To be, or not to be: A study of suicides in India

Ray, Shaswata and Husain, Zakir

Economics Department, Presidency University, Economics Department, Presidency University

10 May 2019

TO BE, OR NOT TO BE

A STUDY OF SUICIDES IN INDIA

SHASWATA RAY

Email: shaswataray@gmail.com

ZAKIR HUSAIN

Email: dzhusain@gmail.com

DEPARTMENT OF ECONOMICS

PRESIDENCY UNIVERSITY

KOLKATA, INDIA

TO BE, OR NOT TO BE
A STUDY OF SUICIDES IN INDIA

Abstract

Suicide is a complex public health and social issue of global dimension, which has taken a staggering toll on global public health, with almost one million people dying annually due to suicide worldwide. A WHO report in 2016 found that 79% of the global suicides occur in low- and middle-income countries like India. This study looks at the regional and across time variations in the incidence of suicides across the different states and union territories of India. The rates of suicide differ across the different demographics and regions of the country, with there being specific clusters of states with high or low suicide rates. Suicide is a societal crisis and is hence related to various socio-economic factors like income, inequality, education, unemployment, etc. A regression analysis has been done studying the dependence of such variables on suicide rates of various states, with income, degree of industrialisation of the economy and education levels evidencing to be important correlates with suicide rate.

Keywords: Suicide; Regional variations in suicide; Determinants of suicide rate; Panel data; India.

JEL classification: C23; Z0.

1. Introduction

There has been much debate and disagreement over the years regarding the definition of suicide. The reason is that suicide has been defined differently, depending on the purpose of the definition (e.g., medical, legal, administrative). However, an often-cited definition was first given by psychologist Edwin Schneidman in his book "Suicide as Psychache: A Clinical Approach to Self-destructive Behavior" (1993). He defines suicide as "the conscious act of self-induced annihilation, best understood as a multidimensional malaise in a needful individual who defines an issue for which the act is perceived as the best solution" (1993:4).

Premature death from suicide is estimated to be the tenth leading cause of death in the world, and is as common as deaths from road-traffic accidents. Furthermore, in all countries there is a greater or lesser degree of stigma that attaches to suicide, so not all suicides are officially recorded as such. It is sometimes called the "silent killer", because unlike other deaths caused due to diseases and illnesses, there are sometimes no symptoms or precursors for suicidal death. Epidemiological necropsy studies in several countries suggest that the proportion of suicides that are "unofficial" is very high. Apart from the loss of life, a suicide means the loss of a breadwinner and parent for the family, long-lasting psychological trauma for children, friends, and relatives, and the loss of economic productivity for the nation, so there is every reason to take suicide seriously.

Suicide, therefore, is an increasingly important social and public health issue: from 1990 to 2010 the number of global suicides increased by 32% (Rane & Nadkarni 2014). In the age group of 15 to 49, it is a particularly serious issue with suicide accounting for 4.8 % and 5.7% of all deaths in females and males, respectively. However, there is considerable variability in the prevalence of suicides and in the factors that influence the occurrence of suicide between geographic regions, cultures, and over time, so country-specific analyses are needed to develop targeted suicide prevention efforts (Rane & Nadkarni 2014).

A World Health Organisation (WHO) report in 2004 found that India accounted for nearly 20% of the 900,000 victims of suicide in the world, while the suicide rate in India (the number of suicides per 100,000 of the population) has risen from 7.03 in 1985 to 10.6 in 2015 (NCRB). Suicide is, thus, an increasingly important and relevant social problem in the Indian society, yet there seems to be a lack of discussion and attention given to it by the general public and the policy makers. While farmer suicides may have attracted the headlines in the past few years, suicide remains an equally relevant problem in the urban areas. Students and young individuals in the age group of 21

to 30 are particularly vulnerable to the risk of suicide, with there being huge amount of mental stress caused due to academic and career related endeavors.

Another serious concern is the widespread allegations of severe underreporting of suicidal deaths in the country. National Crime Records Bureau (NCRB), which is the most comprehensive source of data on suicidal deaths in the country and uses police records to source their data, have particularly come under the scanner. The main reason for the underreporting of suicide is the huge social stigma attached to mental health problems in the country. So, there have been numerous cases when deaths caused due to suicide have been reported as natural deaths. The situation is particularly grim in a number of rural areas of the country, where independent research has reported suicide rates that are almost five times higher than the national average. Another possible reason could be that attempted suicide was considered a crime under the Indian Penal Code, until the passage of the Mental Healthcare Act in April, 2017. Cultural influences, religious sanctions, mentally ill stigmatization, competing political imperatives, and socioeconomic factors reinforce this neglect of the issue (Rane & Nadkarni 2014).

2. Literature Review

Suicides in India have broadly been analysed in context of their prevalence, means adopted, probable variations across ages, genders, education levels, incomes and other socio-economic factors.

2.1 Prevalence

Suicide rate, generally defined as the number of suicides per 100,000 of the population, has been found to vary across regions.

One of the earliest studies on suicides in India examined all suicide cases reported in two village police stations in West Bengal, from January 1976 to September 1977 (Nandi et al., 1979). Their findings in the two villages were quite drastically different, with the suicide rate being 28.6 per 100,000 in one village and 5.1 per 100,000 in the other. Banerjee (1990) studied 58 suicides in one year based on police records in a cluster of villages with a population of 133,510, and found the suicide rate to be 43.4 per 100,000 per year. Hedge (1980) studied 51 suicides recorded over 9 years in a cluster of villages with a population of 61,561 and found that there were 9.3 suicides per 100,000 of the population.

Since 1986, Christian Medical College in Vellore, Tamil Nadu has operated a community-based surveillance system using verbal autopsy, based on a population of close to 108,000. Over the

years, a number of studies have been done using this database. Joseph (2003) analysed the data between 1994 and 1999 and found that suicides accounted for 8 to 12% of total deaths while the mean suicide rate was 95 per 100,000. Aaron (2004) studied 154 male and 152 female suicides (10 to 19-year olds) in the same area, and found huge disparity in the suicide rates of males and females. Abraham (2006) studied 152 male and 100 female suicides in persons 55 years or older over 8 years in a rural development area with total population of 108,000. Annual suicide rate for people over 55 years turned out to be 189 per 100,000.

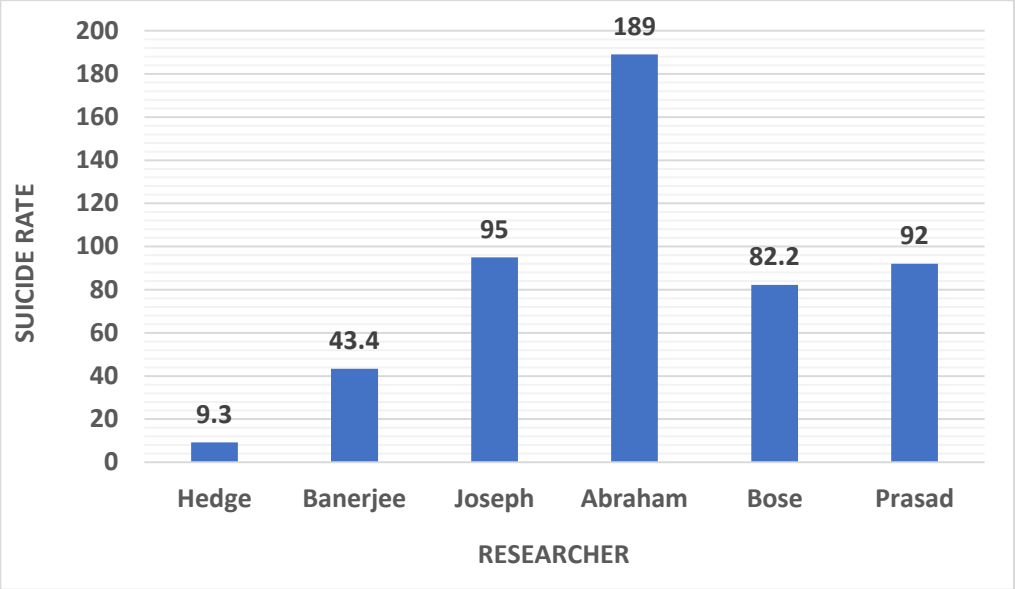

Figure 1: Suicide rates in rural areas as computed by different researchers

Figure 1 depicts a comparison of suicide rates as computed by different researchers from their studies in rural areas. There seems to be huge variations in the rates computed by different researchers, depending on the sample sizes taken, age and gender of the individuals studied and the time period of study.

2.2 Methods of suicide

The main methods of committing suicide in India have been extensively studied. Hanging and poisoning were found to be the most common methods of suicide. However, a rural and urban divide could be observed in this respect.

Ponnudurai investigated 87 cases of suicide in Chennai (then Madras) in 1978, using various police records. The most common method was hanging followed by ingestion of organophosphate pesticides in males and drowning in females. Various factors like feasibility, accessibility, credibility and rapidity of its action could be behind such a choice. Joseph (2003) found that

poisoning (45%) and hanging (41%) were the most common methods, while Abraham (2005) found that hanging (44%), poisoning with insecticide (40%), self-immolation (9%), and drowning (7%) were the most common. Gururaj (2004) analysed 269 suicide cases identified from police records (over a 3-month period) and 269 age- and gender-matched controls from a city of 6 million and found that hanging (59%), poisoning (25%) and self-immolation (11.5%) were the most common methods while burns (self-immolations) were twice more frequent among women than men.

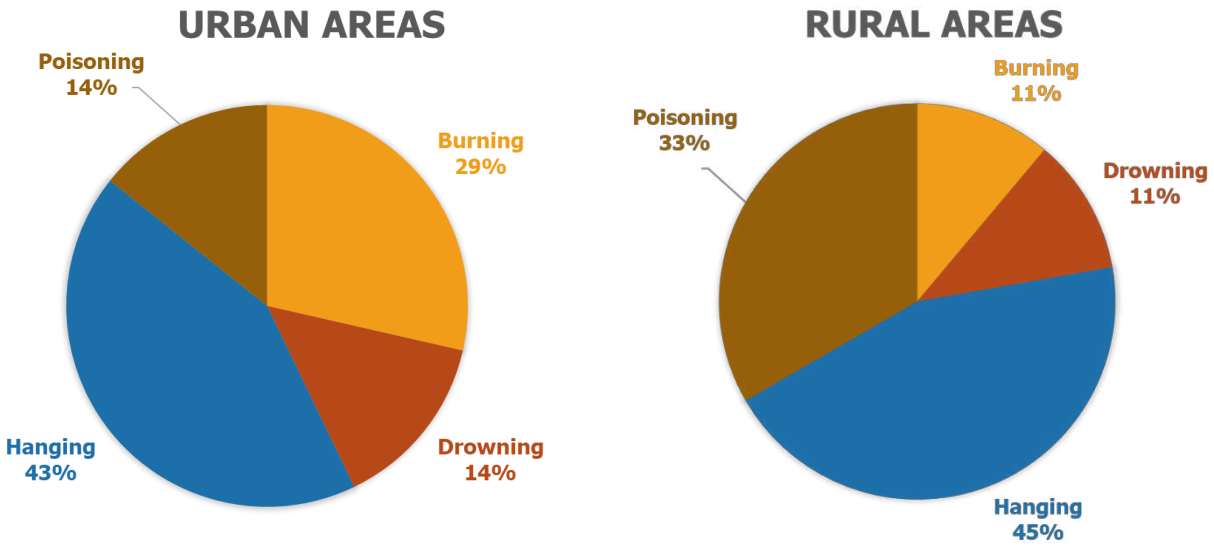

Figure 2 : Percentage share of the main method of suicides in selected studies on urban and rural areas

Figure 2 shows the urban-rural difference, with poisoning being the main method of suicide in 33% of the studies in rural areas. This percentage share is more than double than what is observed in the urban area. This could be possibly due to the easy availability of poisonous pesticides in rural area, which makes it the most accessible method of suicide.

3. Objective

The main objectives of the study are:

i. To find out the trends in the incidence of suicides in India

ii. To study the variations in the means adopted for committing suicide and the educational level of suicide victims

iii. To analyse the regional variations in the suicide rate across India

iv. To identify the determinants of suicide at a state level

4. Methodology

4.1 Sources of data

National Crime Records Bureau (NCRB) is the most comprehensive source of data on suicide in India. Data on various suicide rates, means adopted for committing suicides, educational levels of suicide victims have been sourced from the NCRB.

Unemployment rate (according to Current Weekly Status) data have been sourced from the 55th (1999-2000), 61st (2004-05), 66th (2009-10) and 68th (2011-12) rounds of the NSSO surveys. Literacy rate data have been sourced from the Census 2001 and Census 2011. The state domestic products for the different states have been sourced from the Directorate of Economics & Statistics of respective State Governments, and for All-India, it has been done from the Central Statistics Office. Gini co-efficients data for the different states have been sourced from the Planning Commission database.

4.2 Methods of Analysis

The initial part of the study comprises a graphical analysis, using simple line and bar charts. For the exploratory spatial analysis, the software GeoDa was used to create choropleth maps which are thematic maps in which areas are shaded or patterned in proportion to the value of the variable being displayed on the map.

Global Moran's I is estimated to test whether the data has a spatial pattern, or whether it is random. It measures how a variable in a particular region is similar to the values of the same variable in the surrounding regions. Moran's I is given by:

$$I = \frac{N}{W} \frac{\sum_i \sum_j W_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2}$$

when N is the number of spatial units indexed by i and j; x is the variable of interest; W_{ij} is a matrix of spatial weights with zeroes on the diagonal, and W is the sum of all w_{ij}.

Moran's I ranges from +1, denoting the highest positive spatial autocorrelation (clustering), to -1, reflecting the highest negative autocorrelations (dispersion). A value of zero indicates that there is absence of autocorrelation in the data. The values of Moran's I is important because it gives an overall indication of whether there is clustering in the regions being studied. Moran's I, however, is a measure of global spatial autocorrelation; it does not allow the identification of the presence (or absence) of significant spatial clusters for each location. Nor does it indicate what type of autocorrelation is occurring spatially. Therefore, Local Indicators of Spatial Association (LISA)

are employed to test the null hypothesis of spatial randomness by comparing the values in a given location with values in neighbouring regions (Anselin 1996).

The LISA significance map shows the statistical significance level at which each region can be regarded as making a meaningful contribution to the global autocorrelation outcome. This is determined using a Monte Carlo randomization procedure. The LISA value for each location is determined from its individual contribution to the Global Moran's I calculation (I_i). Actual LISA values are ranked relative to the set of values produced by the randomization process. The LISA cluster map, on the other hand, examines the type of spatial autocorrelation, by distinguishing between four cases .Two of these categories indicate positive autocorrelation ($0 < I_i < 1$), viz., when a location with an above-average value surrounded with neighbours with above-average values (high-high; HH), or when a location with below-average value surrounded with below-average values (low-low; LL). In contrast, negative spatial autocorrelation ($-1 < I_i < 0$) refers to a geographic distribution of values when a high value (above-average) is surrounded by low neighbours (high-low; HL) and vice versa (low-high; LH). The combination of the cluster and the significance maps allow identification of clusters contributing most strongly to the global outcome, and assess the nature of interaction.

The regression analysis was done using a panel data model. Panel data models describe the individual behavior both across time and across individuals. There are three types of models: the pooled model, the fixed effects model, and the random effects model.

Pooled model: The pooled model specifies constant coefficients, the usual assumptions for cross-sectional analysis. This is the most restrictive panel data model and is not used much in the literature.

Individual-specific effects model: We assume that there is unobserved heterogeneity across individuals. The next point of distinction is on the basis of whether the individual-specific effects are correlated with the regressors. If they are correlated, we have the fixed effects model. If they are not correlated, we have the random effects model.

Breusch-Pagan Lagrange Multiplier test: This is a test for the random effects model based on the OLS residual. If the LM test is significant, the individual specific effects model is preferable instead of the pooled OLS model.

But there is still is the question of whether a fixed or random effects model is more appropriate.

Hausman test: It tests whether there is a significant difference between the fixed and random effects estimators. The Hausman test statistic can be calculated only for the time-varying regressors. It is chi-square distributed with degrees of freedom equal to the number of parameters for the time-varying regressors. If the Hausman test is insignificant, the random effects model is used, while if it is significant, the fixed effects model is used.

5. Findings

5.1 National trends in incidence of suicides

NCRB defines suicide rate as the total number of suicides divided by the mid-year projected population (in lakh).

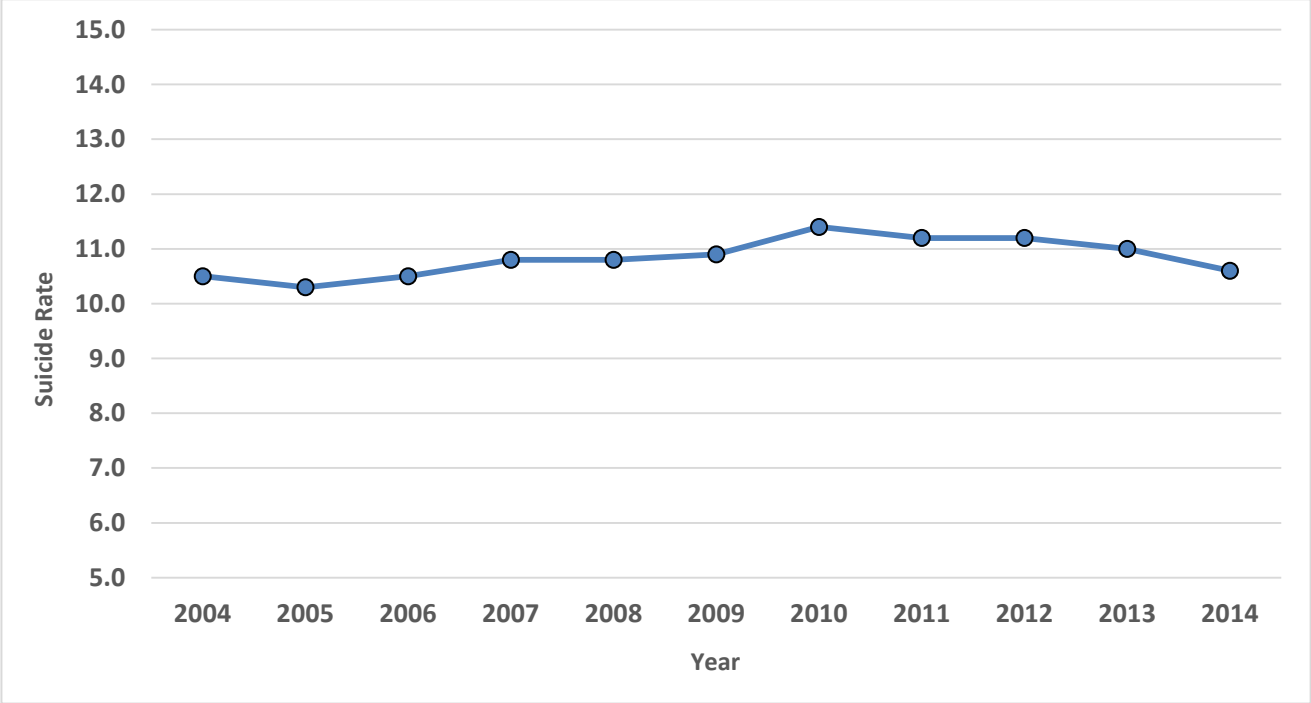

Figure 3: Suicide rate in India between 2004 and 2014

The all-India suicide rate has remained more or less constant between 2004 and 2014, hovering around 11. There has been a marginal decline in the suicide rate since 2010.

5.2 Percentage share of the major means adopted for committing suicide across years

The means adopted for committing suicide vary from the easily available means such as consumption of poison, jumping into the well, etc. to more painful means such as self-inflicted

injuries, hanging, etc. The most common means adopted for committing suicides have been by hanging, poisoning, drowning and burning/self-immolation.

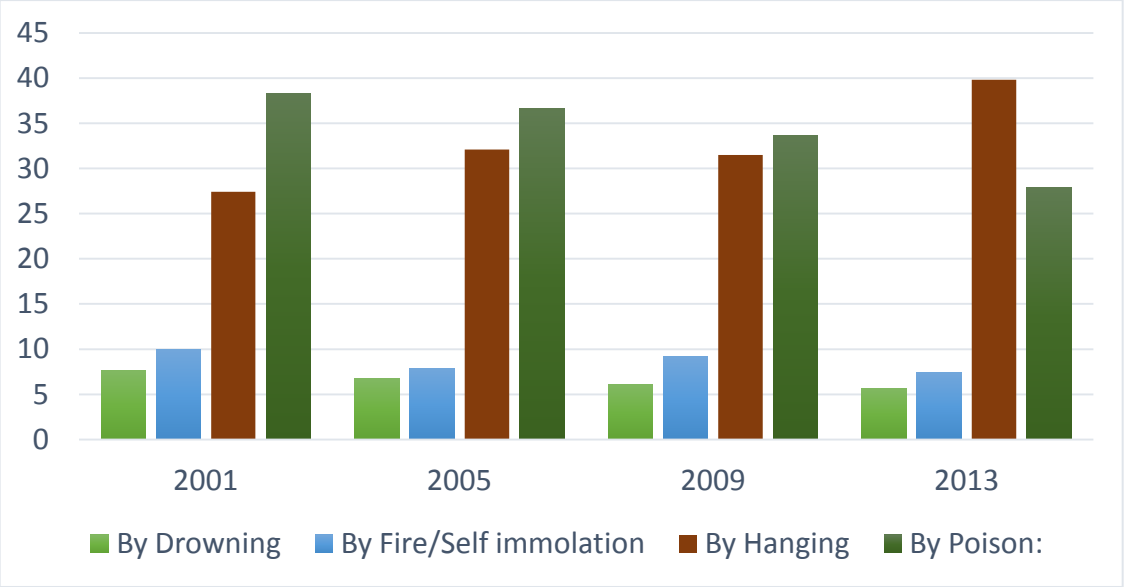

Figure 4: Percentage shares of the major means of committing suicide across years

In 2001, across India, the most common method was by poisoning, accounting for close to 40% of the total number of suicides committed. Over the years, this percentage share has gradually declined and by 2013, hanging was found to be the most common method.

5.3 Education levels of suicide victims in India

The number of suicides could also be analysed on the basis of the educational status of the victims.

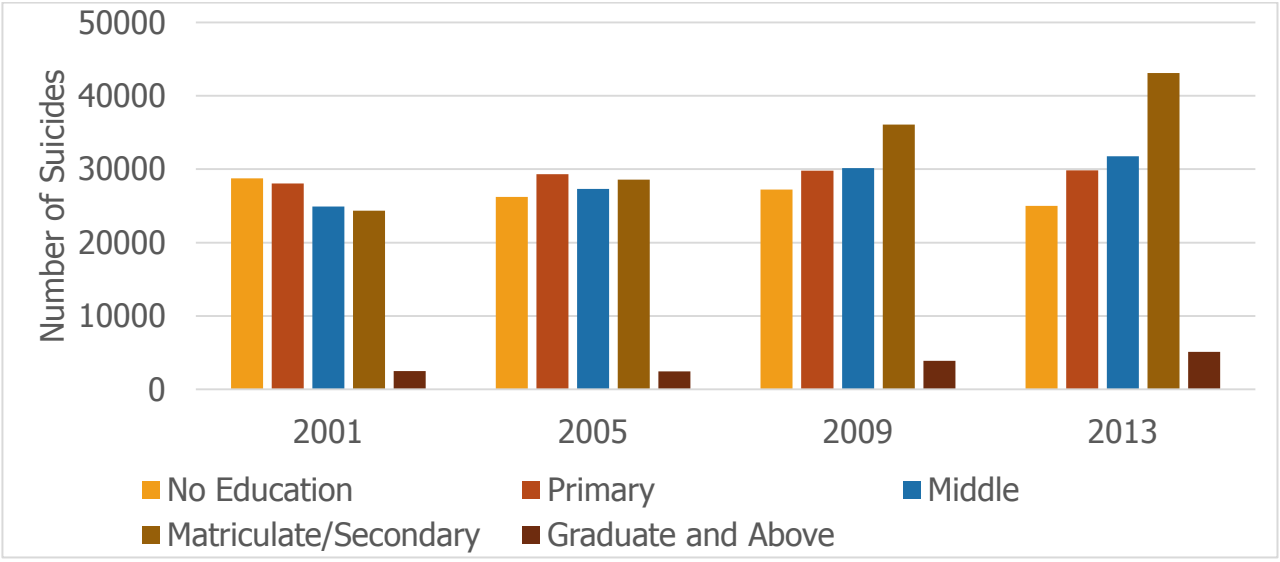

Figure 5: Education levels of suicide victims across years

Figure 5 shows that between 2001 and 2013, there has been a stark increase in the number of individuals with matriculate or secondary levels of education committing suicide. The total number of suicide victims who were graduates has remained fairly constant in the time period of study.

5.4 Suicide rates across the states in India over the years

5.4.1 Choropleth maps

The suicide rates have shown great cross-sectional variation across the states in India over the years. The rate can be as high as 39.9 per 100,000 as in Sikkim in 2009, or as low as 1 like in Manipur in the same year.

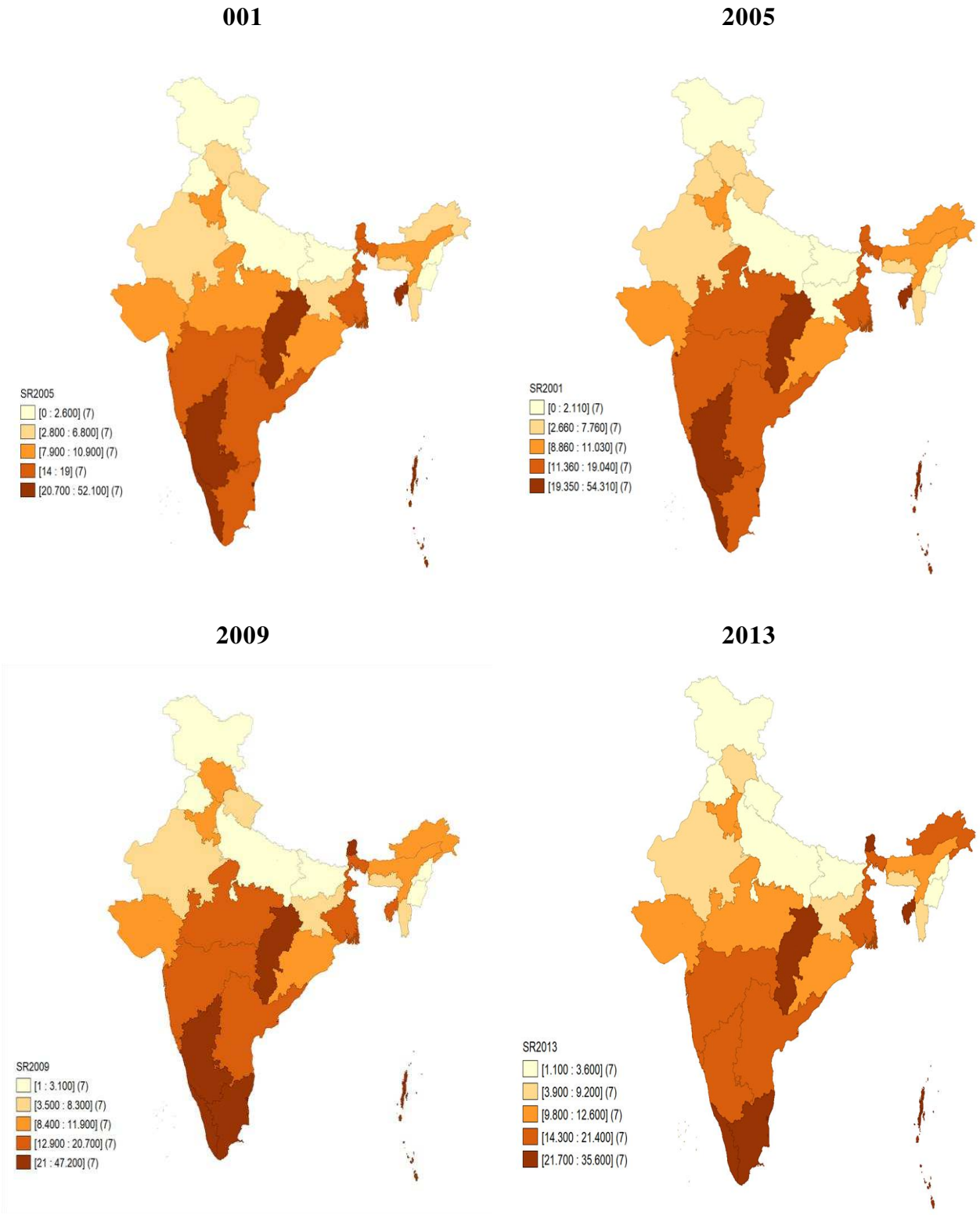

Figure 6: Choropleth maps showing the variations in suicide rates across years

Choropleth maps representing the suicide rates for the various states and union territories of India were created for 4 different years: 2001, 2005, 2009 and 2013.The suicide rates were divided into five quintiles for each year. A darker shade represents a higher value of the suicide rate, while a lighter shade represents a lower value.

Kerala, Karnataka and Chhattisgarh have had consistently high suicide rates. Tamil Nadu has seen a rise in the suicide rate over the years, while it has fallen in Karnataka. An overall North-South divide in the rates of suicide could be observed, with suicide rates in the northern states being consistently lower. Hence, suicide is not necessarily a development phenomenon.

5.4.2 Spatial Autocorrelation

Spatial autocorrelation checks how a cross-sectional component like a country or state correlates with other nearby components across a spatial area. When many similar values are present close to each other, there is positive autocorrelation while if there are a number of different values located close to each other, there is negative autocorrelation. It helps to identify whether there are specific clustering of highly similar or dissimilar values.

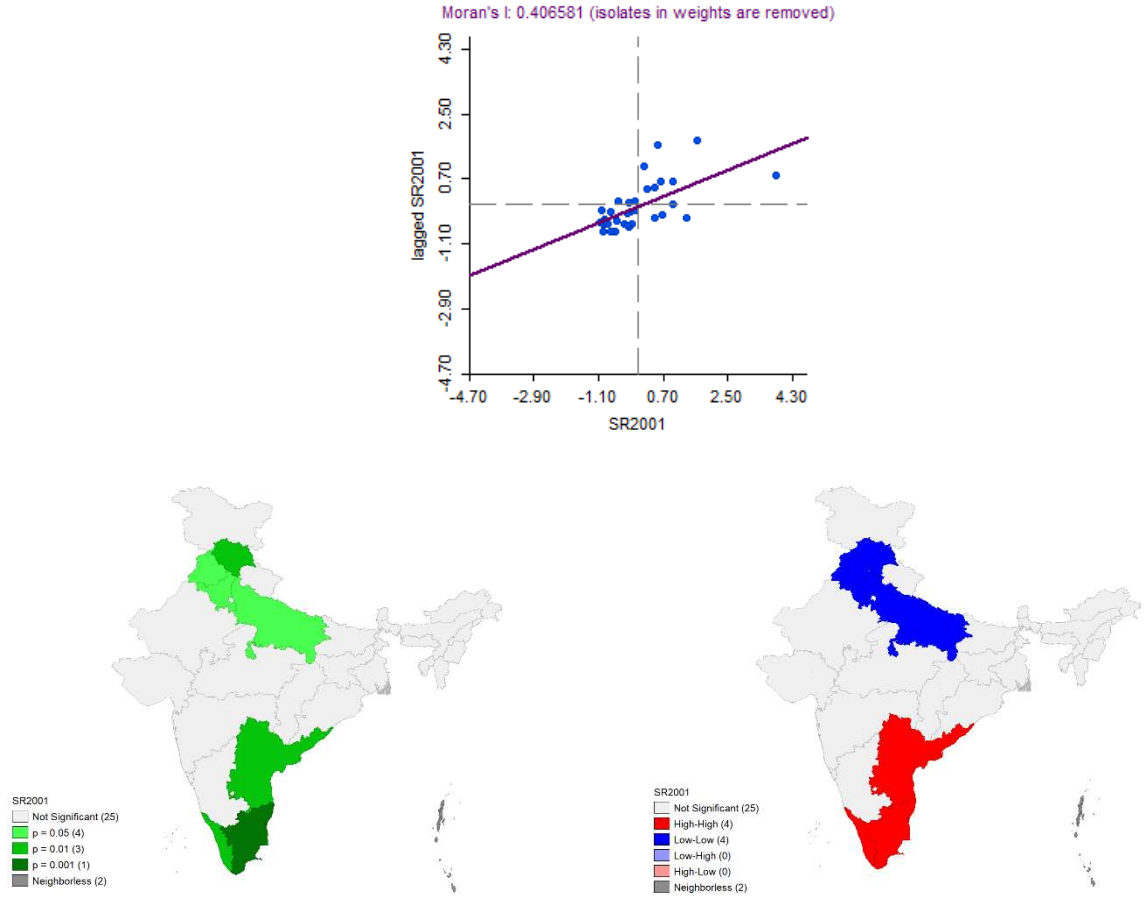

Figure 7.1 - Global Moran's I plot and significance and cluster maps for 2001

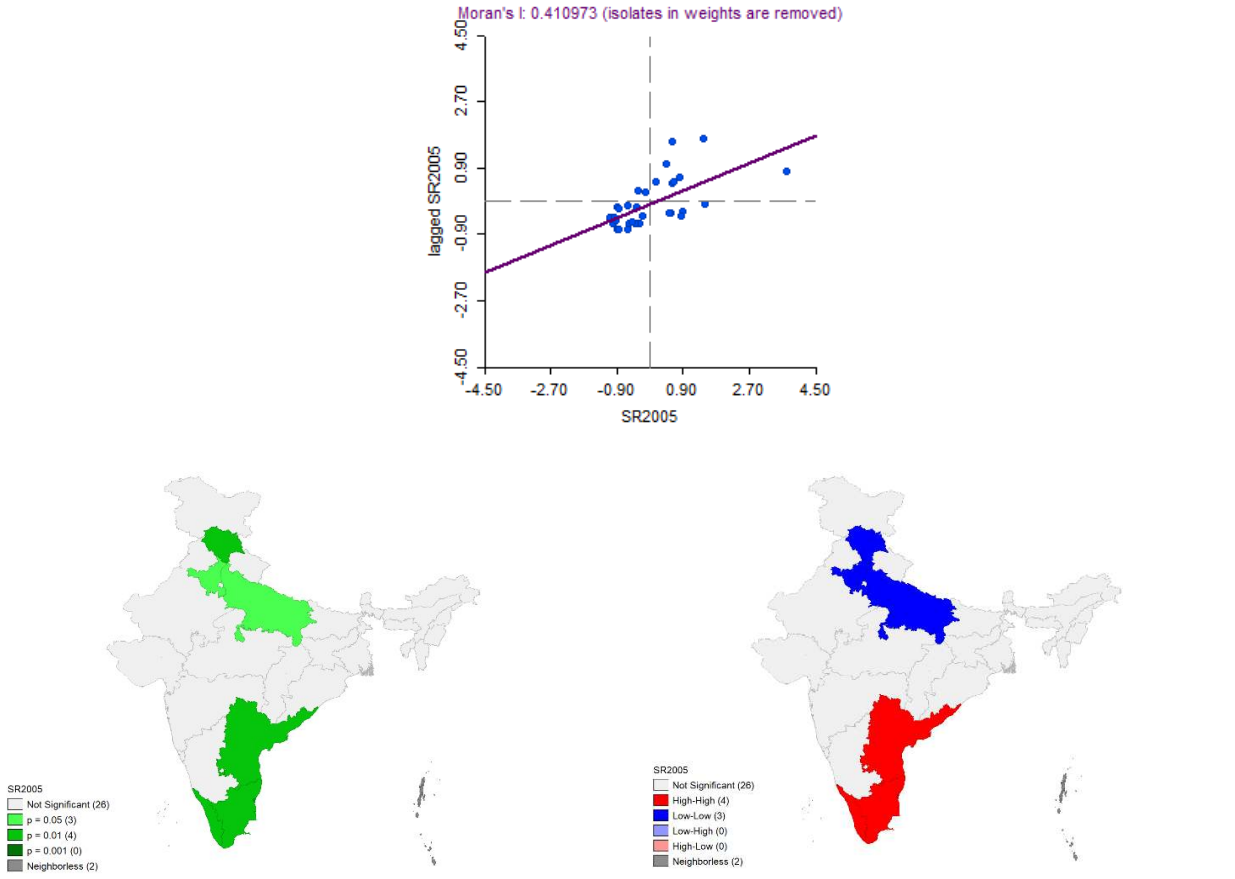

Figure 7.2 - Global Moran's I plot and significance and cluster maps for 2005

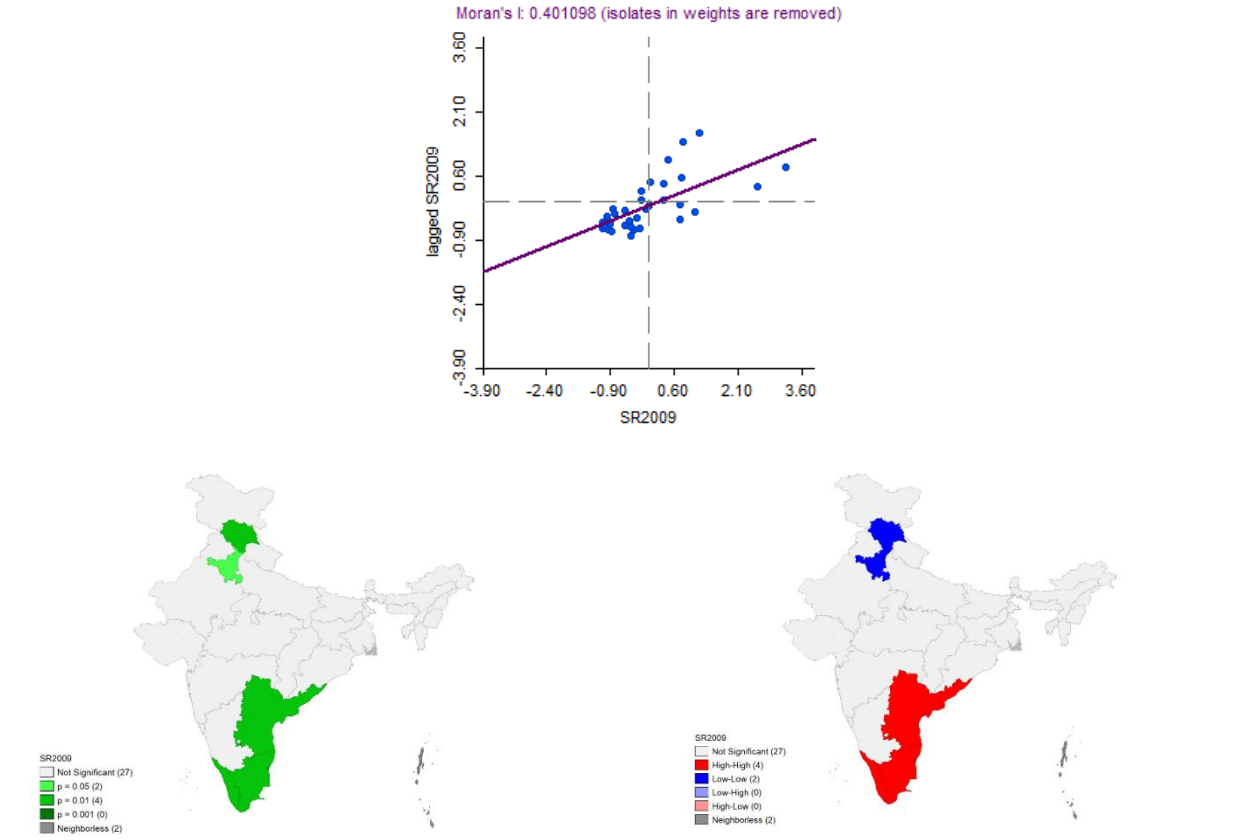

Figure 7.3 - Global Moran's I plot and significance and cluster maps for 2009

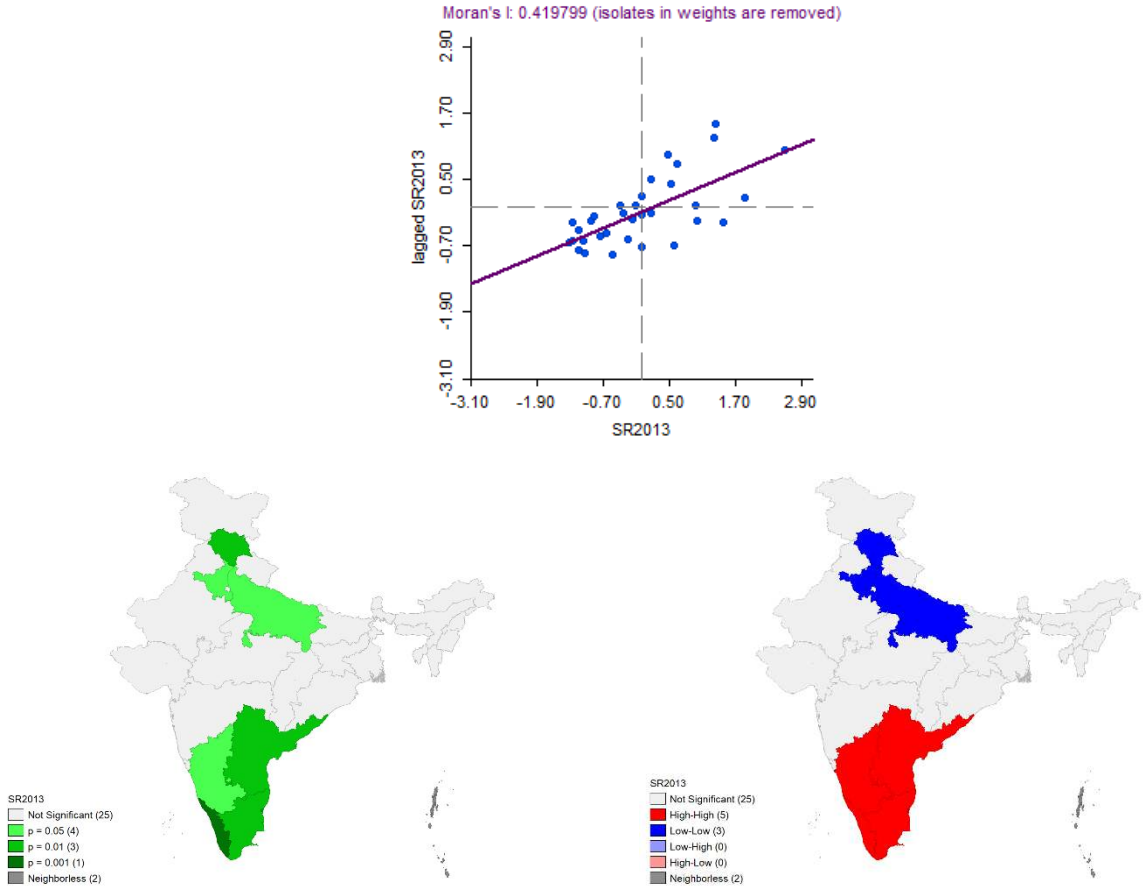

Figure 7.4 - Global Moran's I plot and significance and cluster maps for 2013

The strength of the spatial auto-correlation is measured by the Global Moran's I. The possibility of spatial clusters is signified by the relatively high value of Global Moran's I of close to 0.5**.** The spatial clusters have been significant in the northern states of Uttar Pradesh, Himachal Pradesh and Haryana (except Uttar Pradesh in 2009) and in the southern states of Kerala, Tamil Nadu and Andhra Pradesh.

The nature of the spatial clusters is revealed in the LISA cluster map. The northern cluster belongs to the Low-Low category; it implies that a low value of suicide rate in one state is associated with low values in neighbouring states as well. However, the clusters in the southern states fall in the High-High category.

5.4.3 Box Plots of the distributions of suicide rates of the different states in India

A box plot is a visualisation that represents the distribution of suicde rates across the different states in India in a particular year. The box plot focuses on the quantiles of the distribution. The data points are sorted from small to large. The median (50 percent point) is represented by the

horizontal orange bar in the middle of the distribution. The brown rectangle goes from the first quartile (25th percentile) to the third quartile (75th percentile). The difference between the values that correspond to the third and the first quantiles is referred to as the inter-quartile range (IQR). The interquartile range is a measure of the spread of the distribution, a non-parametric counterpart to the standard deviation. The horizontal lines drawn at the top and bottom of the graph are the so-called *fences* or *hinges*. They correspond to the values of the first quartile less 1.5 IQR, and the third quartile plus 1.5 IQR. Observations that fall outside the fences are considered to be *outliers* (Anselin 2005).

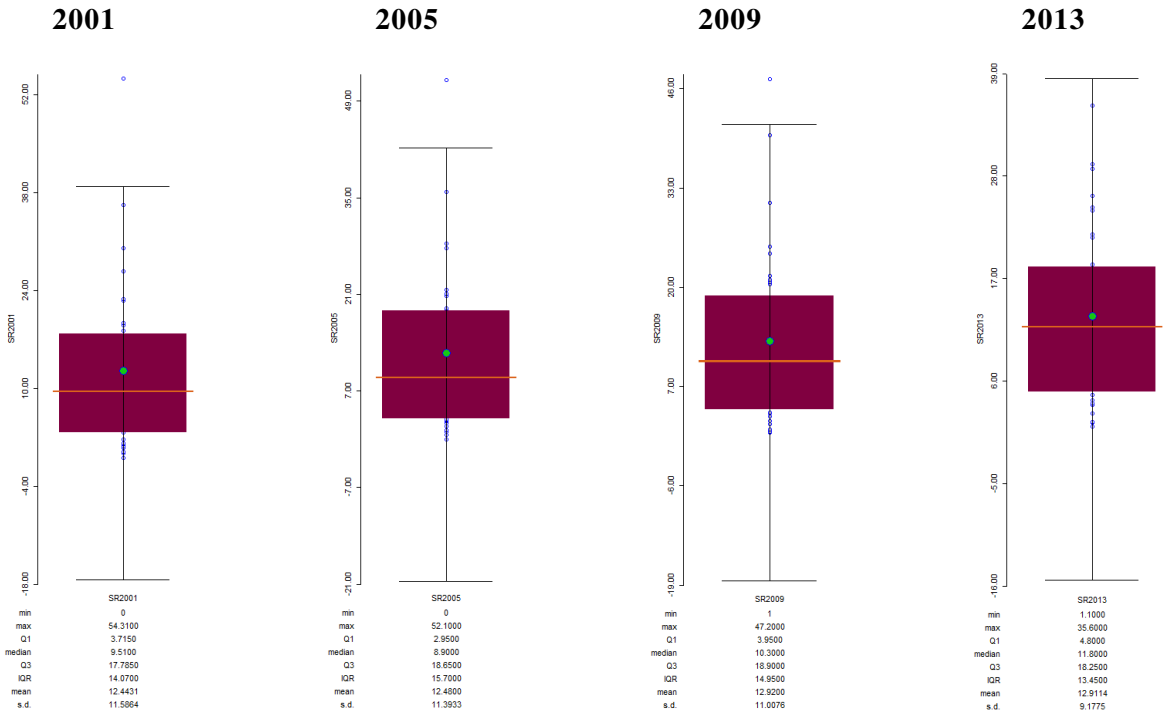

Figure 8 - Box plots of the distribution of suicides in 2001, 2005, 2009 and 2013

Figure 8 shows the box plots of the distribution of suicides in India over the years. The median of the distribution has increased progressively since 2005, while the mean has remained relatively constant in the four time periods. In each of the four years of study, there is an upper outlier which corresponds to the union territory of Puducherry which has historically had an abnormally high suicide rate.

6. Suicide rate and its relationship with various socio-economic factors

Suicide is a multicausal phenomenon that results from interactions of psychological, social, biological, cultural, economic and environmental factors. So, individual risk factors do not explain the regional variations in rates (Machado et al., 2015). Researchers have focused on attempts to explain the relationship between suicide and various socio-economic factors like income, income inequality, education, unemployment, etc. A comprehensive review of the association between socio-economic factors and suicide was done by Chen et. al in 2014.

Income

One of the foremost studies on suicide, in context of economics, was done by Hamermesh and Soss (1974) where they proposed a model in which a person attempts suicide when his or her discounted expected lifetime utility falls below a specific threshold level. Higher levels of income are generally associated with improved standards of living and also greater satisfaction with life, and also usually signals the availability of more resources to cope with life's stressful events and circumstances (Burr et al., 1994). Overall, higher income is expected to increase the utility level of the individual and thus his or her chances of committing suicide are reduced.

Generally, researchers use the real GDP per capita or the average growth rate of the region to indicate the average level of income in the region. However, there have been conflicting results regarding the relationship between income level and suicide rate. Some studies have found that suicide rates are higher in regions of lower per capita GDP (Kimenyi and Shughart, 1986; Chuang and Huang, 2003) while some have shown the exact opposite results. A positive relationship has convinced many researchers to conclude that this could be used to testify Emile Durkheim's theory that poorer people get used to the hardships and deprivation of their lives, and thus, their coping mechanism may actually reduce the risk of suicide (Burr et al., 1994).

Income Inequality

With rising inequality levels across the world, researchers have realised that it is not just the average income, but also how the income is distributed across the economy that plays a part in affecting the number of suicides. A country plagued by high income inequality leads to extra levels of stress and anxiety in the minds of the citizens, who are at the bottom of the socio-economic ladder. This poor state of mental health may directly lead a person to commit suicide, or indirectly, after prolonged alcohol and drugs abuse. However, despite the theoretically clear prediction, the empirical evidence is mixed. Some studies (Daly and Wilson, 2006) find a significantly positive relationship between income inequality and suicide rate, while others fail to find a statistically significant relationship (Neumayer, 2003).

Unemployment

Unemployment leads to a huge amount of uncertainty in an individual's life. Having a job is not just a source of current income, but also generally is an indicator of future financial stability. Thus, unemployment causes a reduction in permanent income and should lead to an increase in the incidence of suicides and suicide attempts according to Hamermesh and Soss' (1974) framework. Also, unemployment could lead to severe stress and mental health problems which could ultimately lead to suicide. A positive relationship between suicide rate and unemployment has been observed by a number of researchers (Kimenyi and Shughart, 1986; Chuang and Huang, 2003; Klick and Markowitz, 2003; Neumayer, 2003).

Education as an Important Determinant of Income

Education level has been considered as one of the major determinants of income in a number of studies. A higher level of education has both indirect and direct links with a lower level of suicide rate. The former is through the availability of better jobs and higher incomes while the latter through a greater degree of satisfaction in life. On the contrary, individuals with higher levels of education are prone to higher levels of frustration and stress because of the rising competition among students and co-workers, leading to higher suicide rates. Existing studies showed mixed results and the impact of education level on suicide rates are gender-age-region specific (Klick and Markowitz, 2003).

6.1 Regression analysis

The variability in the incidence of suicides and suicide rates and the impact of the various socio-economic factors could be studied with the help of a regression model.

The explanatory variables are:

i. IASDP – inequality adjusted SDP, which factors in the effects of both income and income inequality in one variable. This is calculated for each state and union territory using

$$IASDP = (1 - G) * SDP$$

where G = Gini coefficient for each state and SDP = State domestic product

ii. INDPER – percentage share of industry in the state domestic product, which indicates the degree of industrialisation of the economy

iii. URATE - unemployment rate is defined as the number of persons/person-days unemployed per 1000 persons/person-days in the labour force, calculated according to current weekly status (CWS)

iv. LITRATE – "effective literacy rate" which is defined as the total percentage of the population of an area at a particular time aged seven years or above who can read and write with understanding

The explained or the dependent variable is the suicide rate (SR) which is the number of suicides per 100,000 of the population.

Since consecutive year-wise variations may not be substantial, the years of study are taken at four-year intervals starting from 2001 till 2013.

Scatter Plots

Each of the four explanatory variables are plotted against the dependent variable, suicide rate for the years 2001, 2005, 2009 and 2013.

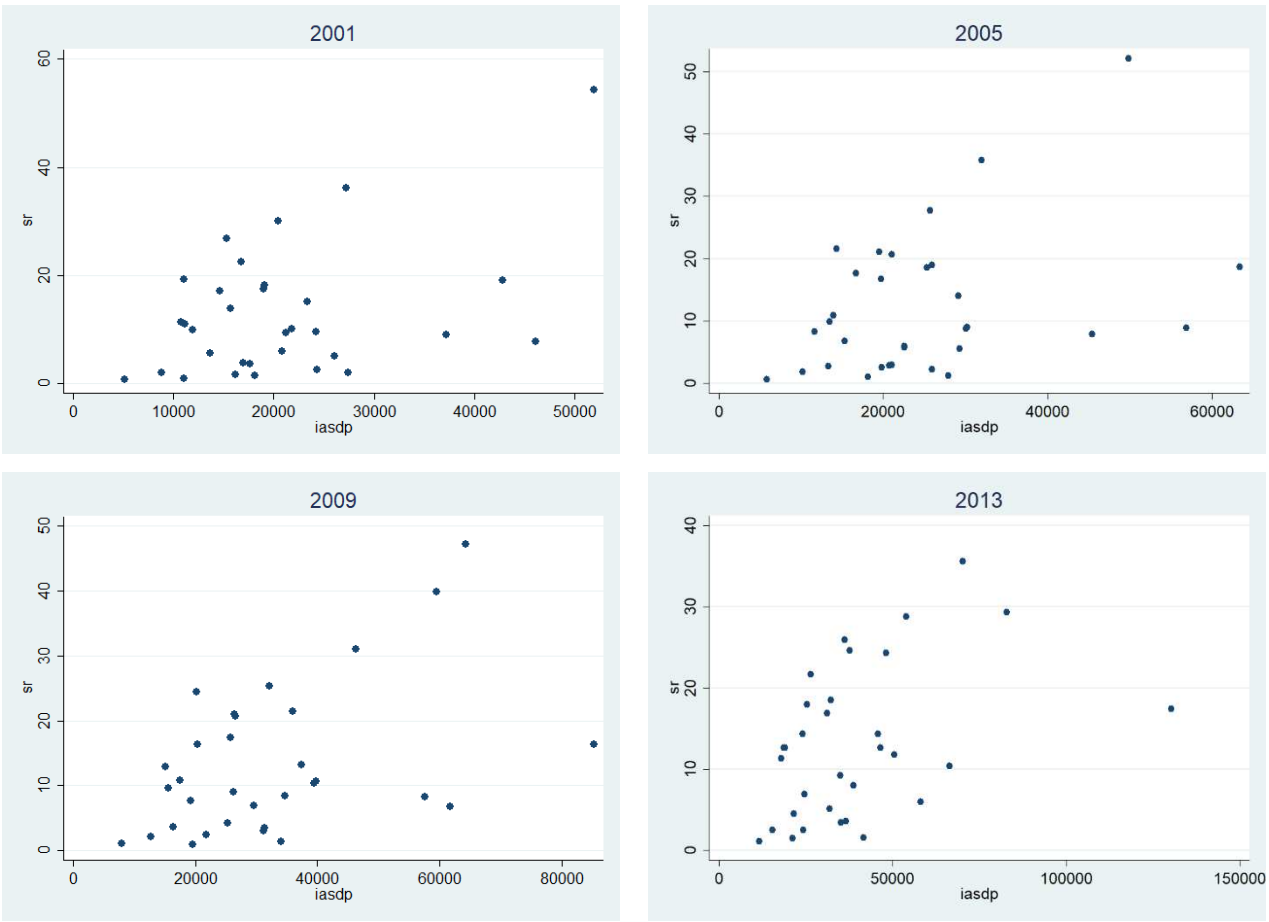

Figure 9.1 Scatter plot between suicide rate and IASDP across the years

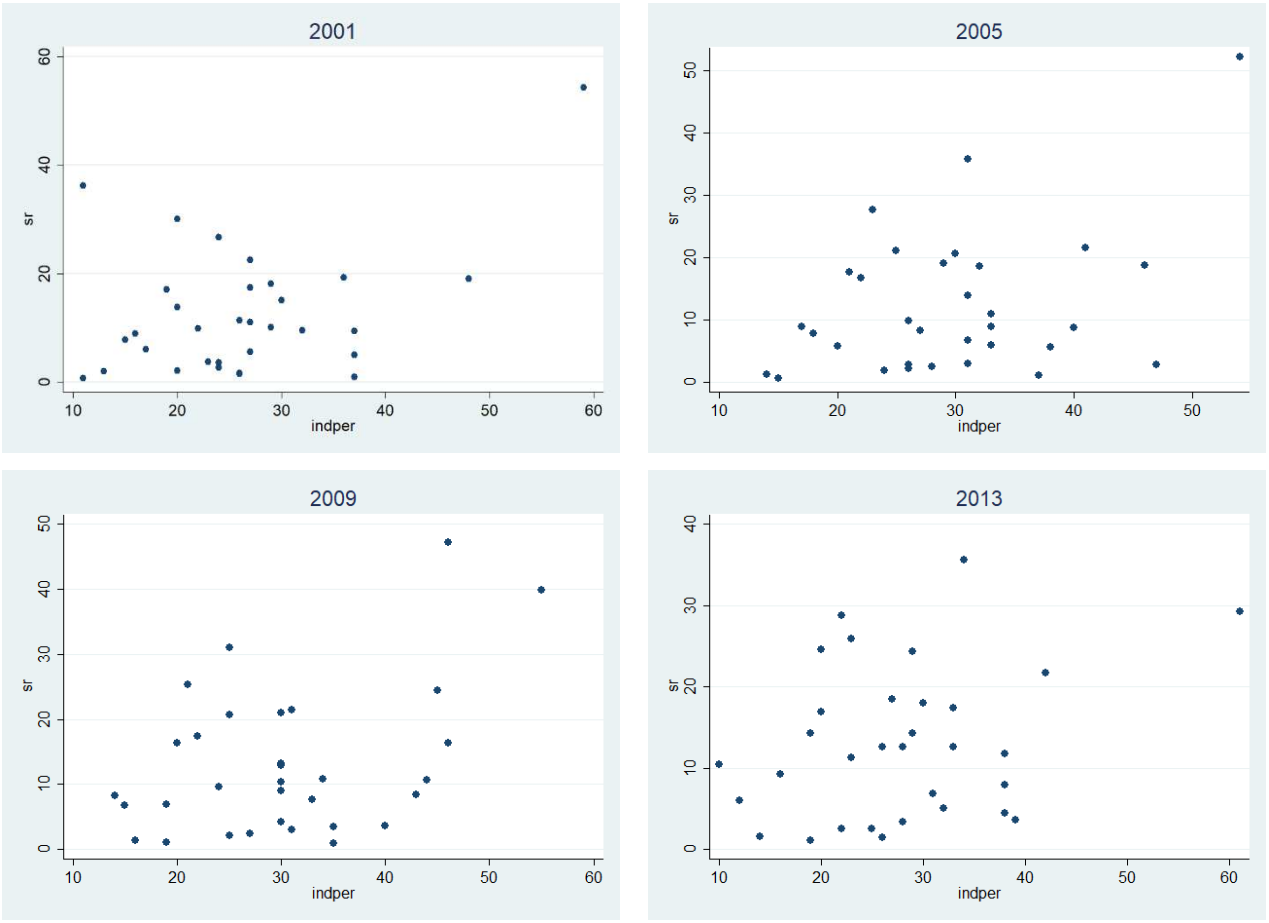

Figure 9.2 - Scatter plot between suicide rate and INDPER across the years

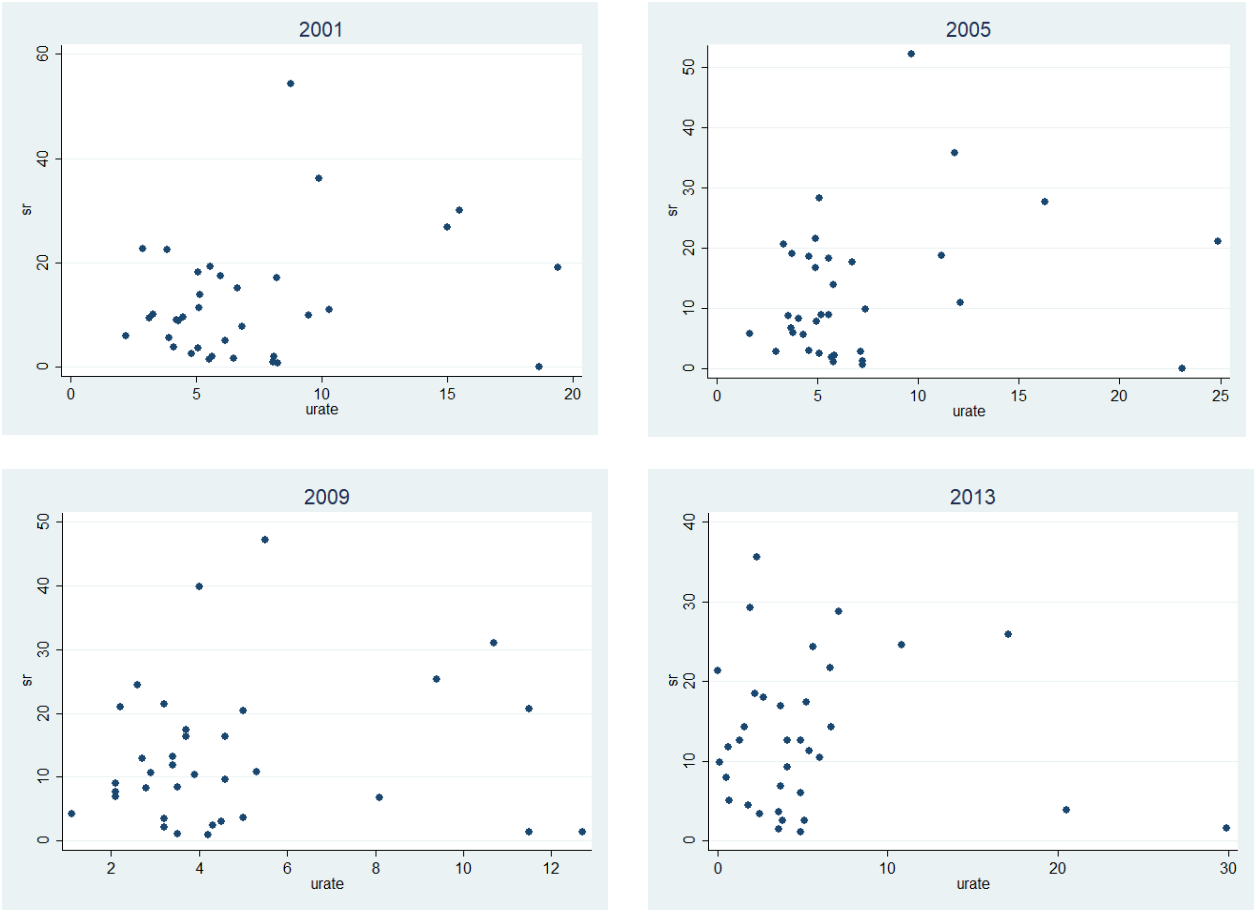

Figure 9.3 - Scatter plot between suicide rate and URATE across the years

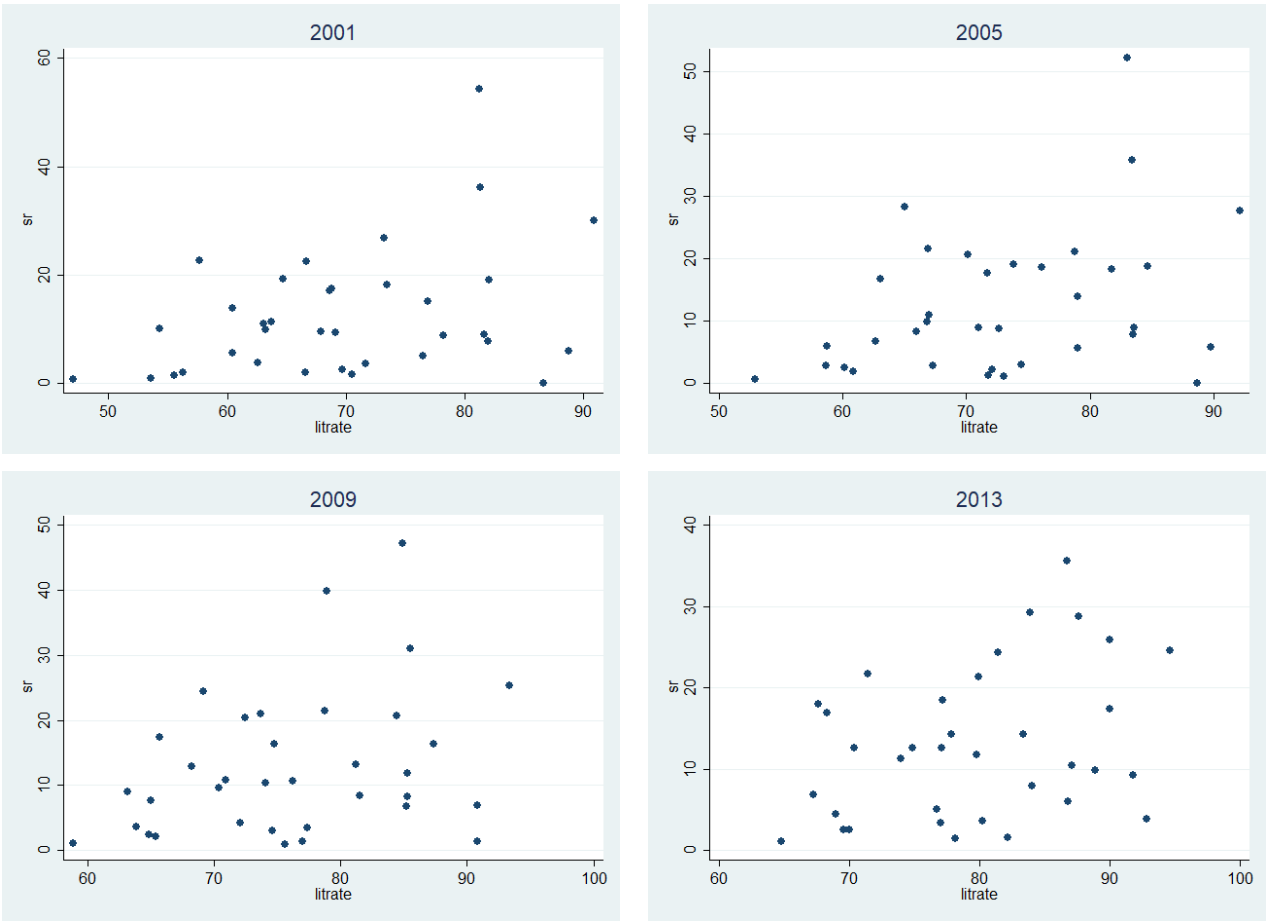

Figure 9.4 - Scatter plot between suicide rate and LITRATE across the years

The scatter plots show a general positive relationship between suicide rate and each of the explanatory variables, except unemployment rate. The scatter plot between suicide rate and unemployment is not conclusive enough to evidence a specific form of relationship between the two. However, from the scatter plots, we can deduce that there is a degree of heteroscedasticity present, that is, the variation in suicide rate differs depending on the value of the regressor.

Breusch-Pagan Lagrange multiplier (LM) test

The LM test helps us decide between an individual specific effects regression and a simple pooled OLS regression. The null hypothesis in the LM test is that variances across the states is zero and no individual specific effects in data (POLS appropriate).

Test: $Var(u) = 0$

$$\chi^2(01) = 153.63$$
$$\text{Prob} > \chi^2 = 0.0000$$

Here, the low p-value implies we reject the null hypothesis and conclude that individual specific effects model is appropriate.

Hausman Test

To decide between fixed or random effect models, a Hausman test was run where the null hypothesis is that the preferred model is random effects vs. the alternative that it is fixed effects. It essentially tests whether the unique errors (u_i) are correlated with the regressors and the null hypothesis is that they are not.

Test H_o: difference in coefficients not systematic

$$\chi^2(6) = 4.13$$
$$\text{Prob} > \chi^2 = 0.6586$$

With a p-value of 0.067, the null hypothesis is accepted, and hence, the random effects model is more appropriate.

Random-effects GLS regression

After running the Breusch-Pagan and Hausman tests, the conclusion was that a random effects model would be appropriate for modelling this regression analysis. In a random effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. It is of the general form:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$$

where u_{it} indicates between entity error and ε_{it} indicates within entity error. Random effects assume that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables.

Due to the presence of heteroscedasticity, biased estimates of the standard errors of the co-efficients are obtained. Hence, robust standard errors are used which relaxes the assumption of the errors being identically distributed and help to obtain unbiased estimates of the standard errors.

A summary of the results of the regression is given in table 1:

Table 1: Summary of regression results

Variable	Coefficient	Robust Std. Err.	z	P>|z|
IASDP	0.00004	0.000023	2.08	0.038
INDPER	0.323	0.092	3.49	0.000
URATE	0.087	0.122	0.71	0.477
LITRATE	0.311	0.165	1.88	0.061
CONSTANT	-18.949	10.379	1.83	0.068
YEAR DUMMY				
2005	-2.707	0.728	3.72	0.000
2009	-3.207	1.356	2.37	0.018
2013	-3.802	1.944	1.96	0.050
F (Wald)	76.98	-	-	0.000
R^2(within)	0.358			
R^2(between)	0.362			
R^2(overall)	0.358			
σ_u	8.726			
σ_e	2.447			
ρ	0.928			

Thus, the random effects GLS model is quite suitable, with the variables IASDP, INDPER and LITRATE being statistically significant. The explanatory power of the model, measured by the R^2 value is also quite acceptable.

An increasingly negative value of the intercept term for the time dummy variables over the years means that controlling for all other variables, the suicide rate has been falling over the years.

Hence, per capita income level, degree of industrialisation of the economy and literacy rate of the region are important determinants of the regional suicide rate in the Indian context. Unemployment rate, which itself suffers from considerable fluctuations across the years, is not statistically significant in explaining the suicide rate.

7. Conclusion

The national suicide rate has remained relatively constant at around 11 per 100,000 of the population. The major means of committing suicide in India are hanging and poisoning, with there being an urban-rural divide. The number of suicide victims with matriculate and secondary level of education has kept on increasing between 2001 and 2013. There is the presence of spatial clustering in three of the northern states (Uttar Pradesh, Himachal Pradesh and Haryana) and in the southern states of Tamil Nadu, Kerala and Karnataka. The northern cluster belongs to the Low-Low category: it implies that a low value of suicide rate in one state is associated with low values in neighbouring states as well. The clusters in the southern states fall in the High-High category. A random effects GLS regression revealed that inequality adjusted SDP, degree of industrialisation of the economy and literacy rate are statistically significant in explaining the suicide rates of the different regions.

Suicide remains an important societal crisis and individuals, communities and wider society can all play a part in reducing the risk of suicidal behaviour. Governments must take the lead by placing greater emphasis on prevention of suicide as an issue of inequality. There needs to be awareness and outreach programs organised, both by the government and private organisations, to destigmatise mental health problems and suicides. Schools, colleges and workplaces should have special support cells with a suicide prevention plan that should provide the necessary support to the needy individuals. Individuals, who have lost their family or friends to suicide, generally face an increased risk of suicide themselves. Proper psychological and financial support needs to be given to them to help them cope with their loss.

References

Aaron R, Joseph A, Abraham S, Muliyil J, George K, Prasad J, Minz S, Abraham VJ, Bose A 2004, 'Suicides in young people in rural southern India', *Lancet*,vol. 363, pp.1117–1118.

Anselin, L 1996, 'The Moran Scatterplot as an ESDA Tool to Assess Local Instability in Spatial Association', Taylor & Francis, London, pp. 111-125.

Anselin, L 2005, *Exploring Spatial Data with GeoDa: A Workbook*, University of Illinois, Urbana-Champaign.

Banerjee S, Chowdhury AN, Schelling E, Brahma A, Biswas MK & Weiss MG 2009, 'Deliberate self-harm and suicide by pesticide ingestion in the Sundarban region, India.' *Tropical Medicine & International Health.* Vol. 14, pp. 213–219.

Burr, JA, McCall, PL and Powell-Griner, E 1994, 'Catholic religion and suicide: the mediating effect of divorce', *Social Science Quarterly*, vol. 75, no.2, pp. 300–318

Chen, J, Choi, YJ, Mori, K, Sawada, Y. and Sugano, S 2012, 'Socio- economic studies on suicide: a survey', *Journal of Economic Surveys*, vol. 26, pp. 271-306.

Chuang, H. & Huang, W 2003, 'Suicide and unemployment: is there a connection? An empirical analysis of suicide rates in Taiwan', *Journal of Socio-Economics,* vol. 26, no. 3, pp. 277–289.

Daly, MC and Wilson, DJ 2006, 'Keeping up with the Joneses and staying ahead of the smiths: evidence from suicide data', Federal Reserve Bank of San Francisco Working Paper 2006-12.

Gururaj G, Isaac MK, Subbakrishna DK, Ranjani R 2004, 'Risk factors for completed suicides: a case-control study from Bangalore, India', *International Journal of Injury Control and Safety Promotion*, vol. 11, pp. 183–191.

Hamermesh, DS and Soss, NM 1974, 'An economic theory of suicide', *The Journal of Political Economy*, vol. 82, no.1,pp. 83–98.

Hedge, RS 1980, 'Suicide in rural community.' *Indian Journal Psychiatry*. vol. 22, pp. 368–70

Kimenyi, MS & Shughart WF 1986, 'Economics of suicide: rational or irrational choice', *Atlantic Economic Journal*, vol. 14, no.3, pp. 120–121.

Klick, J & Markowitz, S 2006, 'Are mental health insurance mandates effective? Evidence from suicide', *Health Economics, vol.* 15, no. 1, pp. 83–97.

Kumar, PNS 2004, 'An analysis of suicide attempters versus completers in Kerala.' , *Indian Journal of Psychiatry*, vol. 46, pp. 144–149.

Machado DB, Rasella D, Dos Santos DN 2015, 'Impact of income inequality and other social determinants on suicide rate in Brazil', *PLoS One, vol.* 10, no.4.

Nandi D, Mukherjee S, Banerjee G, Ghosh A, Boral G, Chowdhury A, Bose J 1979, 'Is suicide preventable by restricting the availability of lethal agents ? a rural survey of West Bengal.', *Indian Journal of Psychiatry*, vol. 21, no.3, pp. 251–255.

Neumayer, E 2003, 'Are socioeconomic factors valid determinants of suicide? Controlling for national cultures of suicide with fixed-effects estimation', *Cross-Cultural Research* vol. 37, no.3, pp. 307–329.

Ponnudurai, R & Jeyakar, J 1980*, '*Suicide in Madras'*, Indian J Psychiatry,* vol. 22, pp. 203–205.

Rane, A & Nadkarni, A 2014, 'Suicide in India: a systematic review', *Shanghai archives of psychiatry*, vol. 26, no.2, pp. 69-80.

Shneidman, ES 1993, *Suicide as Psychache: A Clinical Approach to Self-destructive Behavior,* Jason Aronson.

Soman, CR, Safraj, S, Kutty, VR, Vijayakumar, K & Ajayan, K 2009, 'Suicide in South India: A community-based study in Kerala.', *Indian Journal of Psychiatry*, vol 51, no.4, pp 261–264.