

RESEARCH ARTICLE

# Economic Development, Economic Problems, and Suicide in Thailand: Empirical Evidence Based on Provincial Data

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**Abstract** This study aims to examine the situation and trend of suicide in 76 provinces in Thailand during 2006–2013 and also to investigate the relationship among suicide, economic development, and economic problems by utilizing the feasible generalized least square (FGLS) regression analysis. The findings reveal that the average suicide rate in Thailand during the study period was 5.98 per 100,000 populations and exhibited a slight upward trend. Moreover, Lamphun province had the highest average suicide rate while Pattani province had the lowest rate. Gross provincial product per capita is found to have a curvilinear relationship with total, male, and female suicide rate. That is, suicide rate is likely to decrease as gross provincial product per capita increases but only up to a certain point, thereafter as gross provincial product continues to increase, suicide rate is likely to increase. Additionally, the findings reveal that industrialization and unemployment have the negative effect on suicide rate. In terms of other factors, divorce, having diabetes, and having high blood pressure significantly determine total, male, and female suicide, whereas urbanization affects only male suicide and educational attainment affects only female suicide.

**Keywords** Suicide, Economic Development, Economic Problems, Thailand

Based on World Health Organization (WHO, 2014), 804,000 people worldwide were suicidal in 2012, indicating the suicide rate of 11.4 per 100,000 populations (15.0 for males and 8.00 for females). This figure implies that there is approximately one suicide death every 40 seconds. In addition, suicide is considered as one of the most critical mental health issues in the world since it does not only take the life of the individual who commits suicide but also cause a detrimental effect on the lives of families, friends, and communities. In addition, suicide also causes an

economic burden upon everyone in the country since it leads to the explicit expenditures associated with suicide and its consequence and the expenditures associated with human capital losses, productivity losses or earnings lost due to premature mortality (Center for Suicide Prevention, 2010). Therefore, suicide prevention programme has been carried out by WHO to reduce the number of deaths from suicide.

Although Thailand's average suicide rate is lower than the global average (6.20 per 100,000 population, 9.66 for males and 2.85 for females, in

2012; Department of Mental Health, 2015), suicide is still considered as a major mental health problem in Thailand which is currently being monitored by the Department of Mental Health. Moreover, suicide rates in several provinces out of 77 provinces in Thailand are still greater than 10. For instance, in 2012, the suicide rate in Nan province equaled 15.09 per 100,000 population, the highest in the nation, while those in other 10 provinces were also higher than 10 per 100,000 population. These figures clearly indicate that suicide is not only an individual problem, but also a national problem which requires the appropriate public policies to reduce the number of deaths from suicide in the nation.

Based on the number of previous studies (Daly & Wilson, 2006; Rodriguez, 2006; Helliwell, 2007; and Maag, 2008), suicide is a result of economic development and economic problems. Thailand has been still a small developing country and frequently faced several economic problems, stemming from both internal and external factors. Therefore, understanding the influences of economic development and problems on suicide is very crucial. Unfortunately, the influences of these factors on suicide are found different among different countries, causing a difficulty for Thailand to utilize the findings from these studies in formulating and implementing policies to prevent suicide. Consequently, this study aims to examine the situation and trend of suicide in 76 provinces in Thailand during 2006–2013 and also to investigate the relationship among suicide, economic development, and economic problems with the ultimate goal to provide more insight into suicide in Thailand which enables the appropriate public policy formulation and implementation to lower suicide rates in Thailand.

### *Suicide: Definition and Causes*

Suicide is considered as one of the most serious mental problem as it is ranked the 15th leading cause of death in 2012, accounting for 1.4% of all deaths worldwide and it is rank the second leading cause of death of young people aged 15–29 globally in the same year (WHO, 2014). In addition, suicide not only takes lives of those who committed it but also cause the economic, social, and psychological burdens for families, communities, and countries. Based on the

literature review, the systematic study on suicide in sociology started in late 19th century. In 1897, Emile Durkheim, a French sociologist, published the book, *Suicide*, in attempt to explore the differing suicide rates among Protestants and Catholics (Durkheim, 1897, as cited in Thompson, 1982). In this book, he defined suicide as: “Suicide is applied to all cases of death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result” (p. 44).

Moreover, he stated that suicide is caused by the imbalance of two social forces, including social integration and moral regulation. Accordingly, there are four types of suicide (Durkheim, 1897, as cited in Thompson, 1982):

1. Egoistic suicide: it is the result of a breakdown or decrease in social integration. In other words, it is the result of excessive individuation, implying that individuals become increasingly detached from his community. Therefore, these individuals are not sufficiently bound to social groups and are left with little social support or guidance, causing them to commit suicide. This type of suicide is likely to happen in the society with the fast economic growth.
2. Altruistic suicide: it is the result of insufficient individuation or too high social integration. Therefore, it is opposite to egoistic suicide. It occurs in the society where individual needs and interests are seen less important than the society’s needs and interests as a whole. In other words, this type of suicide reflects the crude morality which disregards the individual. Hence, individuals tend to commit suicide on behalf of society.
3. Anomic suicide: it is the result of moral deregulation and a lack of definition of legitimate aspirations through a restraining social ethic. In other words, it is the result of the imbalance between individuals’ needs and means to satisfy their needs, where means cannot fulfill limitless needs. This type of suicide is divided into four categories. First of all, acute economic anomie occurs when traditional institutions such as religion and government sporadically fail to regulate and fulfill social

needs. Secondly, chronic economic anomie is the result of the long-term diminution of social regulation, stemming from the economic development which erodes the traditional social regulators and often failed to replace them. Note that Durkheim's example of chronic economic anomie was the industrial revolution (Durkheim, 1897, as cited in Thompson, 1982). Durkheim believed that industrialization would lead to decreasing social solidarity and the increase in suicide. Thirdly, acute domestic anomie is the result of the sudden changes on the micro-social level which results in an inability to adapt. Widowhood and divorce are examples of this type of anomie. Lastly, chronic domestic anomie is the result of the long-term changes on the micro-social level, especially marriage. That is, marriage is likely to regulate the sexual and behavioral needs among men and women. For example, unmarried men are more likely to commit suicide than married men due to lack of regulation.

4. Fatalistic suicide: it is the result of overly oppressive society which causes individuals to prefer to die than to carry on living. This type of suicide may occur in the society with excessive regulation which prohibits individuals from pursuing their desires.

Based on Durkheim's four types of suicide, it is sensible to state that egoistic and anomic suicide are the results of social changes which are caused by economic development and economic problems. These changes lead to the decrease in social integration and moral deregulation, eventually causing individuals to commit suicide.

## Literature Review

Economic development and economic problems have been found to be the causes of suicide in several studies. For example, Chen, Choi, and Sawada (2009) examined suicide rates among OECD countries during 1980–2004 and found that, on average, suicide rates were negatively determined by GDP per capita, growth

rate of GDP per capita, female labor force participation rate, and unemployment rate. Moreover, they also found the positive but very small effect of income inequality on suicide rate in these countries. However, Kuroki (2010) found that unemployment positively affected only male suicide in Japan during 1983–2007. Additionally, Pandey and Kaur (2009) investigated suicide rates in India during 1967–2006. They found that GDP per capita had the positive influence on suicide rates in India, implying that individuals were more likely to commit suicide as they have the greater income.

Andres and Halicioglu (2010) examined the influence of social and economic factors on suicide in Denmark during 1970–2006. In terms of economic factors, they found that per capita income had the negative effect on total, male, and female suicide rate, implying that the greater income would lead to the lower suicide tendency, while unemployment rate was found to positively affect suicide rate. Additionally, Andres, Halicioglu, and Yamamura (2011) investigated the socio-economic determinant of suicide in Japan during 1957–2009 and found the relationship among suicide, income, and unemployment. That is, they found the negative impact of income per capita on total, male, and female suicide rates and the positive impact of unemployment rate on only female suicide rate. Furthermore, Okada and Samreth (2013) investigated the factors affecting suicide in 13 European OECD countries during 1960–2007 and found the negative relationship between GDP per capita and suicide. That is, as GDP per capita increased, suicide rate was likely to decrease.

On the contrary, the positive influence of GDP per capita on suicide rate was found by Jalles and Andresen (2015) in Canada during 2000–2008. In this study, they found that the greater GDP per capita led to the increase in male suicide rate, female suicide rate, and overall suicide rate in 10 provinces in Canada. They also found the negative effect of GDP growth rate on overall and male suicide rates and the positive effect of unemployment rate on overall and female suicide rates. Additionally, Neumayer (2003) relied on panel data of 68 countries during 1980–1999 to examine factors which affect suicide rate. He found the curvilinear relationship between GDP per capita and suicide. That

is, suicide rate was likely to decline as GDP per capita increased. However, as GDP per capita increased to the certain level, suicide rate was likely to increase.

Poverty is another economic problem which affected suicide. Iemmi, Coast, Leone, and McDaid (2011) examined the relationship between poverty and suicide in low and middle income countries during 1990–2010. They found that poverty positively affected suicide. This finding is consistent with WHO (2014) which revealed that the average suicide rates of low income and lower middle income countries equaled 13.4 and 14.1 per 100,000 populations, far higher than that of upper middle income countries which was only 7.5 per 100,000 populations. In addition, suicide is also determined by industrialization. More clearly, Anderson (1980) showed the evidence that industrialization cause the increase in suicide in Victorian England. In case of developing countries, Pandy and Kaur (2009) found that industrialization as measured by industrial growth rate had the positive influence on suicide rates in India during 1967–2006.

Besides economic development and problem factors, social factors also cause suicide. Based on the literature review, divorce seems to be one of the most important social factors which determine suicide rate. Chen et al. (2009) found the positive impact of divorce on suicide in case of OECD countries during 1980–2004. In addition, Andres et al. (2011) also found that the increase in divorce rate led to the increase in total, male, and female suicide rates, indicating that suicide was positively determined by divorce. However, Andres and Halicioglu (2010) found no relationship between divorce and suicide in Denmark. Okada and Samreth (2013) found the significant influence of divorce on suicide rate of 13 European OECD countries during 1960–2007. That is, the increase in divorce rate tends to cause the increase in suicide rate in these countries. However, Jalles and Andresen (2015) found that divorce positively affected only suicide in female in Canada during 2000–2008. That is, the increase in divorce rate caused only female suicide rate to increase.

Education is another social factor which determines suicide. Based on the literature review, Marcotte (2003) investigated suicidal behavior of 5,877 Americans aged 15–54 year old based on 1991 and 1992 survey data and found that those with college

degree had higher probability to commit suicide than those with lower education. These findings imply the positive relationship between education and suicide. In contrast, Daly and Wilson (2006) examined suicide of population aged 20–64 years old in the U.S. during 1990–2000. They found that individuals were less likely to commit suicide if they had bachelor's degree or higher, implying the negative linkage between these two factors. These findings are compiled with Macdonald (2010) who suggested that the higher education could help promote psycho-social health and reduce suicide in male aged 25–44 years old in New South Wales, Australia. This finding implies that education and suicide are negatively related.

Besides education, urbanization is also found to affect suicide. Qin (2005) investigated suicidal behavior in Denmark during 1981–1997 based on 21,169 suicides and 423,128 controlled population and found the positive relationship between urbanization and suicide. Qin found that individuals living in the capital city had the highest possibility to commit suicide, followed by those who lived in suburb of the capital city, provincial city, provincial town, and rural area, respectively.

Several studies also found the relationship between suicide and health factors. Ratcliffe, Enns, Belik, and Sareen (2008) investigated the relationship between chronic pain condition and suicide ideation and attempts in Canada based on survey data of 36,984 responses during 2001–2002. Of course, they found the positive relationship between chronic pain condition and suicide.

In case of Thailand, the previous studies on suicide were in micro level based on the surveys and mainly focused on the relationship between demographic background, social, and health status of individuals on suicide. For example, Sriruenthong et al. (2011) found that unemployment, divorce, widowhood, and mental disorder had the positive influences on suicide based on the 2008 surveyed data of 17,140 individuals nationwide. In addition, Khamma (2013) found that chronic illness and stressful life had the positive effect on suicide and suicide attempts of 330 persons in Sukhothai province of Thailand during 2007–2011. Based on the literature review, there seems to be several research gaps about suicide in Thailand. First

of all, there is no empirical study on suicide in macro level in Thailand while factors determining suicide are found different among different countries. These cause a difficulty for Thailand to utilize the findings from the previous studies in formulating and implementing policies to prevent suicide. That is why further study on suicide in Thailand is still necessary.

## Methods

This study relies on time series data of 76 provinces in Thailand during 2006–2013, excluding Bueng Kan province which is the latest province of Thailand, established in 2011. The data to be analyzed in this study include (1) suicide rate (deaths per 100,000 populations), (2) male suicide rate (deaths per 100,000 populations), (3) female suicide rate (deaths per 100,000 populations), (4) gross provincial product (hereafter referred to as GPP) per capita (baht), (5) GPP growth rate (percent per year), (6) poverty rate (percent of total population), (7) unemployment rate (percent of total labor force), (8) GPP of agricultural sector (million baht), (9) GPP of non-agricultural sector (million baht), (10) mean years of schooling (years), (11) urban population (percent of total population), (12) divorce rate (percent of marriage), (13) diabetes rate (persons per 100,000 populations), and (14) high blood pressure rate (persons per 100,000 populations).

Data of suicide rate are obtained from the Department of Mental Health (2016) whereas the other data are obtained from the National Economic and Social Development Board (2016). In addition, only data of suicide rate cover the period of 2006–2013 whereas the other data cover the period of 2006–2011. Note that GPP of agricultural sector and GPP of non-agricultural sector will be utilized to calculate the indicator of industrialization as measured by the ratio of GPP of agricultural sector and GPP of non-agricultural sector.

This study will start with the descriptive statistics of suicide rate in attempt to shed more light on the suicide situation in Thailand. Suicide rate data during 2006–2013 will be analyzed to compare Thailand's suicide situation with that of other countries and to present the trend of suicide in Thailand and the suicide problem in regional and provincial level. Thereafter,

the regression analysis will be employed to examine the relationship among economic development, economic problems, and suicide in Thailand based on the data during 2006–2011 due to provincial data availability. The regression models to be estimated can be expressed as the following:

$$\begin{aligned} \text{suicide}_i = & \beta_0 + \beta_1 \text{gpp}_i + \beta_2 \text{gpp}_i^2 + \beta_3 \text{gppg}_i \quad (1) \\ & + \beta_4 \text{pov}_i + \beta_5 \text{indus}_i + \beta_6 \text{unem}_i + \beta_7 \text{schl}_i + \beta_8 \text{urban}_i \\ & + \beta_9 \text{divorc}_i + \beta_{10} \text{diab}_i + \beta_{11} \text{hblood}_i + \mu_{1i} \end{aligned}$$

$$\begin{aligned} m - \text{suicide}_i = & \delta_0 + \delta_1 \text{gpp}_i + \delta_2 \text{gpp}_i^2 + \delta_3 \text{gppg}_i \quad (2) \\ & + \delta_4 \text{pov}_i + \delta_5 \text{indus}_i + \delta_6 \text{unem}_i + \delta_7 \text{schl}_i \\ & + \delta_8 \text{urban}_i + \delta_9 \text{divorc}_i + \delta_{10} \text{diab}_i + \delta_{11} \text{hblood}_i + \mu_{2i} \end{aligned}$$

$$\begin{aligned} f - \text{suicide}_i = & \gamma_0 + \gamma_1 \text{gpp}_i + \gamma_2 \text{gpp}_i^2 + \gamma_3 \text{gppg}_i \quad (3) \\ & + \gamma_4 \text{pov}_i + \gamma_5 \text{indus}_i + \gamma_6 \text{unem}_i + \gamma_7 \text{schl}_i + \gamma_8 \text{urban}_i \\ & + \gamma_9 \text{divorc}_i + \gamma_{10} \text{diab}_i + \gamma_{11} \text{hblood}_i + \mu_{3i} \end{aligned}$$

The descriptions of all variables in the regression models are presented in Table 1.

Since this study relies on the panel data of 76 provinces in Thailand during 2006–2011 with a total of 396 observations, pooled ordinary least square (OLS) regression may not be appropriate. That is, there is an unobserved effect of each province which also affects suicide rate, causing pooled OLS estimators to be biased and inconsistent. Consequently, this study, instead, utilized the feasible generalized least squares (FGLS) regression analysis. This method allows estimation in the presence of the first order autoregressive (AR(1)) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels.

Please consider the following general linear model:

$$Y_i = \beta X_i + \varepsilon_i$$

where  $i = 1, 2, \dots, n$  is the number of panels and  $t = 1, 2, \dots, T$  is the number of years.

That is, the GLS estimator will be consistent and optimal (Wooldridge, 2003). It can be estimated as the following:

**Table 1**  
*Dependent and Explanatory Variable Descriptions*

Variable	Description	Relationship with Suicide
<b>Dependent Variables</b>		
suicide	Suicide rate (deaths per 100,000 population)	-
m-suicide	Male suicide rate (deaths per 100,000 population)	-
f-suicide	Female suicide rate (deaths per 100,000 population)	-
<b>Economic Development Factors</b>		
gpp	GPP per capita in natural logarithm	Negative
gpp <sup>2</sup>	Squared GPP per capita in natural logarithm	Positive
gppg	GPP growth rate (% per year)	Positive
indus	Industrialization (times)	Positive
<b>Economic Problem Factors</b>		
pov	Poverty rate (% of total population)	Positive
unem	Unemployment rate (% of total labor force)	Positive
<b>Social Factors</b>		
schl	Mean years of schooling (years)	Negative
urban	Urbanization (% of total population)	Positive
divorc	Divorce rate (% of marriage)	Positive
<b>Health Factors</b>		
diab	Diabetes rate (persons per 100,000 population)	Positive
hblood	High blood pressure rate (persons per 100,000 population)	Positive

$$\hat{\beta}_{GLS} = \left( \sum_{i=1}^n \sum_{j=1}^n w_j X_i X_i' \right)^{-1} \left( \sum_{i=1}^n \sum_{j=1}^n w_j X_i Y_j \right)$$

$$\hat{\beta}_{GLS} = \left( \sum_{i=1}^n \sum_{j=1}^n \Omega^{-1} X_i X_i' \right)^{-1} \left( \sum_{i=1}^n \sum_{j=1}^n \Omega^{-1} X_i Y_j \right)$$

where  $w_{ij}$  = weight which depends on the values of  $\sigma_j$   
 $\sigma_j$  = covariance between  $\epsilon_i$  and  $\epsilon_j$  [ $Cov(\epsilon_i, \epsilon_j)$ ]

That is,  
 $w_{ij} = (\Omega^{-1})_j$

where  $\Omega_j = n \times n$  variance matrix with elements  $\sigma_j$

$$\Omega = E(\epsilon \epsilon') = \begin{bmatrix} \sigma_1 \Omega_1 & \sigma_2 \Omega_2 & \dots & \sigma_{1n} \Omega_{1n} \\ \sigma_2 \Omega_2 & \sigma_2 \Omega_2 & \dots & \sigma_{2n} \Omega_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n1} \Omega_{n1} & \sigma_{n2} \Omega_{n2} & \dots & \sigma_n \Omega_n \end{bmatrix}$$

Therefore,

Unfortunately, the values in  $\Omega$  are unknown. Therefore, it has to be estimated empirically by employing feasible generalized least squares (FGLS). To estimate FGLS estimator,  $\hat{\Omega}$  is estimated by employing OLS, thereafter  $\hat{\Omega}$  will be used, instead of  $\Omega$ , to estimate the FGLS estimator. That is,

$$\hat{\beta}_{FGLS} = \left( \sum_{i=1}^n \sum_{j=1}^n \hat{\Omega}^{-1} X_i X_i' \right)^{-1} \left( \sum_{i=1}^n \sum_{j=1}^n \hat{\Omega}^{-1} X_i Y_j \right)$$

First, to estimate the FGLS estimator, OLS estimator ( $\hat{\beta}_{OLS}$ ) and the residual are estimated. That is,  $r_i^{OLS} = Y_i - \hat{\beta}_{OLS} X_i'$ . Thereafter, the estimated residuals will used to estimate the  $\sigma_j$ . Finally, FGLS estimator is estimated with the estimated weights,  $w_{ij}$ .

## Results

### *Suicide Situation: Thailand and the World*

Table 2 compares Thailand's suicide situation with that in the global level. Based on the most recent suicide statistics (2012) from World Health Organization (WHO, 2014), Thailand's suicide rate was only 6.20 per 100,000 population, far lower than the global average suicide rate which was 11.40 per 100,000 population. In addition, Thailand's suicide rate was also lower than the average suicide rate of every country group. Furthermore, the findings reveal that female suicide rate of Thailand was very low, equal to 2.85 per 100,000 population, while the global average female suicide rate was 8.00 and the average female suicide rates of high income and upper-middle income countries were 5.70 and 6.50 per 100,000 population, respectively. Male suicide rate of Thailand (9.66 per 100,000 populations) was lower than the global average (15.00 per 100,000 populations) but higher than the average rate of upper-middle income countries (8.70 per 100,000 populations).

Looking at Table 3 which presents suicide rate of ASEAN countries including China, Japan, and South Korea (ASEAN + 3) in 2012, the findings suggest that suicide rate in Thailand was still high. That is, the suicide rate of Thailand was higher than those of Philippines, Malaysia, Indonesia, and Viet Nam. Even though male suicide rates of Thailand and Singapore (9.80 per 100,000 populations) were very similar, Singapore's female suicide rate, equal to 5.30 per 100,000 populations, was much greater than Thailand's. Moreover, the findings reveal that suicide rate of a transition economy, Myanmar, was also high,

equal to 13.10 per 100,000 population, whereas those of two advanced economies, Japan and South Korea, were extremely high, equal to 18.50 (26.90 for male) and 28.90 (41.70 for male) per 100,000 population.

### *Suicide in Thailand: Situation and Trend*

Thailand's suicide situation during 2006–2013 is summarized in Figure 1. The figure clearly shows that Thailand's suicide rate exhibited a slight upward trend during the study period, increasing from 5.77 per 100,000 populations in 2006, reaching its peak in 2012 at 6.20 before dropping to 6.08 per 100,000 in 2013. Additionally, the findings reveal that male suicide rate of Thailand was far higher than that of female. That is, male suicide rate ranged from 9.24 to 9.70 per 100,000 populations during 2006–2013 whereas female suicide rate ranged from 2.38 to 2.85 per 100,000 populations. Accordingly, male suicide situation is considered worse than female suicide situation.

Figure 2 presents suicide rates in five different regions in Thailand in 2013. The findings reveal that suicide situation in the Northern region of Thailand was the worst since the suicide rate in this region, equal to 9.99 per 100,000 population, was the highest in the nation. Moreover, Figure 2 also shows that male and female suicide rates in the Northern region were 15.34 and 4.35 per 100,000 populations, much higher than any other regions in the nation. Surprisingly, suicide rate in Bangkok and vicinity was the lowest in Thailand. The average suicide rate in this region was only 2.43 per 100,000 populations (3.25 for male and only 1.37 for female). Moreover, suicide rate in the Northeastern region was the second lowest in 2013. That is, on average, 5.34 people per 100,000 people

**Table 2**

*Suicide Rate (per 100,000 Populations) of Thailand and Average Suicide Rates Among Country Groups*

Country/Country Group	Both Sexes	Female	Male
Thailand	6.20	2.85	9.66
Global	11.40	8.00	15.00
High Income	12.70	5.70	19.90
Upper-Middle Income	7.50	6.50	8.70
Lower-Middle Income	14.10	10.40	18.00
Low Income	13.40	10.00	17.00

Source: World Health Organization (WHO, 2014)

**Table 3**  
Suicide Rate (per 100,000 Populations) of ASEAN Plus Three Countries

Country/Country Group	Both Sexes	Female	Male
Philippines	2.90	1.20	4.80
Malaysia	3.00	1.50	4.70
Indonesia	4.30	4.90	3.70
Viet Nam	5.00	2.40	8.00
Thailand	6.20	2.85	9.66
Brunei	6.40	5.20	7.70
Singapore	7.40	5.30	9.80
China	7.80	8.70	7.10
Lao	8.80	6.60	11.20
Cambodia	9.40	6.50	12.60
Myanmar	13.10	10.30	16.50
Japan	18.50	10.10	26.90
South Korea	28.90	18.00	41.70

Source: World Health Organization (WHO, 2014)

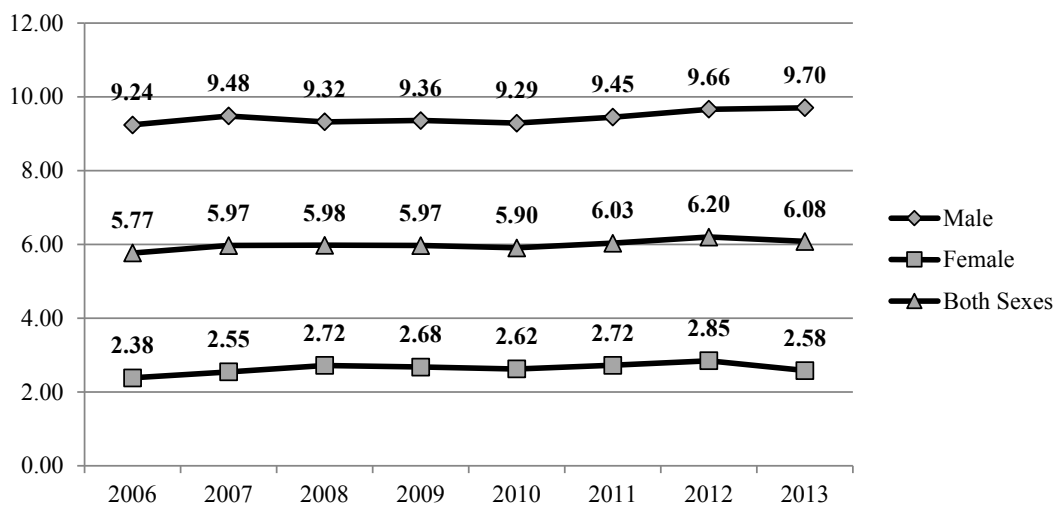


Figure 1. Suicide rate (per 100,000 populations) in Thailand during 2006–2013.

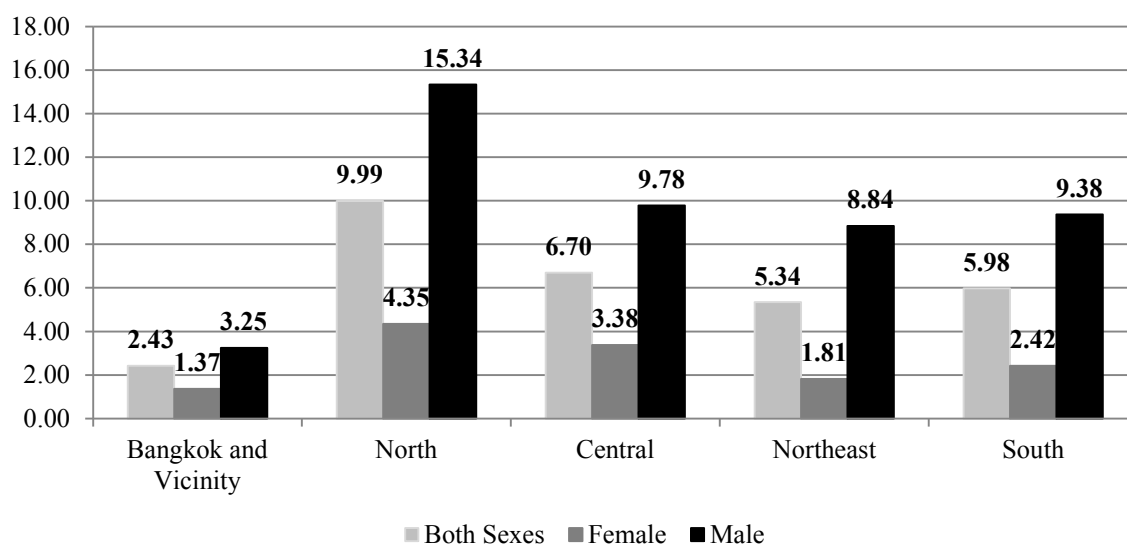
Source: Department of Mental Health (2016)

were suicidal in 2013, 8.84 for male and only 1.81 for female. The average suicide rate in the Central regions was the second highest, equal to 6.70 per 100,000 populations (9.78 for male and 3.38 for female). In the Southern region, the average suicide rate was 5.98 in 2013.

Based on Table 4, which shows the 10 provinces with the highest and lowest suicide rate, Lamphun province seems to have the most serious suicide

problem. The findings reveal that the average suicide rate in this province during 2006–2013 was very high, equal to 15.84 per 100,000 populations. Although suicide rate in Lamphun province exhibited a downward trend during 2010–2012, decreasing from 20.02 in 2010 to 11.87 in 2012, it increased to 14.81 per 100,000 populations in 2013. The average suicide rates in Chiang Mai and Chiang Rai provinces were also high at 13.74 and 13.21 per 100,000 populations,





**Figure 2.** Regional suicide rate (per 100,000 populations) of Thailand in 2013.

Source: Department of Mental Health (2016)

**Table 4**

*Ten Provinces with the Highest and Lowest Suicide Rate (per 100,000 Populations) in Thailand*

No.	Province	2006	2007	2008	2009	2010	2011	2012	2013	Mean
1	Lamphun	17.77	17.02	16.04	13.58	20.02	15.58	11.87	14.81	15.84
2	Chiang Mai	15.36	14.45	14.93	14.29	12.47	12.90	13.33	12.24	13.74
3	Chiang Rai	13.38	13.30	11.17	16.10	15.63	11.43	13.84	10.79	13.21
4	Mae Hong Son	12.19	12.55	15.37	12.94	14.45	9.86	13.92	12.17	12.93
5	Nan	10.88	11.73	10.49	14.71	13.03	12.17	15.09	10.67	12.35
6	Rayong	10.95	10.89	12.35	16.02	9.85	13.45	12.28	8.17	11.74
7	Phayao	13.15	12.75	9.65	11.29	9.45	11.10	9.85	13.15	11.30
8	Phrae	8.73	10.70	14.85	10.16	11.05	10.44	10.04	11.62	10.95
9	Chanthaburi	9.00	12.12	8.50	11.18	11.50	9.11	8.86	12.97	10.41
10	Uttaradit	9.18	8.15	10.97	8.84	9.94	10.39	12.36	7.16	9.62
67	Amnat Charoen	2.98	3.52	3.52	2.97	2.69	4.03	2.68	5.87	3.53
68	Satun	3.93	3.53	1.75	3.78	3.39	3.68	5.60	2.58	3.53
69	Maha Sarakham	3.52	3.42	3.52	3.09	2.34	3.08	3.40	4.92	3.41
70	Nong Khai	3.12	3.44	3.43	3.31	1.76	3.65	4.11	4.47	3.41
71	Pathum Thani	4.41	3.64	3.61	3.29	3.09	2.70	2.84	2.28	3.23
72	Bangkok	2.10	3.21	2.61	2.51	2.49	2.39	2.20	1.67	2.40
73	Nonthaburi	1.52	2.77	2.12	2.72	2.57	3.15	1.59	2.25	2.34
74	Yala	1.29	1.28	1.69	1.67	1.86	2.85	3.42	2.17	2.03
75	Narathiwat	0.43	1.41	1.54	1.38	1.77	1.08	0.93	1.57	1.26
76	Pattani	1.57	1.26	1.25	0.78	0.77	1.82	0.30	1.18	1.12

Source: Department of Mental Health (2016)

respectively. However, suicide rates in both provinces exhibited the downward trend during the study period. Another province of which suicide rate exhibited the downward trend was Rayong province while suicide rates in Phrae and Chanthaburi provinces obviously exhibited an upward trend during the study period.

Looking at 10 provinces with the lowest suicide rate, the findings reveal that the average suicide rates in five out of 10 provinces during 2006–2013 ranged from 3.23 to 3.53 per 100,000 populations. Pattani province had the lowest average suicide rate in Thailand, equal to 1.12 per 100,000 populations, followed by Narathiwat and Yala provinces, which had the average suicide

rates during 2006–2013 of 1.26 and 2.03 per 100,000 populations, respectively. In addition, Table 4 shows that suicide rates in five provinces—Amnat Charoen, Maha Sarakham, Nong Khai, Nonthaburi, Yala, and Narathiwat—clearly exhibited the upward trend during study period, indicating that suicide problem in these provinces is still of concern.

Furthermore, the average suicide rates in Bangkok, the capital city of Thailand, and Nonthaburi province, vicinity of Bangkok, were only 2.40 and 2.34 per 100,000 populations. The average suicide rate in Pathum Thani province, another vicinity of Bangkok, was also low, equal to 3.23 per 100,000 populations.

**Table 5**

*Suicide Rates, Economic Development and Economic Problem Indicators in Thailand*

No.	Province	suicide (m)	suicide (f)	suicide	gpp	gppg	indus	pov	unem
1	Lamphun	28.454	5.461	16.670	101.935	3.930	6.544	12.444	0.939
2	Chiang Mai	23.383	5.104	14.065	60.021	2.326	5.871	13.244	1.378
3	Chiang Rai	22.070	5.151	13.503	35.791	2.844	3.115	28.314	1.667
4	Mae Hong Son	20.222	5.100	12.892	26.713	1.372	3.621	71.494	0.609
5	Nan	18.160	6.069	12.168	30.385	1.906	4.018	28.929	1.298
6	Rayong	17.433	7.194	12.251	520.475	3.420	26.979	5.043	1.285
7	Phayao	18.183	4.513	11.232	38.237	1.504	2.862	24.110	0.944
8	Phrae	17.498	4.772	10.988	33.195	1.073	6.845	23.232	0.462
9	Chanthaburi	14.301	6.273	10.236	98.700	4.476	1.138	11.562	0.713
10	Uttaradit	14.546	4.742	9.580	39.818	2.433	3.721	27.600	1.484
67	Amnat Charoen	5.929	0.632	3.287	26.815	2.019	4.031	25.049	1.154
68	Satun	5.671	1.027	3.343	79.935	2.402	0.964	17.770	1.231
69	Maha Sarakham	5.519	0.846	3.163	28.736	4.465	4.141	25.180	1.544
70	Nong Khai	5.062	1.153	3.118	34.919	0.768	3.308	17.032	1.250
71	Pathum Thani	5.530	1.564	3.458	202.913	3.706	79.245	2.923	1.308
72	Bangkok	4.221	1.028	2.550	316.145	2.125	1,574.012	3.675	1.202
73	Nonthaburi	3.599	1.471	2.474	105.402	3.529	51.963	1.597	1.029
74	Yala	2.804	0.757	1.774	53.452	2.302	2.588	27.259	1.043
75	Narathiwat	2.003	0.547	1.268	39.082	3.168	1.688	47.182	2.628
76	Pattani	2.095	0.408	1.241	54.491	2.923	1.091	47.425	1.690

**Remarks:** suicide (m) = male suicide rate (per 100,000 population), suicide (f) = female suicide rate (per 100,000 population), suicide = suicide rate (per 100,000 population), gpp = GPP per capita (thousand baht), gppg = GPP growth rate (% per year), indus = industrialization as measured by ratio of GPP of non-agricultural sector to GPP of agricultural sector (times), pov = poverty rate (% of total population) and unem = unemployment rate (%). Figures in the table are the average values of each indicator during 2006–2011 due to data provincial data availability. Suicide rate, male suicide rate, and female suicide rate are also the average values during 2006–2011 so that they are consistent with the other indicators.

**Source:** *Department of Mental Health (2016) and National Economic and Social Development Board (2016)*

The explanation for the very low average suicide rates in Bangkok, Nonthaburi, and Pathum Thani provinces is that Bangkok and these two provinces are the major locations of businesses and factories in Thailand and millions of people who work and live in these provinces have household registration in other provinces. When these people commit suicide, their deaths will not be accounted for suicide in Bangkok, Nonthaburi, and Pathum Thani provinces. Instead, they will be accounted for suicide in the provinces where these people have household registration. That is why suicide rate in Bangkok and vicinity was the lowest as presented in Figure 2. As a result, Bangkok, Nonthaburi, and Pathum Thani provinces will be excluded from this study.

#### *Economic Development and Suicide in Thailand*

Table 5 aims to present suicide rates and several economic development indicators of 10 provinces with the highest and lowest suicide rate in Thailand. Based on this table, it is hard to identify the precise influence of these economic development indicators on suicide. However, it is quite obvious that unemployment and suicide rate are negatively related as Table 4 reveal that, on average, unemployment rates of the 10 provinces with the lowest suicide rate were higher than that of 10 provinces with the highest suicide rate. Moreover,

as Bangkok, Nonthaburi, and Pathum Thani provinces are excluded, industrialization seems to have the positive effect on suicide rate as the table reveal that, on average, ratio of GPP of non-agricultural sector to GPP of agricultural sector of 10 provinces with the highest suicide rate were higher than that of 10 provinces with the lowest suicide rate. Nevertheless, the influences of the other indicators, GPP per capita, growth rate of GPP and poverty rate, on suicide rate are still ambiguous.

Table 6 presents correlation coefficients among explanatory variables in the regression models. Based on this table, there appears to be the significant linear relationship between several pairs of explanatory variables. Fortunately, no correlation coefficient of any pair of explanatory variables is greater than 0.8 or lower than -0.8. Consequently, it is reasonable to state that there is no multicollinearity problem in the regression analysis.

The results from FGLS regression analysis on suicide rate are presented in Table 7. When only economic development and problem indicators are included in the regression model, only two variables, including industrialization and unemployment are found to have the significantly negative influence on suicide rate of Thailand. That is, industrialization and unemployment seem to cause Thai people less likely to commit suicide. These findings remain unchanged

**Table 6**  
*Correlation Coefficients among Explanatory Variables*

Variables	gpp	gppg	indus	pov	unem	schl	urban	divorce	diab	hblood
gpp	1.000									
gppg	0.087	1.000								
indus	0.559*	0.086	1.000							
pov	-0.634*	-0.018	-0.319*	1.000						
unem	-0.081	-0.007	0.072	0.200*	1.000					
schl	0.216*	0.015	0.234*	-0.471*	-0.001	1.000				
urban	0.640*	0.043	0.494*	-0.524*	-0.058	0.159*	1.000			
divorc	0.275*	-0.046	0.208*	-0.380*	-0.119*	0.131*	0.405*	1.000		
diab	0.109*	0.001	-0.061	-0.256*	-0.216*	0.260*	0.053	0.313*	1.000	
hblood	0.219*	-0.097	-0.065	-0.238*	-0.277*	0.165*	0.098*	0.375*	0.765*	1.000

**Remarks:**

1. gpp = GPP per capita, gppg = GPP growth rate, indus = industrialization, pov = poverty rate, unem = unemployment rate, schl = mean years of schooling, urban = urbanization, divorc = divorce-marriage ratio, diab = diabetes rate and hblood = high blood pressure rate.

2. \* indicates statistical significance at 5% level.

**Table 7**  
Results from FGLS Regression Analysis on Suicide Rate

Variables	Coefficient	Std. Error.	P-Value	Coefficient	Std. Error.	P-Value
gpp	-1.2363	6.1706	0.8410	-23.0939***	5.3531	0.0000
gpp <sup>2</sup>	0.1044	0.2718	0.7010	1.0375***	0.2346	0.0000
gppg	-0.0377	0.0277	0.1730	-0.0027	0.0224	0.9030
indus	-0.0271**	0.0131	0.0390	-0.0505***	0.0113	0.0000
pov	0.0119	0.0148	0.4220	0.0193	0.0142	0.1730
unem	-0.7518***	0.2347	0.0010	-0.4829**	0.1947	0.0130
schl	-	-	-	-0.2855	0.2502	0.2540
urban	-	-	-	0.0245	0.0157	0.1180
divorc	-	-	-	0.1938***	0.0175	0.0000
diab	-	-	-	-0.0049***	0.0007	0.0000
hblood	-	-	-	0.0028***	0.0005	0.0000
Observations		396			396	
Chi-Square		30.30***			269.85***	
P-Value		0.0000			0.0000	
Wooldridge Test Stat		0.5280			0.6060	
P-Value		0.4697			0.4387	

**Remarks:**

1. gpp = GPP per capita, gppg = GPP growth rate, indus = industrialization, pov = poverty rate, unem = unemployment rate, schl = mean years of schooling, urban = urbanization, divorc = divorce-marriage ratio, diab = diabetes rate and hblood = high blood pressure rate. Moreover, \* indicates statistical significance at 5% level.

2. \*, \*\* and \*\*\* indicate statistical significance at 10%, 5%, and 1% levels, respectively. Moreover, Wooldridge Test Stat is the Wooldridge Test statistic for autocorrelation in panel data.

as social and health factors are added into the model. Additionally, GPP per capita (representing income per capita) is found to have a curvilinear (U-shaped) relationship with suicide rate. That is, suicide rate is likely to decrease as GPP per capita increases but only up to a certain point, thereafter as GPP continues to increase, suicide rate is likely to increase.

Looking at the other factors, the findings reveal that divorce rate has the significantly positive influence on suicide rate, indicating that divorce is one of the major causes of suicide in Thailand. Surprisingly, diabetes rate is found to have the significantly negative effect on suicide rate. That is, having diabetes does not cause Thai people, on average, to commit suicide. On the contrary, having high blood pressure causes Thai people to commit suicide as the regression analysis indicates the significantly positive relationship between high blood pressure rate and suicide rate of Thai people. Nevertheless, GPP growth rate, poverty rate, years of

schooling, and urbanization do not significantly affect suicide in Thailand.

Table 8 presents the results from FGLS regression analysis on male suicide rate. Based on the model with only economic development and problem indicators, Thailand's male suicide rate is negatively affected only by unemployment. That is, unemployment seems to cause Thai men less likely to commit suicide. However, as social and health factors are added into the regression analysis, the results dramatically change. First of all, industrialization is found to have the significantly negative impact on male suicide rate. In other words, moving out of agricultural sector to industrial sector causes Thai men less likely to commit suicide. Income as measured by GPP per capita has U-shaped relationship with male suicide rate. That is, male suicide rate tends to decrease as GPP per capita (income) increases but up to the certain level. Thereafter, as GPP per capita

**Table 8**  
*Results from GLS Regression Analysis on Male Suicide Rate*

Variables	Coefficient	Std. Error.	P-Value	Coefficient	Std. Error.	P-Value
gpp	-2.2847	9.8951	0.8170	-34.4502***	8.9135	0.0000
gpp <sup>2</sup>	0.1628	0.4358	0.7090	1.5368***	0.3907	0.0000
gppg	-0.0412	0.0444	0.3530	0.0095	0.0374	0.7990
indus	-0.0301	0.0211	0.1530	-0.0704***	0.0189	0.0000
pov	0.0106	0.0238	0.6550	0.0294	0.0236	0.2130
unem	-1.0492***	0.3764	0.0050	-0.7082**	0.3243	0.0290
schl	-	-	-	-0.2065	0.4167	0.6200
urban	-	-	-	0.0484*	0.0261	0.0640
divorc	-	-	-	0.2923***	0.0291	0.0000
diab	-	-	-	-0.0073***	0.0012	0.0000
hblood	-	-	-	0.0039***	0.0008	0.0000
Observations		396			396	
Chi-Square		20.78***			207.78***	
P-Value		0.0000			0.0000	
Wooldridge Test Stat		0.010			0.019	
P-Value		0.9212			0.8910	

**Remarks:** \*, \*\* and \*\*\* indicate statistical significance at 10, 5 and 1 percent levels, respectively. Moreover, Wooldridge Test Stat is the Wooldridge Test statistic for autocorrelation in panel data.

continues to increase, male suicide rate is likely to increase.

Divorce is one of the major social factors which causes suicide in Thai males. The regression results clearly indicate that divorce rate has the significantly positive influence on male suicide rate. In addition, urbanization is also found to significantly affect suicide in males. That is, as the proportion of urban population increases, male suicide rate tends to increase. However, the influence of health factors, diabetes rate and high blood pressure rate, on male suicide rate remains the same as that on overall suicide rate. That is, having diabetes does not cause Thai men to commit suicide but having high blood pressure does. Likewise, GPP growth rate, poverty rate, and years of schooling seem to have no impact on suicide in males.

Let's look at the female suicide rate model. In the case of female suicide rate, Newey-West regression analysis is employed instead of the FGLS regression analysis to eliminate autocorrelation in panel data (see Table 9). In the case of female suicide rate model with only economic development and problem indicators,

besides industrialization and unemployment, GPP growth rate also has the significantly negative influence on female suicide rate. However, as social and health factors are included in the model, the influence of GPP growth rate on Thailand's female suicide rate becomes insignificant while female suicide rate appears to be significantly affected by GPP per capita. That is, GPP per capita also has U-shaped relationship with female suicide rate.

Unlike suicide in males, suicide in females is not significantly affected by urbanization. However, it is negatively influenced by mean years of schooling. This finding indicates that as women have higher educational attainment, they are less likely to commit suicide. The results from female suicide rate model help confirm that divorce is one of major causes of suicide in both females and males as Table 9 also suggests that divorce rate and female suicide rate of Thailand are positively related. Looking at health factors, the results remain the same. That is, female suicide rate is negatively affected by diabetes rate but positively affected by high blood pressure rate, implying that having diabetes does not

**Table 9**  
*Results from Newey-West Regression Analysis on Female Suicide Rate*

Variables	Coefficient	Std. Error.	P-Value	Coefficient	Std. Error.	P-Value
gpp	0.4143	6.2622	0.9470	-11.3711*	5.8261	0.0520
gpp <sup>2</sup>	0.0203	0.2812	0.9420	0.5219**	0.2607	0.0460
gppg	-0.0345**	0.0141	0.0150	-0.0150	0.0126	0.2330
indus	-0.0234***	0.0081	0.0040	-0.0315***	0.0085	0.0000
pov	0.0091	0.0105	0.3870	0.0082	0.0084	0.3260
unem	-0.4343***	0.1318	0.0010	-0.2374**	0.1162	0.0420
schl	-	-	-	-0.3210*	0.1634	0.0500
urban	-	-	-	0.0066	0.0105	0.5310
divorc	-	-	-	0.0992***	0.0110	0.0000
diab	-	-	-	-0.0024***	0.0005	0.0000
hblood	-	-	-	0.0017***	0.0004	0.0000
Observations		396			396	
F-Stat		7.73***			20.40***	
P-Value		0.0000			0.0000	
Wooldridge Test Stat		6.083***			7.868***	
P-Value		0.0160			0.0065	

**Remarks:** \*, \*\* and \*\*\* indicate statistical significance at 10, 5 and 1 percent levels, respectively. Moreover, Wooldridge Test Stat is the Wooldridge Test statistic for autocorrelation in panel data.

cause Thai women to commit suicide but having high blood pressure does.

## Discussion

This study explored suicide rates of 76 provinces in Thailand during 2006–2013 and found that suicide rates in the national level ranged from 5.77 to 6.20 per 100,000 populations with the average rate of 5.98 per 100,000 populations. Although Thailand's suicide rate is lower than the global average (11.40 per 100,000 populations in 2012), suicide is still an important issue for Thailand since it has exhibited the slight upward trend during the study period. The findings also reveal the number of provinces with very low suicide rate. For example, the average suicide rates of Pattani, Narathiwat, and Yala during 2006–2013 were only 1.12, 1.26, and 2.03 per 100,000 populations, respectively. On the contrary, several provinces were found to have very high suicide rates. That is, nine out of 76 provinces in Thailand had the average suicide rate over 10 per

100,000 populations and Lamphun province had the highest average suicide rate of 15.84 per 100,000 populations (far higher than the global average). These findings confirm the importance of suicidal problem in Thailand.

Additionally, the regression analysis suggested that suicide in Thailand was significantly determined by the economic development and economic problem. First of all, income per capita as measured by GPP per capita significantly affected total, male, and female suicide rates. However, the relationship between these two factors was curvilinear, similar to the findings of Neumayer (2003). That is, suicide rate is likely to decrease as GPP per capita increases but only up to a certain point, thereafter as GPP continues to increase, suicide rate is likely to increase. The explanation is that even though Thailand is currently an upper middle income country, there are still a lot of poor people in the country. These people tend to have insufficient income to finance their consumption and lack of accessibility to social services, causing the decrease in social integration and suicide among these people. Suicidal behavior of these poor people is considered

as Durkheim's egoistic suicide (Durkheim, 1897, as cited in Thompson, 1982).

As these people have the greater income, they are likely to have the better standard of living and the increasing social integration, causing them less likely to commit suicide. Nevertheless, the suicide rate is likely to decrease only up to the certain level of income. If the income continues to increase, people are more likely to commit suicide. This is because such economic growth is likely to cause the moral deregulation and the collapse of traditional institutions such as family and religion, leading to the Durkheim's anomic suicide. Moreover, industrialization was found to negatively determine total, male and female suicide. That is, the suicide rate tends to decrease as the ratio of GPP of non-agricultural sector to GPP of agricultural sector increases. This finding is consistent with Pandy and Kaur (2009). This result is not surprising since leaving agricultural sector and working in non-agricultural sector enables Thai people to earn greater income and have better lives, causing them less likely to commit suicide.

Surprisingly, suicide in Thailand was negatively affected by unemployment. That is, suicide rate tends to fall as unemployment rate increases. This finding coincides with Chen et al. (2009) but contradicts with Kuroki (2010), Andres and Halicioglu (2010), and Andres et al. (2011). The reason for this is the underemployment problem in Thailand. Underemployment is the measure of labor force utilization. Labors are considered underemployed if they are highly skilled labors but working in low paying jobs, working in low skill jobs, or working part time (International Labour Office, 2003). In other words, underemployed labors are those who have inadequate jobs.

More clearly, Thailand's average unemployment rate during 2006–2011 was amazingly low at 1.21%, stemming from the very high underemployment. People who are underemployed, though having jobs, are likely to earn low income, causing stress, unhappiness, and suicide. As a result, the higher unemployment rate in Thailand seems to reflect that labors are seeking new and more adequate jobs, rather than losing jobs. Consequently, they are likely to be more satisfied with their lives and of course less likely to commit suicide.

That is probably why unemployment and suicide are negatively related in case of Thailand.

Divorce was found to have the positive impact on suicide in both male and female, consistent with Andres et al. (2011), Okada and Samreth (2013), and Jalles and Andresen (2015). That is, divorce is likely to cause Thai people more likely to commit suicide. This finding confirms Durkheim's acute domestic anomie which is the result of the sudden changes on the micro level, a result of an inability to adapt. Having high blood pressure causes Thai people more likely to commit suicide. This finding is similar to Ratcliffe et al. (2008) who suggested chronic pain and suicide are positively related. In contrast, this study found the negative relationship between having diabetes and suicide. The explanation is that diabetes rates in wealthier provinces with high industrialization were higher than in poorer provinces with low industrialization. Those who live in such wealthy provinces tend to have higher income and better accessibility to public health service. Therefore, they are less likely to commit suicide despite having diabetes. These findings imply that economic factors have the greater influence on suicide than health factors.

Moreover, educational attainment as measured by mean years of schooling, affected only female suicide rate. This finding suggests that females are less likely to commit suicide as they have higher educational attainment, like the findings of Daly and Wilson (2006). Like Qin (2005), this study found that urbanization positively affected suicide in Thailand but only in males. This finding implies urbanization may cause males more likely to commit suicide since it always comes with stress and moral deregulation.

## Conclusion

Suicide is considered as one of the major social problems of Thailand. Although Thailand's current suicide situation is far better than the global situation in other countries, it could not be disregarded as suicide rate in the nation still exhibit the upward trend and several provinces still have high suicide rates. Based on the study results, economic development and economic problems are the major causes of suicide. To lower

the suicide rate in Thailand, therefore, the appropriate public policies are extremely necessary. They include the policies to reduce the underemployment, promote capital intensive industry, and boost per capita income of Thai people. That is, Thai economy has been still dominated by labor intensive industries while most of working age people in the country are highly skilled labors with college degree, causing underemployment and low labor income. Consequently, the development of capital intensive industries, especially service sector, will help promote labor utilization in Thailand, leading to the lower underemployment and the higher per capita income. These will help reduce the suicide rate, especially egoistic suicide, in the country.

Additionally, the strong public policy to protect the traditional institutions, especially family and religion, and to prevent moral deregulation are also strongly recommended to stop the anomic suicide. Specifically, public campaign to encourage couples to realize the value of marriage is extremely needed since divorce is one of the primary cause of the collapse of family and of course the anomic suicide. Furthermore, balanced regional and provincial development is also essential to reduce urbanization. That is, infrastructure development and job creation in less wealthy provinces will help reduce urbanization and suicide in male. Finally, education and health policies are also recommended since people are less likely to commit suicide if they have the higher educational attainment and better health. With these policies, Thailand will have a good opportunity to eradicate suicide problem in the country, preventing economic lost from premature mortality, benefiting human capital development, and leading to the economic growth in ageing society.

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