violence to animal cruelty, and from livestock production to homicide—is the general acceptance that violence may be a legitimate or at least necessary way of interaction.

The tolerance of violence in societies may be the core background variable behind the two phenomena of animal production and homicides. If one decides to take the empirical results seriously, one will have to conclude that there may well be synergies in reducing the rate of homicides and reducing our reliance on animal production. Consequential work for a non-violent society could benefit both.

5. CONCLUSIONS

After developing the hypothesis that the extent of the so-called production of animals may contribute to explaining the homicide rate in a country, it was shown, after certain transformations, that the development of livestock production is a significant predictor of masculicides, while both livestock production and aquaculture are significant predictors of femicides. While this finding holds for a subsample of countries with particularly high-quality data, it has the potential to lead to significant theoretical and empirical follow-up work. Empirically, both national and international levels offer ample opportunities to explore in more depth the connection between land-based and aquatic animal production on one hand, and homicides on the other. Theoretically, it may be time to reconsider our approach toward farmed animals, as this could have synergies in combating human murder.

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