

Research on the Relationship between Suicide Rates and GDP: A Statistical Analysis

Yifan Cao*

Shanghai Guanghai Cambridge International School, Shanghai, China

*Corresponding author: 1812211211@mail.sit.edu.cn

Abstract. The complex relationship between suicide rates and economic factors has gained substantial attention because it can have a significant impact on the public health, societal well-being, and economic development areas. This comprehensive study delves into the intricate interplay between suicide rates and Gross Domestic Product (GDP) across 173 countries, spanning the years from 2000 to 2019. Employing a rigorous Linear Regression Model, our analysis unveils a notably weak association between GDP and suicide rates. It becomes increasingly evident that economic prosperity, as symbolized by GDP, offers only limited predictive power when it comes to understanding the fluctuations in suicide rates. These findings underscore the multifaceted nature of suicide, emphasizing the pivotal roles played by a myriad of social, mental health, and economic factors that extend beyond the scope of GDP. This research serves as a valuable resource, providing vital insights for policymakers and researchers seeking to navigate the complex landscape of factors influencing global suicide rates and develop more targeted interventions.

Keywords: GDP; suicide rate; linear regression model.

1. Introduction

Suicide rates have always been an important public health problem all over the world, with far-reaching and complex impacts on individuals, families, and society. In the past few decades, research on suicide rates in various countries has gradually attracted widespread attention. This attention comes not only from concerns about mental health issues, but also from the urgent need to understand how socioeconomic factors affect suicide rates. The increase in the suicide rate will not only lead to a humanitarian crisis [1], but also have a negative impact on the country's social stability and economic development [2, 3].

Gross domestic product (GDP), as a core indicator of national economic health, has been subject to extensive research. GDP not only reflects a country's economic vitality, but is also related to many social and health factors [4, 5]. Therefore, studying the relationship between suicide rate and GDP has important theoretical and policy significance. Understanding the potential relationship between the two can help us better understand the dynamics of suicide rates and provide targeted policy recommendations to reduce the rising suicide rate.

However, despite much attention being paid to the relationship between suicide rates and GDP, there are still many complexities and controversies surrounding research in this area. Some studies suggest that economic growth may lead to declining suicide rates because it provides more employment opportunities and improved social support systems [6-8]. On the other hand, some studies suggest the opposite, suggesting that high levels of economic stress and inequality may contribute to rising suicide rates [9-11]. Moreover, there are also researches illustrating that there is not much correlation between suicide rate and GDP [12].

Before delving further into the intricacies of the relationship between suicide rates and GDP, it is imperative to appreciate the magnitude of the global suicide burden. According to the World Health Organization's (WHO) estimation, every year, there are about 800,000 people's death is due to suicide, making it a grave public health issue that claims more lives than war, natural disasters, and homicides combined [13]. These statistics underscore the urgency of comprehending the multifaceted factors influencing suicide rates.

Suicide does not discriminate, it transcends age, gender, socioeconomic status, and geographic boundaries. It leaves a profound impact on families and communities, with repercussions that extend far beyond the individual act. Each suicide represents a story of despair, unfulfilled potential, and the shattered lives of those left behind. The aftermath of a suicide can evoke feelings of guilt, grief, and bewilderment among surviving family members and friends, perpetuating a cycle of emotional trauma [14].

Beyond its individual and familial toll, suicide exacts a substantial societal and economic cost. The loss of human capital and the burden on healthcare systems are evident manifestations of this cost. Additionally, suicide carries a stigma that can impede open discussions, making it challenging for affected individuals to seek help and for society to address this critical issue effectively. The complex interplay of factors contributing to suicide underscores the necessity of comprehensive research to inform prevention and intervention strategies.

In this context, the correlation between suicide rates and GDP assumes particular importance. The aim of this essay is to rummage (around) in the correlation between suicide rate and GDP by using of statistical models, specifically linear regression models. GDP and suicide rate data at various time points in each country will be utilized to try to identify the correlation between the two and explore the potential relationship between GDP growth and suicide rate.

2. Methods

2.1. Data Sources

Two primary sources are chosen to become the datasets for the study: the World Health Organization and Kaggle. Suicide rate data from the Global Suicide Rate database is provided by the World Health Organization. This database compiles suicide rate statistics from various countries and is widely recognized for its comprehensive coverage and high reliability. Additionally, GDP data is obtained from Kaggle's international economic datasets. Kaggle provides a diverse array of datasets contributed by the community and often includes valuable economic indicators. The GDP data we accessed from Kaggle is widely accepted and commonly used for international research and policy analysis.

2.2. Variable Selection

For the study, two key indicators are selected: suicide rate statistics and GDP data. We collected data for 173 countries spanning the years from 2000 to 2019. Suicide rate, which specifically means the quantity of death do to suicides per 100,000 people within a given time frame. It is a critical metric for measuring the severity of the suicide issue within a country. High suicide rates can indicate underlying mental health issues and societal pressures, while low rates may reflect a healthier social environment. Gross Domestic Product is a basic index that indicates the economic situation of a country. GDP is chosen due to economic conditions are believed to have a potential association with suicide rates. Economic growth can offer more employment opportunities and improved social support systems, potentially reducing suicide rates.

2.3. Model Principle

In the research conducted, a simple linear regression model will be utilized to investigate the association between suicide rates and GDP. The application of the linear regression model facilitates the establishment of a mathematical relationship to forecast variations in suicide rates concerning fluctuations in GDP. In this study, a Simple Linear Regression Model is employed to explore the relationship between GDP and suicide rates. This model assumes a linear association between a dependent variable (suicide rates) and an independent variable (GDP). The model can be expressed mathematically as:

$$\text{Suicide Rate} = \beta_0 + \beta_1 \cdot \text{GDP} + \varepsilon \quad (1)$$

Suicide Rate represents the dependent variable, which is the rate of suicides we aim to predict or explain. GDP stands as the independent variable, representing the economic indicator that we believe may influence suicide rates. β_0 denotes the intercept, signifying the predicted suicide rate when GDP is zero. β_1 represents the slope, indicating how a unit change in GDP corresponds to a unit change in suicide rates. ϵ accounts for the error term, reflecting unexplained variability.

3. Results and Discussion

3.1. Model Results

By creating linear regression model using the R language brief information about the results are carried out. This section will discuss the results of linear regression analysis on the data set from 2000 to 2019, with GDP as the dependent variable and suicide rate as the independent variable. The following table 1 summarizes the key findings from that period.

Table 1. Model results

Intercept (β_0)	GDP Coefficient (β_1)	R-squared	p-value
10.77	3.441e-13	0.00265	0.05431

In addition to the results presented in the table, linear regression analysis was further visualized through graphical representations for the years from 2000 to 2019. The scatter plot with regression lines provide a visual understanding of the relationships between GDP and suicide rates in this particular period (Figure 1).

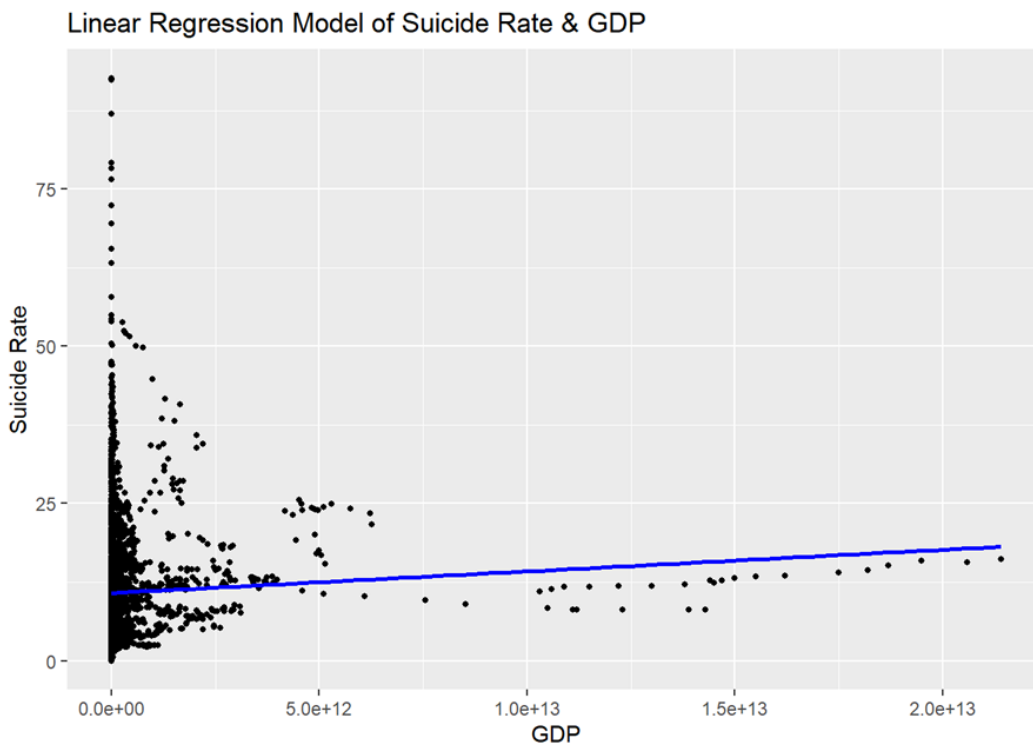


Fig. 1 Linear regression graph

3.2. Discussion

The results of the regression analysis during this study period paint a vivid picture of the intricate relationship between GDP and suicide rates. It is evident that the connection between these two variables is exceedingly feeble. The coefficient derived from our regression model is strikingly close to zero, indicating a striking absence of any substantial correlation between a nation's economic prosperity, as represented by GDP, and its suicide rates. This discovery carries significant

implications, emphasizing that economic affluence, at least as measured by GDP, provides little predictive power concerning changes in suicide rates.

A closer inspection of the data reveals a remarkable degree of variability in the residuals, which represent the discrepancies between our model's predicted values and the actual observed suicide rates across all the years encompassed in our analysis. This pronounced statistical variability serves as a stark reminder that multiple additional elements are at play when it comes to influencing suicide rates. These factors encompass a wide spectrum, including the availability and quality of mental health services, the strength of social support systems, societal attitudes toward suicide, accessibility to lethal means, and various public health policies. The interplay of these factors appears to overshadow the influence of GDP.

Moreover, it is of utmost importance to underscore that, for the majority of the years examined, the p-values associated with the GDP coefficient remains well above the conventional significance level of 0.05. This statistical observation underscores that, from a strict statistical perspective, the connection between GDP and suicide rates does not attain the threshold of statistical significance. In more straightforward terms, changes in GDP do not offer a reliable foundation for predicting fluctuations in suicide rates throughout these years.

A notable aspect of our analysis is the intercept values in the regression model. The intercept, while not practically meaningful as it posits a scenario of zero economic activity, emerges as both positive and statistically significant. This finding implies the existence of a baseline suicide rate even in the hypothetical absence of economic activity. This emphasizes that factors beyond GDP play a pivotal role in determining suicide rates, and the economic dimension alone is insufficient to explain this public health concern.

Lastly, the R-squared values, which gauge the proportion of variance in the data that our linear regression model can account for, are strikingly low, approaching zero. This low R-squared value reinforces the limitations of our linear model in explaining the fluctuations in suicide rates solely based on GDP. It underscores the multifaceted nature of the phenomenon and underscores the necessity of adopting a more comprehensive approach to investigate the multitude of factors that contribute to the complex tapestry of suicide rates.

4. Conclusion

From 2000 to 2019 the research reveals a consistent and important message: unlike expected, that a strong negative correlation between GDP value and the suicide rate may be occurred. The relationship between GDP and suicide rates is remarkably weak and statistically insignificant however. While this analysis focused solely on the economic dimension of suicide rates, it underscores the complexity of the issue and the need for a more comprehensive understanding.

Suicide rates are affected by several factors in several areas, for instance, health, social support networks, cultural attitudes, access to mental health services, and public health policy. GDP, as an economic indicator, does not capture the intricacies of these determinants adequately. This reaffirms the idea that suicide is a multifaceted problem that cannot be reduced to economic conditions alone.

The results highlight the importance of a holistic and multidisciplinary approach to suicide prevention. Addressing this public health concern effectively requires strategies that encompass mental health awareness, early intervention, reducing access to lethal means, promoting social cohesion, and addressing the underlying determinants of mental well-being.

Furthermore, these findings also highlight the limitations of linear regression models when studying complex social phenomena. Suicide rates are influenced by numerous interrelated factors, and a simple linear model based on GDP alone cannot capture the nuanced dynamics at play.

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