



Faculty of Economics and Business

**Assessing the Impact of Socioeconomic Factors on Suicide: A Panel
Study in ASEAN Countries**

Hon Kwang Hui

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Assessing the Impact of Socioeconomic Factors on Suicide: A Panel Study in
ASEAN Countries

Hon Kwang Hui

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



Signature

Name: Hon Kwang Hui

Matric No.: 20020352

Faculty of Economics and Business

Universiti Malaysia Sarawak

Date:

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ABSTRACT

This paper examines the impact of socioeconomic factors on ASEAN's suicide from year 2000 to 2019. Both linear and non-linear connection between age-standardised total suicide rate with per capita GDP, current health spending, unemployment rate, fertility rate, female labour force participation rate and per capita alcohol consumption are examined utilising a panel data obtained from WHO and The World Bank. This study is based on the panel unit root tests, panel cointegration test, panel ARDL estimation and differential calculus approach turning point estimation. The panel unit root tests resulted that all variables are stationary at $I(0)$, $I(1)$ or both levels. The long-run association between variables in ASEAN countries is found in Pedroni cointegration test. The results from panel ARDL presented that all socioeconomic factors are significantly related to age-standardised total suicide rate. Additionally, per capita GDP showed the linkage of U-shaped with age-standardised total suicide rate, with the estimated turning point at about \$65,150.00 USD after which higher GDP per capita are linked to a higher age-standardised total suicide rate in ASEAN countries.

Keywords: Socioeconomic factors, age-standardized total suicide rate, ASEAN, panel ARDL estimation

***Penilaian Impak Faktor-faktor Sosioekonomi terhadap Bunuh Diri: Kajian Panel di
Negara-negara ASEAN***

ABSTRAK

Kajian ini bertujuan untuk menyelidiki impak faktor-faktor sosioekonomi terhadap bunuh diri di ASEAN pada tempoh masa 2000 hingga 2019. Hubungan linear dan bukan linear antara jumlah kadar bunuh diri standardisasi umur dengan KDNK per kapita, perbelanjaan kesihatan semasa, kadar pengangguran, kadar kesuburan, kadar penyertaan tenaga buruh wanita, dan pengambilan alkohol per kapita dikaji menggunakan panel data diperolehi dari WHO dan Bank Dunia. Analisis ini berdasarkan ujian punca unit panel, ujian kointegrasi panel, ujian panel ARDL, dan ramalan titik perubahan pendekatan kalkulus pembezaan. Ujian punca unit panel menunjukkan hasil bahawa semua pembolehubah pegun pada tahap $I(0)$, $I(1)$, atau kedua-duanya. Hubungan jangka panjang antara pembolehubah di ASEAN didapati di ujian kointegrasi Pedroni. Hasil daripada ujian panel ARDL menunjukkan bahawa semua factor-faktor sosioekonomi secara signifikan berkaitan dengan jumlah kadar bunuh diri standardisasi umur. Selain itu, KDNK per kapita menunjukkan hubungan berbentuk U dengan jumlah kadar bunuh diri standardisasi umur, dengan anggaran titik perubahan \$65,150.00 USD setelah itu KDNK per kapita yang lebih tinggi dikaitkan dengan jumlah kadar bunuh diri standardisasi umur yang lebih tinggi di ASEAN.

Kata Kunci: *Faktor-faktor socioekonomi, jumlah kadar bunuh diri standardisasi umur, ASEAN, ujian panel ARDL*

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AR	Autoregressive
ARDL	Autoregressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
BAC	Blood Alcohol Concentration
BMA	Bayesian Model Averaging
bpw	births per woman
CASMIN	Comparative Analysis of Social Mobility in Industrial Nations
COVID-19	Coronavirus Disease 2019
CPI	Consumer Price Index
ECM	Error Correction Model
ECT	Error Correction Term
EIU	Economist Intelligence Unit
ERHNI	Environmentally Responsible Happy Nation Index
FDI	Foreign Direct Investment
FGLS	Feasible Generalized Least Squares
FMOLS	Fully Modified Ordinary Least Squares
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalised Method of Moments
GNP	Gross National Product
GPP	Gross Provincial Product

HICs	High-Income Countries
ILO	International Labour Organization
IPS	Im-Pesaran-Shin
IRLS	Iteratively Reweighted Least Squares
KDNK	Keluaran dalam Negeri Kasar
LLC	Levin-Lin-Chu
LMICs	Low- and Middle-Income Countries
LR	Likelihood Ratio
LSDV	Least Square Dummy Variable
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PIP	Posterior Inclusion Probability
PP	Phillips–Perron
PVAR	Panel Vector Autoregression
SAR	Spatial Autoregression
SEM	Spatial Error Model
SER	Standard Error of the Regression
SES	Socioeconomic Status
SHE	Socioeconomic, Health and Environmental
SI	Social Isolation
SMEs	Small and Medium Enterprises
SOS	Samaritans of Singapore
UNFPA	United Nations Population Fund

UNICEF	United Nations Children’s Fund
US	United States
USD	United States Dollar
VECM	Vector Error Correction Model
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Introduction

Suicide is defined as the deliberate act of causing one's own death (Stedman, 1920). In ancient folklore and history, suicide occasionally played a significant role. The earliest documented case of suicide in history involved a person named Empedocles around 434 B.C. (Sheldon, 2017). He believed that death was a transformation and chose to end his life by jumping into Mount Etna in Sicily. In polytheistic cultures, such as those in ancient Rome and Greece, the attitude towards suicide was notably open (Gourevitch, 1969). However, this perspective shifted during the medieval period. The Christian Church opposed suicide, and individuals who attempted it were excommunicated. It can be concluded that during this era, attitudes towards suicide were heavily influenced by religious beliefs.

Nowadays, suicide has become a significant global public health concern. It is one of the top twenty leading causes of mortality worldwide, with more people dying from it than from malaria, breast cancer, war, and homicide. For every suicide among the nearly 800,000 annual deaths, there are more than 20 attempts (WHO, 2019). Additionally, suicide rates in Southeast Asian countries, the majority of which are ASEAN member states, rank as the third highest in the world, accounting for 39% of suicides in low- and middle-income countries (WHO, 2017). These alarming statistics have raised considerable concern among the governments of ASEAN nations regarding this issue.

1.2 Background of the Study

1.2.1 Age-Standardised Total Suicide Rate

Figure 1.1 shows the age-standardised total suicide rates from 2000 to 2019. Over these 20 years, the global age-standardised total suicide rate decreased by 35.7% (from 14.0% to 9.0%), with reductions varying from 16.9% in the Eastern Mediterranean (from 14.0% to 9.0%), 28.2% in Africa (from 15.6% to 11.2%), 32.5% in Southeast Asia (from 15.1% to 10.2%), 46.4% in Europe (from 19.6% to 10.5%), and 48.6% in the Western Pacific (from 14.0% to 7.2%). However, the age-standardised total suicide rate in the Americas increased by 16.9% during the same period, rising from 7.7% to 9.0%.

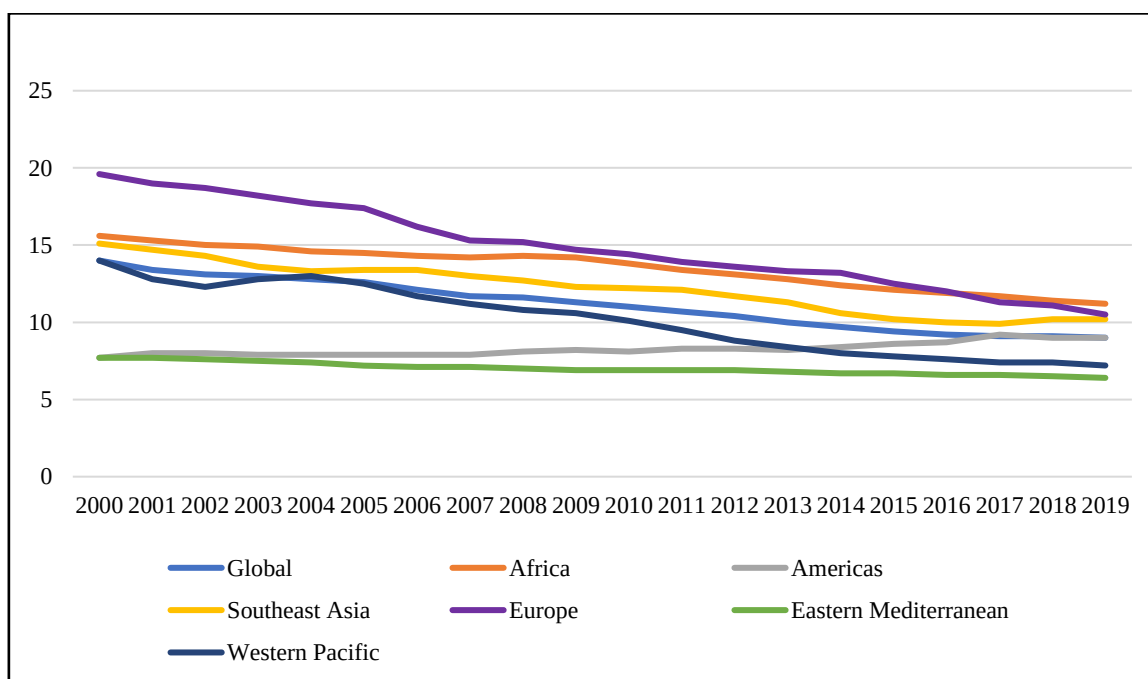


Figure 1.1: Age-Standardised Total Suicide Rates (2000 to 2019)

Source: WHO (2023)

Figure 1.2 illustrates the age-standardised total, male, and female suicide rates in 2019. The global age-standardised total suicide rate was 9.0%, which was lower than the rates in Africa (11.2%), Southeast Asia (10.2%), and Europe (10.5%). Meanwhile, the Eastern Mediterranean had the lowest age-standardised total suicide rate (6.4%). Additionally, the age-standardised male suicide rates in Africa (18.0%), Americas (14.2%), and Europe (17.1%) were higher than the global age-standardised male suicide rate (12.6%). The age-standardised female suicide rate in Southeast Asia (8.1%) was also higher than the global rate (5.4%).

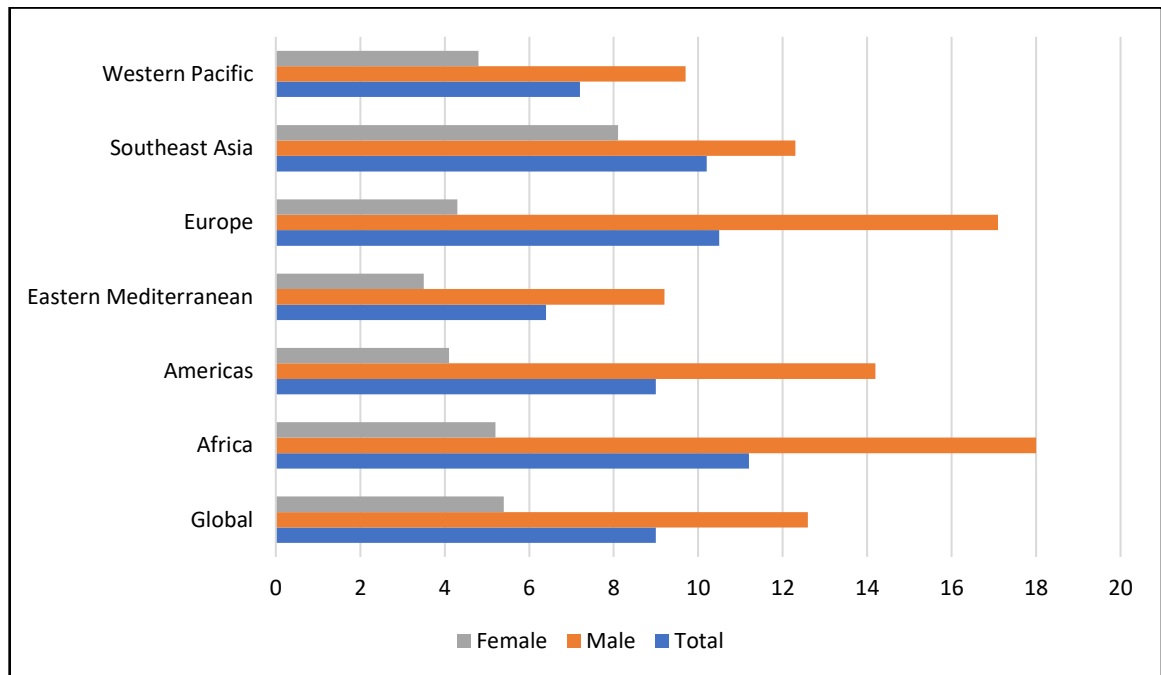


Figure 1.2: Age-Standardised Total, Male, and Female Suicide Rates in Year 2019

Source: WHO (2023)

Figure 1.3 displays the age-standardised total, male, and female suicide rates for ASEAN countries in 2019. Among these nations, Singapore had the highest age-standardised

total and female suicide rates, at 9.7% and 6.4%, respectively, while Thailand recorded the highest age-standardised male suicide rate (13.9%).

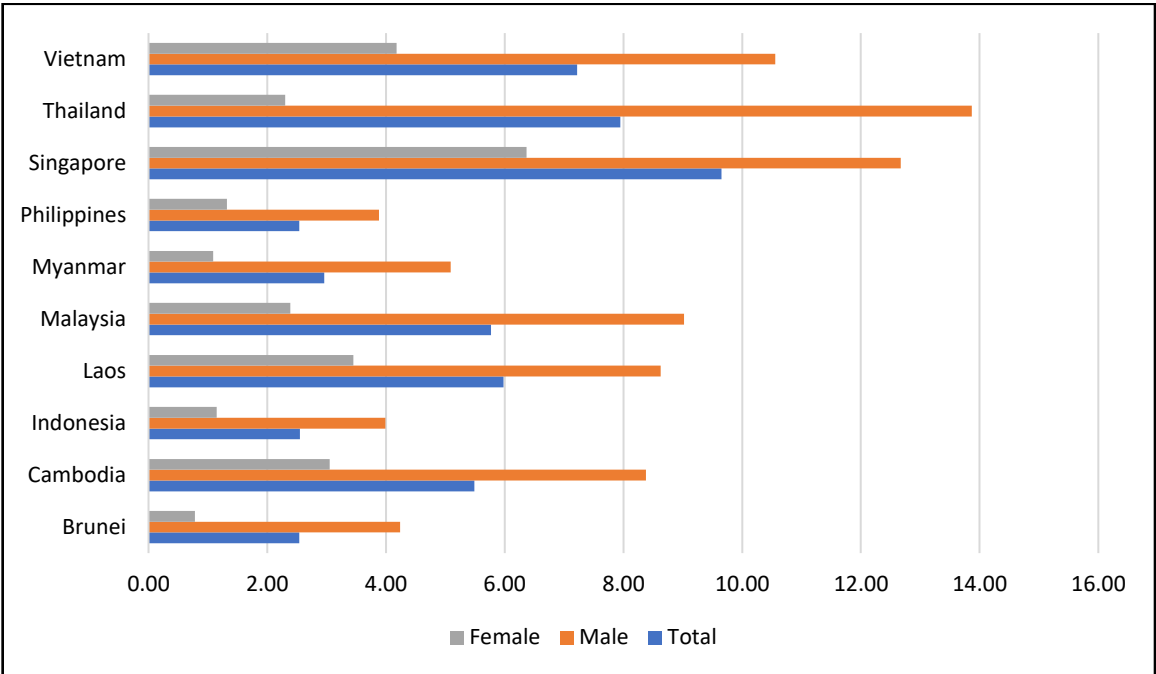


Figure 1.3: ASEAN Age-Standardised Total, Male, and Female Suicide Rate in Year 2019
Source: WHO (2023)

Suicide is considered a serious issue in Singapore. In 2019, Singapore had the highest age-standardised total suicide rate (9.7%) compared to other ASEAN countries. According to the SOS (2017), 197 suicide deaths were recorded among elderly people in 2016. Additionally, these suicide deaths were more common among senior men, attributed to the prevalence of a “man-up” or “macho” mentality that discourages emotional expression and seeking professional help. In 2023, Singapore reported 322 suicide cases, with 30% involving individuals under the age of 29, and a significant portion (one-third) involving those aged 10 to 19 (Ng, 2024). Similar to previous years, men were disproportionately affected, accounting for 222 out of 322 suicide deaths (Chan & Lim, 2024).

In Thailand, the age-standardised total suicide rate was 8.0%, with the rate among men being six times higher than that of women, at 13.9% and 2.3%, respectively. The Thailand Mental Health Department reported that approximately six people attempt suicide every hour, amounting to about 53,000 attempts per year (Saksornchai, 2018). The issue of suicide has been exacerbated by economic hardships during the COVID-19 pandemic. Although the Thai government launched a financial aid programme for those whose incomes were affected, it did not sufficiently prevent suicides. Bureaucratic red tape, delays, and rejections related to the programme led to increased desperation among the poorest, contributing to suicide (Almendral, 2020).

Myanmar's age-standardised total suicide rate was 3.0%. The male suicide rate was approximately five times higher than the female rate, at 5.1% and 1.1%, respectively. According to The ASEAN Post (2019), a major cause of suicide in Myanmar is pre-existing mental illness, particularly among people aged 25 to 40. Myanmar's mental health crisis has become more pressing, especially following the military coup in 2021 and ongoing conflicts that have intensified socioeconomic vulnerabilities (Htay et al., 2024). Additionally, cultural and traditional discrimination by elders against young people negatively impacts their attitudes and mental health, potentially leading to violence, depression, isolation, and suicide (UNFPA, 2019). Hence, community-led initiatives and increased awareness are vital for addressing these urgent issues.

Cambodia, on the other hand, exhibited higher age-standardised total, male, and female suicide rates compared to Myanmar, at 5.5%, 8.4%, and 3.1%, respectively. According to The Phnom Penh Post (2022), primary factors contributing to suicide in

Cambodia include debt, depression, failed relationships, chronic health issues, and alcohol- or drug-related mental health problems. Socioeconomic injustices further exacerbate depression and increase the risk of suicide (Chakrya, 2022). By contrast, the ongoing economic crisis in Laos has raised the risk of suicide, with 2019 rates of 6.0% (total), 8.6% (male), and 3.5% (female) (Hutt, 2024).

In Vietnam, the age-standardised female suicide rate (4.2%) was the second highest among ASEAN countries, with rates of 7.2% for the total and 10.6% for males. The primary risk factors for youth suicide in Vietnam include family socioeconomic status and family connectedness (UNICEF & ODI, 2017). Blum et al. (2012) found that living away from parental homes was protective, indicating that most suicides occurred among youth living with family members, leading to increased family conflict. This may be due to high parental expectations regarding academic performance, which can cause stress and conflicts. Many children who have attempted suicide cited strained relationships with parents as a key factor (Lê, 2009).

The Philippines had an age-standardised total suicide rate of 2.5%, the lowest among ASEAN countries, with male and female rates of 3.9% and 1.3%, respectively. However, youth suicide attempts are higher, particularly in remote areas where access to mental health care is limited. This issue worsened during the COVID-19 pandemic (The Atlantic Philanthropies, 2021). According to the Department of Education in the Philippines, 404 students died by suicide, and 2,147 attempted suicides during the 2021-2022 academic year (Save the Children, 2023). This highlights the urgent need for government intervention to improve mental health services and ensure adequate resources for students.

Similarly, Brunei had the lowest age-standardised total suicide rate at 2.5%, with the female rate (0.8%) being the lowest among ASEAN countries and the male rate at 4.2%. However, these figures may not accurately reflect the true situation due to cultural taboos and underreporting. The reluctance to report suicides stems from the perception of suicide as a criminal offence and a sinful act (Ho, 2020), making data collection difficult. According to Bandial (2019), factors influencing suicide in Brunei include depression, mental health issues, socioeconomic challenges, psychological and biological factors, and cultural norms.

In Indonesia, the age-standardised total, male, and female suicide rates were 2.6%, 4.0%, and 1.2%, respectively. A study by Wirasto (2012) indicated that most suicides in Indonesia were related to mental health problems, family conflict, alcohol and drug use, religious non-compliance, and poor social integration. Although Indonesia's suicide rate is lower than that of most ASEAN countries, underreporting is a significant issue. A recent study found an underreporting rate of 859.10% when comparing data from local police with WHO data (Onie et al., 2024). Consequently, the Indonesian government has established a national suicide registry to gather comprehensive data on suicides and suicide attempts, covering various demographics and risk factors to inform prevention strategies (Loasana, 2024).

Malaysia's age-standardised total suicide rate was 5.8%, with male and female rates of 9.0% and 2.4%, respectively. In Malaysia, ten people die by suicide each day (Relate Malaysia, 2016). Most suicides historically occurred among Indians, followed by Chinese individuals (Armitage, 2015; Lew et al., 2022; Ministry of Health Malaysia, 2011). However, since 2019, the racial distribution of suicides has shifted, with Chinese individuals

now representing the highest number of annual cases, followed by Indians and Malays, according to Deputy Prime Minister Datuk Seri Ahmad Zahid Hamidi (Morhan, 2024). Malaysia is experiencing significant social and economic changes driven by factors such as demographic shifts, urbanisation, digital innovation, economic inequality, and increased global connectivity (Lee et al., 2024). These rapid changes have altered social behaviours, cultural norms, and family structures, leading to adaptation challenges that contribute to suicide.

1.2.2 GDP per Capita

Figure 1.4 shows the ASEAN GDP per capita from 2000 to 2019. Overall, the GDP per capita of all ASEAN countries, except Brunei, increased over these 20 years. The GDP per capita of Singapore and Brunei, considered high-income economies, was much higher than that of other ASEAN countries, which are classified as upper-middle-income economies (Malaysia and Thailand) and lower-middle-income economies (Indonesia, Philippines, Vietnam, Laos, Cambodia, and Myanmar). In 2019, Singapore had the highest GDP per capita at \$61,386.24 USD, while Myanmar had the lowest at \$1,434.43 USD among ASEAN countries.

Singapore's GDP per capita was the highest, accounting for 48.91% of ASEAN's total GDP per capita in 2019. High creditworthiness, favourable tax rates, and a business-friendly environment have attracted substantial FDI, placing the country among the wealthiest globally in terms of GDP per capita (Export Finance Australia, 2023). However, there is significant disparity among individual ASEAN members, indicating an imbalance within the

association (Mordecai, 2017). Brunei, despite having the second-highest GDP per capita in ASEAN, showed a declining trend according to Figure 1.4. This decline is attributed to Brunei's economic expansion lagging behind its population growth, primarily due to its heavy reliance on oil and gas exports (Saim, 2010).

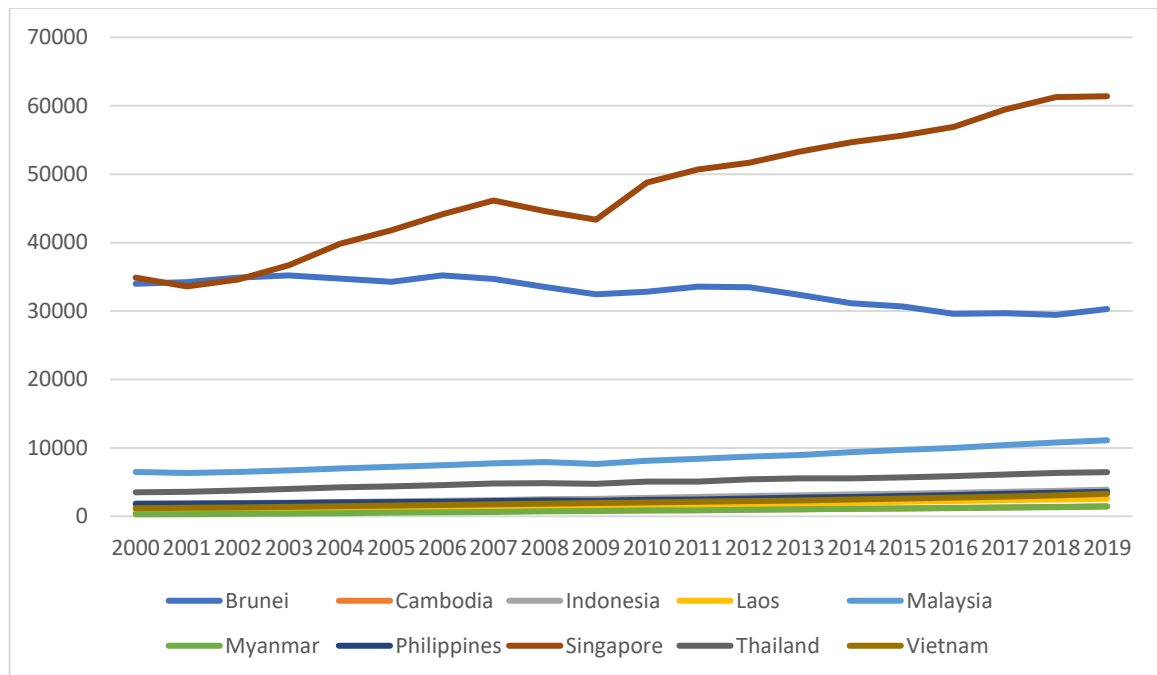


Figure 1.4: GDP per Capita of ASEAN (2000 – 2019)

Source: The World Bank (2023)

Among the upper-middle-income economies in ASEAN, Malaysia's per capita GDP was larger than Thailand's. The openness to trade and investment in Malaysia has played a crucial role in generating employment opportunities and increasing GDP per capita, with approximately 40% of jobs in Malaysia linked to export-related activities (The World Bank, 2022). In Thailand, the increase in GDP per capita is driven by the tourism industry, which attracts millions of visitors each year and significantly contributes to the GDP and employment opportunities (Statista Research Department, 2023).

Indonesia had the highest GDP per capita among the lower-middle-income ASEAN economies. The growth in Indonesia's GDP per capita is primarily driven by domestic activities rather than exports (Asialink Business, 2023). The Philippines has a stable macroeconomic situation characterised by low inflation and a favourable debt-to-GDP ratio (Mourdoukoutas, 2017), contributing to steady growth in GDP per capita. Vietnam's political stability and appeal of relatively low labour costs have attracted FDI, supporting improvements in GDP per capita (Vietnam Investment Review, 2018).

Laos has consistently adapted its trade and investment strategies to engage foreign capital to support local infrastructure and the mineral industries (Hays, 2014). Besides, regional integration has provided significant economic opportunities, allowing local industries to engage in value chains with neighbouring nations, positively impacting GDP per capita (Janus, 2018). Cambodia's steady increase in GDP per capita is linked to open trade and investment policies and a focus on the services sector (Menon, 2017). Myanmar's low GDP per capita is due to factors such as the shift to a managed float exchange rate, limitations on foreign currency acquisition by the Central Bank of Myanmar, frequent power shortages, armed conflicts, and nationwide infrastructure deficiencies (Yangon, 2023).

1.2.3 Current Health Expenditure

Figure 1.5 shows the current health expenditure of ASEAN countries from 2000 to 2019. Overall, most ASEAN countries showed an increase in current health expenditure over these 20 years. Countries with increased expenditure included Cambodia (from 6.54% to 6.90%), Indonesia (from 1.85% to 2.90%), Malaysia (from 2.51% to 3.84%), Myanmar

(from 1.99% to 4.68%), Philippines (from 3.06% to 4.17%), Singapore (from 3.34% to 4.42%), Thailand (from 3.10% to 3.86%), and Vietnam (from 3.82% to 5.03%). In contrast, Brunei and Laos saw decreases, from 2.55% to 2.19% and from 4.28% to 2.60%, respectively.

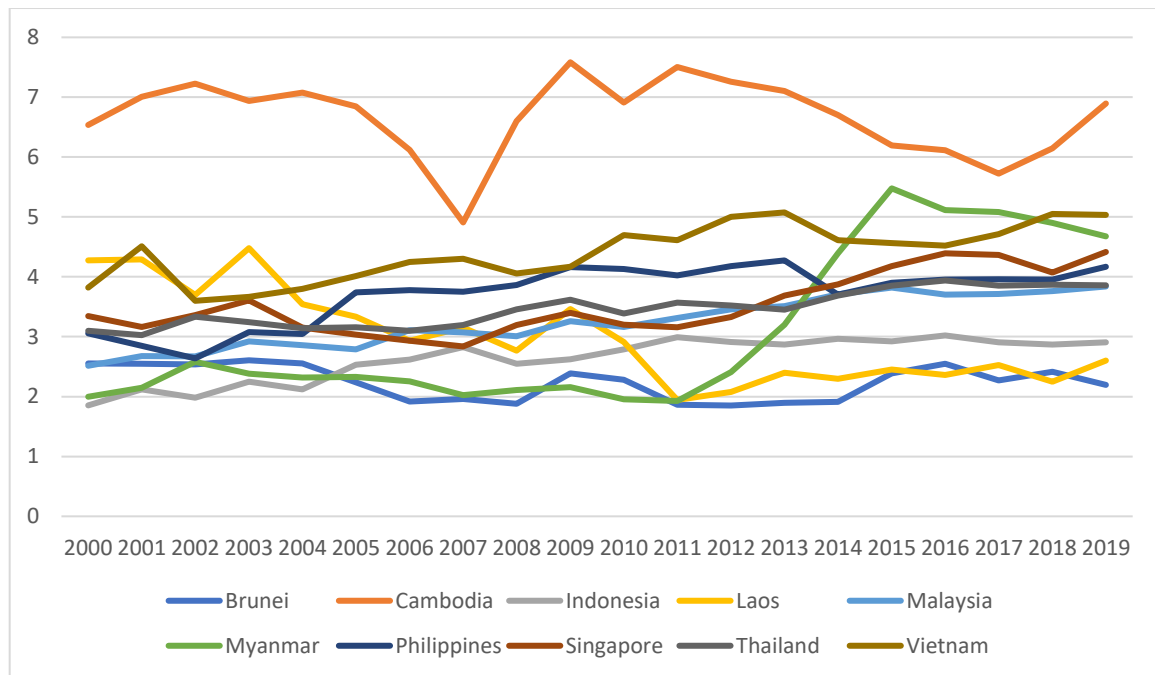


Figure 1.5: Current Health Expenditure of ASEAN (2000 – 2019)

Source: The World Bank (2023)

In Laos, the decline in current health expenditure (% of GDP) is attributed to fluctuations in external financing for health (The World Bank, 2012). Despite having the lowest health expenditure among ASEAN countries, Brunei offers its citizens extensive health services and performs well in various health indicators (ILO, 2021). However, the sustainability of this health expenditure, reliant on revenue from non-renewable natural resources, could present future challenges.

The increase in current health expenditure in other ASEAN countries reflects their governments' focus on improving public well-being amid rising globalisation, urbanisation, and industrialisation. However, while health expenditure has trended upwards over the past 20 years in Southeast Asia (comprising mostly ASEAN countries), it remains significantly below other regions and global averages. In 2019, the current health expenditure for Southeast Asia was 4.22%, the lowest compared to other regions (5.32% in Africa, 7.02% in Americas, 7.69% in Europe, 5.44% in Eastern Mediterranean, 7.35% in Western Pacific) and the world average of 9.83% (WHO, 2023).

1.2.4 Unemployment Rate

Figure 1.6 shows the unemployment rate of ASEAN countries from 2000 to 2019. Over this period, the unemployment rate increased in Brunei (from 5.60% to 6.92%), Laos (from 2.04% to 3.27%), and Malaysia (from 3.00% to 3.26%). Meanwhile, other ASEAN countries showed a declining trend, including Cambodia (from 0.97% to 0.15%), Indonesia (from 6.08% to 3.59%), Myanmar (from 0.65% to 0.41%), Philippines (from 3.66% to 2.24%), Singapore (from 3.70% to 3.10%), Thailand (from 2.39% to 0.72%), and Vietnam (from 2.26% to 1.68%).

In 2019, Brunei had the highest unemployment rate among ASEAN countries. The unemployment rate rose significantly between 2014 (6.86%) and 2017 (9.32%), reaching its highest level in two decades. According to the Report of Labour Force Survey 2017, out of 19,200 unemployed individuals, 18,200 were local residents, with a higher proportion of unemployed males (52.1%) compared to females (47.9%) (Department of Economic

Planning and Statistics, 2017). The elevated unemployment rate in Brunei is linked to labour underutilisation, which refers to the gap between labour supply and demand or unfulfilled employment needs within the population (Bakar, 2019).

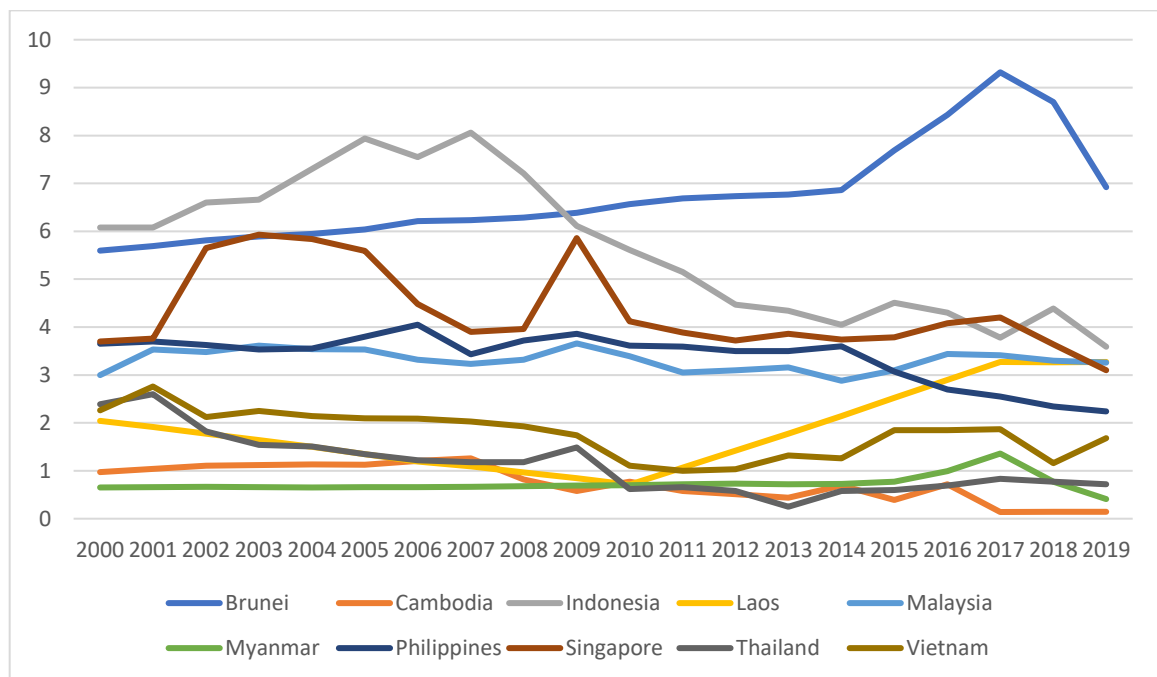


Figure 1.6: Unemployment Rate of ASEAN (2000 – 2019)

Source: The World Bank (2023)

In Laos, the unemployment rate rose sharply from 2010 (0.71%) to 2017 (3.27%) due to the implementation of a new international approach to defining unemployment (Southichack et al., 2020). Under this updated method, the labour force includes individuals engaged in paid work or actively seeking employment, excluding those primarily involved in subsistence agriculture. People with free time after the harvest, who do not actively seek employment, are considered nonparticipants in the labour market. This revised method narrows the labour force base, resulting in a higher reported unemployment rate. Malaysia was one of the three ASEAN countries to show an increase in unemployment over these 20

years, peaking at 3.66% in 2009. This was attributed to the global financial crisis, which forced struggling manufacturers to reduce output and lay off workers (Zuberi, 2009).

Cambodia's unemployment rate decreased, becoming the lowest in ASEAN by 2019. The Cambodian government's initiatives to establish international, bilateral, and multilateral trade relationships have facilitated greater trade opportunities, creating jobs in production, domestic trade, and export sectors (Vannak, 2022). In Indonesia, while the unemployment rate declined, it remained the second highest among ASEAN countries in 2019. This was due to slow growth in the manufacturing industry, which struggled to create sufficient job opportunities (Septrila & Kurniasih, 2022).

1.2.5 Fertility Rate

Figure 1.7 illustrates the fertility rate in ASEAN countries from 2000 to 2019. Overall, fertility rates declined across all ASEAN countries over these 20 years, with decreases ranging from 22.46% in Brunei (from 2.35 to 1.82 bpw), 35.32% in Cambodia (from 3.77 to 2.40 bpw), 12.66% in Indonesia (from 2.54 to 2.22 bpw), 41.57% in Laos (from 4.40 to 2.57 bpw), 37.06% in Malaysia (from 2.91 to 1.83 bpw), 21.01% in Myanmar (from 2.79 to 2.20 bpw), 24.47% in Philippines (from 3.71 to 2.81 bpw), 28.75% in Singapore (from 1.60 to 1.14 bpw), 16.13% in Thailand (from 1.61 to 1.35 bpw), and 5.98% in Vietnam (from 2.07 to 1.95 bpw). This declining trend is not only present in ASEAN countries but is also a global issue, with the global fertility rate dropping by 11.11% from 2.7 bpw in 2000 to 2.4 in 2019. In 2019, Brunei, Malaysia, Singapore, Thailand, and Vietnam had fertility rates below the replacement-level fertility of 2.1 bpw.

According to the EIU (2019), several factors explain the decline in fertility rates in ASEAN countries. Firstly, rapid urbanisation and development have prompted people to migrate from rural areas to urban centres in search of better economic opportunities. This shift results in higher living costs, making it more expensive to raise children in urban areas compared to rural settings. Consequently, women face the challenge of balancing work and family life, as both partners often need to work to maintain a suitable standard of living. As a result, women in cities are less inclined to have children.

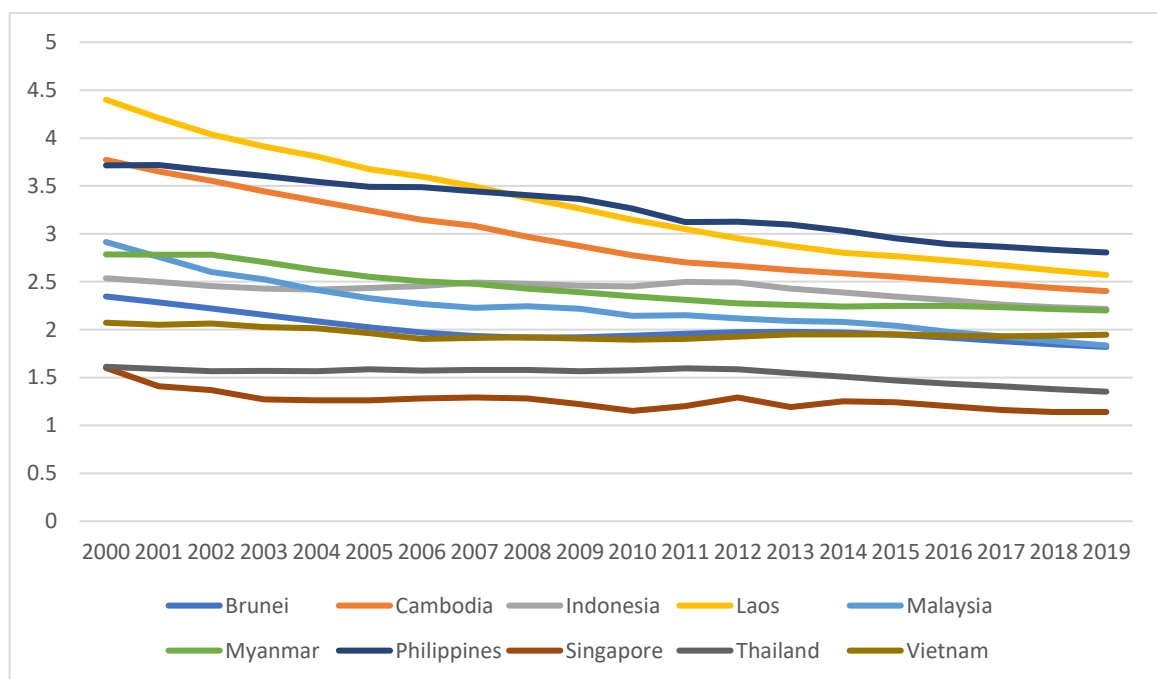


Figure 1.7: Fertility Rate of ASEAN (2000 – 2019)

Source: The World Bank (2023)

Another factor influencing the decline in fertility rates is the increasing level of women's education. Higher educational attainment leads many women to delay marriage and childbirth in pursuit of career opportunities. Women in formal, graduate-level professions are more likely to postpone marriage and childbirth compared to those in

informal sectors (Subramaniam & Saleh, 2016). Educated women also tend to prefer smaller family sizes. Statistics show that over 50% of women with no schooling or only primary education have five or more children, compared with only 18.4% of women with tertiary education (Peng, 2002).

A further factor contributing to lower fertility rates is the shift from prioritising quantity to quality. The concept of the quality-quantity trade-off highlights how some couples are allocating more financial resources to ensure a higher standard of living for their children, rather than focusing on having larger families (Lai et al., 2017). Rising education costs, along with the opportunity cost associated with women's time due to employment and higher living expenses, encourage couples to prioritise quality over quantity (Tang & Tey, 2017). The use of effective contraception becomes essential for this approach, enabling parents to devote more attention and resources to fewer children.

Finally, the decline in fertility rates can be attributed to a lack of awareness about infertility. Among women, age-related factors, especially prevalent in educated urban areas, contribute to increased infertility rates due to delayed childbirth (Sinthamoney, 2015). Infertility is not only an issue for women; men also face challenges such as reduced sperm count, motility, and abnormalities. Infertility is often not recognised as a medical condition, leading to limited insurance coverage. As a result, individuals typically bear the high costs of treatment, which can be a significant barrier to accessing care.

1.2.6 Female Labour Force Participation Rate

Figure 1.8 displays the female labour force participation rate in ASEAN from 2000 to 2019. Over these 20 years, half of the ASEAN countries experienced a declining trend in female labour force participation, including Cambodia (from 73.55% to 69.73%), Laos (from 60.14% to 55.84%), Myanmar (from 61.94% to 46.30%), Philippines (from 47.13% to 46.40%), and Thailand (from 65.02% to 59.02%). Conversely, Brunei (from 54.99% to 55.22%), Indonesia (from 51.61% to 53.91%), Malaysia (from 43.86% to 51.97%), Singapore (from 52.28% to 62.41%), and Vietnam (from 68.80% to 70.52%) showed an increasing trend during the study period.

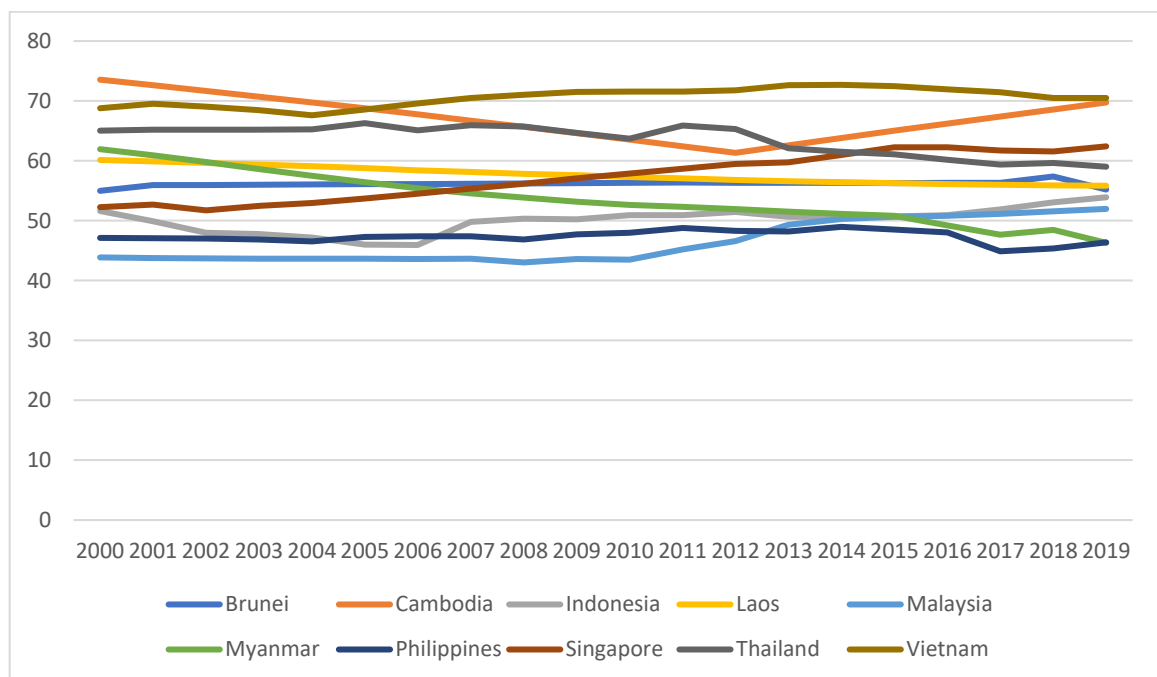


Figure 1.8: Female Labour Force Participation Rate of ASEAN (2000 – 2019)

Source: The World Bank (2023)

Vietnam had the highest female labour force participation rate among ASEAN countries. The country has established a robust legal framework to protect the rights of female workers. According to Tran (2019), the Labour Code 2012 provides comprehensive safeguards against gender discrimination in the workplace, mandating that employers uphold equality in recruitment, employment, promotion, and compensation. Additionally, the code ensures equal pay for work of equal value. As a result, individuals aged 15 and above, regardless of gender, who meet job requirements can be employed, fostering equal job opportunities for both men and women.

In Brunei and Singapore, the increase in female labour force participation can be attributed to higher education attainment among women. In Brunei, a strategy focused on education and human capital development has led to equal literacy rates between men and women, particularly among the younger generation (OECD, 2013). Similarly, in Singapore, efforts to reduce gender-based educational disparities and the growing acceptance of women in the workforce have created increased economic opportunities for women, contributing to higher female labour force participation rates (Koh, 2007). However, in Thailand, the pursuit of higher education by women, leading to a delay in joining the workforce, has contributed to a decline in female labour force participation (Hsiao, 2018).

While the female labour force participation rates in Indonesia and Malaysia have increased, they face similar challenges as other ASEAN countries (such as Cambodia, Laos, Myanmar, and the Philippines) that have seen declines. Factors such as the gender gap in wage employment, childcare responsibilities, and unpaid family duties make women hesitant

to participate in the labour force (Epetia, 2019; Khant & Mai, 2022; Khouangvichit, 2010; Schaner & Das, 2016; UNFPA, 2023; Weimann-Sandig & Sem, 2022).

1.2.7 Alcohol Consumption per Capita

Figure 1.9 illustrates alcohol consumption per capita in ASEAN countries from 2000 to 2019. During these 20 years, alcohol consumption per capita decreased in Indonesia (from 0.54ℓ to 0.22ℓ), Malaysia (from 1.44ℓ to 0.93ℓ), and Singapore (from 2.46ℓ to 2.00ℓ). Conversely, consumption increased in Brunei (from 0.25ℓ to 0.46ℓ), Cambodia (from 1.66ℓ to 7.84ℓ), Laos (from 1.66ℓ to 7.84ℓ), Myanmar (from 4.70ℓ to 12.08ℓ), Philippines (from 0.14ℓ to 2.14ℓ), Thailand (from 5.53ℓ to 7.02ℓ), and Vietnam (from 1.81ℓ to 7.93ℓ).

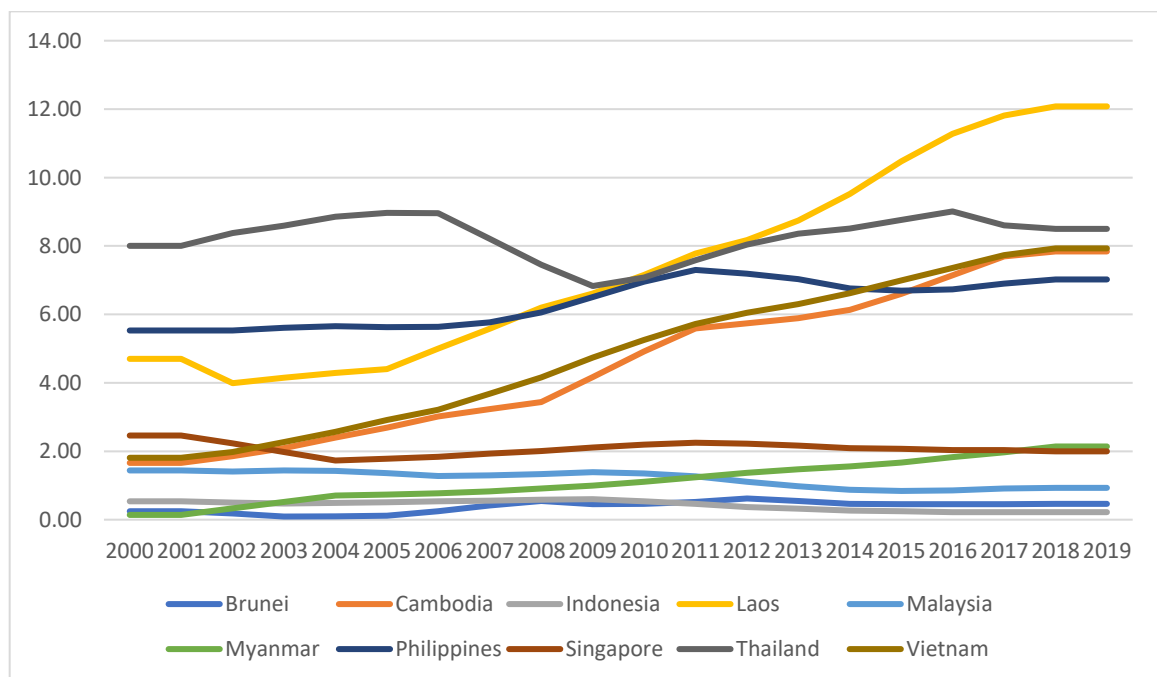


Figure 1.9: Alcohol Consumption per Capita of ASEAN (2000 – 2019)

Source: WHO (2023)

Indonesia had the lowest alcohol consumption per capita among ASEAN countries in 2019, due to strong cultural and religious influences (Arfines et al., 2022). Indonesia is home to the largest Muslim population in the world, and Islam is the predominant religion (Zaini, 2022). Islamic teachings generally discourage or prohibit the consumption of alcoholic beverages (Michalak & Trocki, 2006). Consequently, many Indonesians adhere to these religious guidelines, resulting in low alcohol consumption per capita.

Other Muslim-majority countries, such as Brunei and Malaysia, also recorded lower alcohol consumption per capita. According to Ong et al. (2017), the sale of alcohol has been banned in Brunei since 1984. However, non-Muslims aged 17 and older are permitted to bring in limited amounts of alcohol for personal use when entering the country. This policy has significantly contributed to the low alcohol consumption per capita in Brunei. In Malaysia, a combined approach of specific and ad valorem taxes on alcohol aims to reduce consumption and deter the initiation of drinking (Sornpaisarn et al., 2017).

In Myanmar and Singapore, while alcohol consumption per capita was higher than in Brunei, Indonesia, and Malaysia, it remained below the global average of 5.5ℓ. Both countries have similar policies to regulate alcohol consumption. According to WHO (2019), the minimum legal age for purchasing alcohol is 18, and the maximum legal BAC for drivers is 0.08%.

Cambodia, Laos, Philippines, Thailand, and Vietnam had alcohol consumption per capita rates exceeding the global average of 5.5ℓ. In the Philippines, alcohol consumption has steadily increased, as drinking is a customary part of many celebrations, such as the Bac-

Bacarra, Amian, and Empanada festivals, which promote cultural awareness and tourism (Salas & Hinlo, 2019). In Cambodia, the absence of a minimum age for alcohol purchases and ineffective law enforcement mean that anyone can buy alcohol without restrictions (Chea, 2020).

Thailand's status as a major tourist destination also contributes to higher alcohol consumption (Hong & Peltzer, 2019). Employees in the tourism sector are particularly at risk of excessive drinking (Room, 2005). In Laos, alcohol consumption per capita was the highest among ASEAN countries. The use of ad valorem taxes on alcohol in Laos, which are based on the price of the beverage rather than the quantity, has led to increased consumption as alcohol is not directly taxed (Sornpaisarn et al., 2020).

1.2.8 Socioeconomic Disparities and Suicide Rate

Socioeconomic disparities significantly influence suicide rates across different populations. The study by Näher et al. (2020) found that lower SES is associated with higher suicide rates. The research consistently demonstrated that factors such as income, employment status, and education level impact suicide rates. In ASEAN countries, where income inequality and poverty rates vary significantly, these disparities are even more pronounced. Individuals from low-income backgrounds often face multiple stressors, including financial insecurity, job instability, and limited access to essential services, which increase the risk of suicide (Kirkbride et al., 2024). These socioeconomic disparities underscore the importance of examining the socioeconomic impacts on suicide rates.

One of the most prominent socioeconomic drivers of suicide is financial stress, particularly related to unemployment (Sinyor et al., 2024). Job loss or the inability to secure stable employment can lead to feelings of worthlessness, hopelessness, and depression, increasing the risk of suicide. Unemployment affects not only an individual's economic standing but also their social identity and self-worth. When these are compromised, individuals may experience social isolation, a critical risk factor for suicide. Research indicates that unemployed individuals are two to three times more likely to die by suicide than those with stable employment (Thornton & Platt, 2012). Economic recessions and downturns exacerbate these risks, as seen after the 1997 Asian Financial Crisis, when suicide rates surged in countries like South Korea and Thailand (Kwon et al., 2009).

Educational attainment is also an important factor in suicide prevention. Education level often influences suicide risk later in life (Lorant et al., 2021). Since formal education is usually completed early in life and remains unchanged, differences in suicide rates between education levels suggest that lower educational attainment can elevate the risk of suicide. This can occur directly or through links to lower SES and mental health issues. Factors such as early mental health problems, impulsiveness, adverse childhood experiences, and lower intelligence can reduce the likelihood of higher educational attainment and increase suicide risk (Lorant et al., 2021).

Income inequality also plays a key role in influencing suicide rates. In contexts of high-income inequality, social class distinctions become more pronounced, intensifying competition and feelings of defeat among those in lower social positions. This can increase the likelihood of suicidal thoughts (Buttrick & Oishi, 2017). Additionally, income inequality

can produce negative emotional effects due to perceived injustices between wealthier and poorer groups (Andres & Mostafa, 2023). Addressing income inequality is crucial not only for economic improvement but also for reducing mental health burdens and suicide rates.

1.3 Problem Statement

ASEAN, an intergovernmental organisation of 10 Southeast Asian countries, continues to face significant challenges related to suicide despite a declining trend in suicide rates. From 2000 to 2019, the suicide rate in Southeast Asia decreased from 15.1% to 10.2%. However, this rate remained higher than the global average of 9.0% in 2019, with Southeast Asia ranking as the third-highest region for suicide rates globally in the same year. Compared to East Asia, the suicide rate in Southeast Asia highlights the severity of the issue. As reported by The ASEAN Secretariat (2020), ASEAN's GDP followed a positive trend from 2000 to 2019. By 2019, ASEAN's GDP reached \$3.2 trillion USD, nearly five times the 2000 figure of \$0.6 trillion USD. A similar upward trend was observed in GDP per capita, which rose to \$4,827.40 USD in 2019, more than four times the \$1,200.30 USD figure in 2000. As ASEAN experiences economic growth, its health and social challenges, including suicide, may begin to resemble those of more developed East Asian countries. This underscores the urgency for ASEAN countries to adopt more effective suicide prevention strategies.

While systematic reviews, such as Knipe et al. (2015), have examined the association between socioeconomic factors and suicide in East, South, and Southeast Asia, significant gaps remain. Existing research has primarily focused on certain countries (notably China

and India), without comprehensively exploring the broader dynamics and interplay of socioeconomic variables in the context of ASEAN countries. Findings from this review indicate the need for more localised, in-depth studies that address the unique socioeconomic landscape of East, South, and Southeast Asia. This lack of regional specificity makes it challenging for ASEAN policymakers to rely on findings from global or high-income country studies when designing effective suicide prevention policies and programmes.

Additionally, theories such as the economic theory of suicide by Hamermesh and Soss (1974), which suggests that higher economic prosperity reduces suicide by increasing expected lifetime utility, contrast with Durkheim's (1897) social theory of suicide, which posits that both economic expansion and contraction can increase suicide by disrupting social integration and regulation. These theoretical inconsistencies, coupled with empirical studies showing mixed results regarding the relationship between income, economic conditions, and suicide rates, make it difficult for ASEAN policymakers to identify key socioeconomic drivers of suicide.

1.4 Research Questions

The research questions of this study are as follows:

- i. What is the impact of socioeconomic factors on ASEAN' suicide rates?
- ii. How do these socioeconomic factors differ from findings in previous studies in other countries and regions?
- iii. How can the results inform the development of targeted suicide prevention policies in ASEAN?

1.5 Objective of the Study

1.5.1 General Objective

This study's general objective is to assess the impact of socioeconomic factors on suicide in ASEAN.

1.5.2 Specific Objectives

The specific objectives of this study are:

- i. To investigate the linear association between socioeconomic variables on ASEAN's suicide rates.
- ii. To analyse the non-linear relationship between socioeconomic variables on ASEAN's suicide rates.

1.6 Significance of the Study

This study provides a comprehensive analysis of the impact of socioeconomic factors on suicide in ASEAN countries, offering valuable insights that can guide ASEAN policymakers. Previous studies conducted in Southeast Asia have often focused on specific socioeconomic variables and been limited to individual countries. This study adopts a broader regional approach, using panel data to investigate the relationship between multiple socioeconomic factors and suicide rates across ASEAN nations. This regional focus is essential as the diverse socioeconomic and cultural contexts of ASEAN countries require

policies tailored to local conditions. By providing region-specific insights, this study addresses gaps in the existing literature and contributes new empirical evidence to inform more targeted and effective suicide prevention strategies.

The findings of this study have practical implications for ASEAN governments, enabling policymakers to review and assess the impact of existing socioeconomic policies on suicide rates more accurately. By identifying which socioeconomic factors have the greatest impact on suicide, ASEAN governments can develop policies that specifically target these risk factors. This study also provides a framework for evaluating the effectiveness of current interventions and offers evidence-based recommendations for improving policies aimed at reducing ASEAN suicide rates. This facilitates a more efficient policy-making process, reducing the time needed for evaluation, preparation, and refinement of legislation and programmes focused on suicide prevention.

Moreover, this study helps reduce information asymmetry within ASEAN by raising public awareness about the socioeconomic determinants of suicide. In today's digital world, information spreads rapidly through social media and web platforms. The findings of this study can be disseminated widely, enhancing public understanding of the causes of suicide. By promoting knowledge and information sharing, this study can contribute to a more informed society, equipping the public to recognise risks and work collectively to prevent suicides. Reducing information asymmetry is crucial for ensuring that vulnerable groups have access to the knowledge they need to seek help and prevent suicide.

Additionally, this study serves as a valuable resource for future researchers and academics. It acts as a foundational study in the field of socioeconomic factors and suicide within the ASEAN context, addressing a significant gap in the literature where research on this topic is still limited. By providing empirical evidence and methodological insights, this study will assist future researchers in developing more advanced and nuanced analyses. It also contributes to the broader academic discourse on how socioeconomic variables affect suicide, expanding the body of knowledge in this area and encouraging further exploration of the topic in both regional and global contexts.

1.7 Scope of the Study

This study assesses the socioeconomic determinants of suicide rates in ASEAN countries. The data used in this study are annual data covering a 20-year period from 2000 to 2019. The study includes all ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam). The variables examined are age-standardised total suicide rate, per capita GDP, current health spending, unemployment rate, fertility rate, female labour force participation rate and per capita alcohol consumption.

1.8 Organisation of the Study

This study aims to assess the influence of socioeconomic variables on suicide rates in ASEAN. It is organised into five chapters. Chapter 1 introduces the study, providing an overview and background, followed by the problem statement, objectives, significance,

scope, and organisation of the study. Chapter 2 reviews previous studies, developing a theoretical framework based on past research and presenting empirical findings to understand existing discoveries and limitations for future development. Chapter 3 details the methods adopted for conducting the empirical analysis. Chapter 4 analyses and interprets the empirical findings. Chapter 5 concludes the study and provides recommendations and policy suggestions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter contains a study of prior literature-related works. This study purposes to access the effect of socioeconomic factors on ASEAN's suicide rate. There have been many useful insights into the analysis in terms of methodology and its drawbacks as several prior academics and researchers studied in the suicide-related field. This literature review provides a review at theoretical frameworks and empirical findings on socioeconomic factors and suicide in various countries. This chapter divides into three sections: theoretical reviews, empirical findings from past studies and concluding remarks.

2.2 Theoretical Reviews

2.2.1 Social Theory of Suicide

Durkheim (1897) was the first to propose a social theory of suicide, suggesting that suicide was influenced by how individuals were integrated into social groups governed by rules and customs. According to this sociological model, low or high levels of social integration and regulation were linked to incidences of societal suicide. Durkheim (1897) identified four types of suicide, as shown in Table 2.1:

Table 2.1: Four Types of Suicide

Types of suicide	Explanation
Egoistic suicide	Caused by a reduction in social integration. In other words, it results from excessive individuation, where people become increasingly disconnected from their communities. As a result, these individuals lack appropriate social ties and social support, ultimately leading to suicide.
Altruistic suicide	Caused by a lack of individuation or a high level of social integration. This type of suicide is the opposite of egoistic suicide, occurring in cultures where the needs and interests of society are prioritised over those of the individual. In essence, this form of suicide reflects a rigid morality that disregards the individual.
Anomic suicide	Results from moral deregulation and the absence of defined and reasonable ambitions due to weak social norms. It occurs when there is an imbalance between people's desires and their ability to fulfil them, particularly when resources are limited.
Fatalistic suicide	The outcome of living in a repressive society where individuals prefer death over life. This type of suicide is more common in societies with heavy regulation that prevents people from achieving their dreams.

Source: Durkheim (1897).

Durkheim (1897) further categorised anomic suicide into four subtypes: acute economic anomie, chronic economic anomie, acute domestic anomie, and chronic domestic anomie. Acute economic anomie arises when traditional institutions, such as religion and government, fail to consistently meet societal demands. Chronic economic anomie results from the long-term erosion of social regulation due to economic development, which undermines old social structures and often fails to replace them.

Acute domestic anomie is caused by an inability to adapt to rapid changes at the micro-social level, exemplified by widowhood and divorce. Chronic domestic anomie, on the other hand, is the result of long-term micro-social changes, particularly within marriage. This means that marriage helps regulate the behaviour of both men and women. For instance, single men are more prone to suicide than married men due to a lack of regulation.

Moore (2016) expanded on Durkheim's (1897) types of suicide, specifically egoistic, altruistic, and anomic suicide, linking them to the concept of social capital. Moore (2016) explained how social capital influences these three types of suicide. Firstly, a low level of social integration occurs when individuals feel different from those around them, making it difficult for them to share values and norms, feel respected, or be satisfied with life. Consequently, low social capital can lead to a lack of positive feedback about one's position in life, increasing the likelihood of egoistic suicide.

Additionally, the level of social support affects altruistic suicide. A higher level of social support can create pressure to succeed, which may become overwhelming for individuals who feel unable to meet expectations. This results in an excessive level of social capital, increasing the risk of altruistic suicide. Furthermore, when societal regulation breaks down, the level of social capital decreases, as individuals are unregulated and free to pursue any desires, leading to anomic suicide. Moore's (2016) study, which examined data from 53 countries between 2000 and 2007, concluded that levels of respect and life satisfaction were significantly negatively associated with egoistic suicide, while higher levels of social support significantly increased the likelihood of altruistic suicide.

2.2.2 Economic Theory of Suicide

Understanding the factors that contribute to rising suicide rates involves examining the circumstances that may drive individuals to suicide. Although sociological theories on suicide have been widely accepted, this review takes an economic approach. This does not

imply that non-economic factors are irrelevant; rather, an individual's economic and social conditions often play a significant role in suicidal behaviour.

Hamermesh and Soss (1974) developed the first economic model of suicide, treating individuals as rational agents who decide to end their lives when their total discounted lifetime utility reaches zero. The utility function for an individual was expressed as:

$$U_m = U[C(m, Y) - K(m)] \quad \text{Equation 2.1}$$

where m represents the individual's age, C is consumption, Y is income, and K is expenditure to maintain health each year. The present value of lifetime expected utility was given by:

$$Z(a, Y) = \int_a^\omega e^{-r(m-a)} U_m P(m) dm \quad \text{Equation 2.2}$$

where ω is the maximum attainable age, r is the discount rate, and $P(m)$ is the probability of surviving to age m at the given age a . In this model, Z is a decreasing function of a and an increasing function of Y , predicting that suicide rates rise with age and decrease with income. Hamermesh and Soss (1974) demonstrated that these predictions held true over time and across US states.

Brainerd (2001) further explained that life expectancy might impact the decision to commit suicide. A high likelihood of survival implies that an individual has a longer life expectancy, which increases lifetime expected utility and reduces the probability of it reaching zero before natural death. Conversely, reduced life expectancy can increase suicide rates, worsening the decline in life expectancy and creating a negative cycle.

Koo and Cox (2008) extended the theory by incorporating human capital depreciation during periods of unemployment. In their revised model, relative income is defined as the gap between an individual's income and the average social income at a given time. This suggests that suicide rates do not always decline as aggregate income rises, aligning with the observation that suicide rates have not consistently fallen despite significant economic growth. Relative income is positively related to human capital, which remains stable during employment but declines during unemployment due to lost opportunities for skill maintenance. Economic transitions, such as technological changes or shifts in governance, accelerate the depreciation of human capital for unemployed individuals, thereby reducing their relative lifetime utility more rapidly. The revised model was expressed as:

$$RZ(a, RY(h)) = \int_a^\omega e^{-r(m-a)} RU[RC(m, RY(h)) - RK(m)]P(m)dm \quad \text{Equation 2.3}$$

where h represents human capital, and RY is relative income as an increasing function of h . RU , RC and RK are the relative versions of U , C , and K in Equation 2.1, respectively. Unemployed individuals accumulate less human capital than their employed counterparts, resulting in lower relative lifetime utility and an increased likelihood of suicide in response to higher unemployment rates.

2.2.3 Economics of Happiness Theory

Reviewing Ng's (2022) economics of happiness theory is essential in suicide research as it provides a framework for understanding how socioeconomic factors influence subjective well-being, which inversely relates to suicide risk. While traditional theories such as Durkheim (1897) and Hamermesh and Soss (1974) focus on social integration, social regulation, and economic utility, Ng's (2022) theory addresses how economic conditions like

income inequality, public expenditure, and economic growth impact individual happiness. Since suicide is often a result of extreme dissatisfaction with life, examining how these socioeconomic conditions affect happiness provides deeper insight into the relationship between economic factors and suicide.

Ng (2022) defines happiness as the net balance of positive over negative affective feelings, emphasising a subjective, hedonic understanding of happiness. This approach focuses on individual experiences of pleasure and pain, which Ng (2022) argues is consistent with common usage and analytically valuable. He critiques the conflation of happiness with concepts like morality or self-realisation, suggesting that these approaches create confusion as happiness and morality are distinct constructs.

Ng (2022) argues that happiness can be cardinally measured and compared across individuals using survey questionnaires. This allows for meaningful cross-individual and cross-societal comparisons, which is crucial for understanding and enhancing well-being. Ng's (2022) insistence on happiness as an intrinsically valuable metric aligns with the utilitarian tradition, where the goal is to maximise happiness rather than wealth or other objective indicators.

A key element of Ng's (2022) theory is the assertion that happiness is the only intrinsic value, a position grounded in utilitarianism. This view holds that all other values, such as health, success, and environmental well-being, are only valuable if they contribute to happiness. This challenges conventional economic theories that prioritise economic growth over subjective well-being. Ng (2022) highlights the Easterlin Paradox, which shows that

beyond a certain level of economic development, increased income does not correlate with greater happiness. This is particularly relevant for developed economies, where further consumption can decrease happiness due to stress, inequality, and environmental issues.

Ng (2022) also argues that happiness is not solely determined by higher GDP. He proposes ERHNI as a new measure of national success that integrates happiness and environmental sustainability. This index addresses GDP's limitations as a well-being metric by focusing on individual happiness and quality of life. Ng (2022) suggests that public expenditure on health, education, and environmental protection can significantly improve societal happiness, especially when private consumption often revolves around competitive status-seeking rather than genuine well-being.

Ng (2022) identifies 12 key factors for individual happiness: attitude, balance, confidence, dignity, engagement, family and friends, gratitude, health, ideals, joy, kindness, and love. These factors align with Maslow's Hierarchy of Needs, emphasising the importance of meeting both basic and psychological needs for happiness. Ng (2022) also finds that there is a U-shaped relationship between age and happiness, indicating that happiness declines during midlife before rising in older age. This pattern, influenced by changing expectations and life circumstances, highlights the complex, multi-dimensional nature of happiness.

Ng (2022) notes that happiness levels are lower in East Asian countries, even in those with significant economic success. This is attributed to intense societal pressures and cultural factors that diminish well-being despite material prosperity. This finding underscores the

limitations of using economic growth as the sole indicator of success and reinforces Ng's (2022) argument for prioritising subjective well-being in public policy. It also highlights the importance of cultural sensitivity when applying happiness-based policies across different regions.

2.3 Empirical Reviews

2.3.1 Empirical Findings from Past Studies in Americas Region

The relationship between socioeconomic factors and suicide has been extensively studied in various regions, providing important insights into how specific factors contribute to suicide rates. Kuncie and Anderson (2002) examined US states from 1985 to 1995, finding that a higher percentage of housing units occupied by one person and a larger percentage of the population aged 15 – 24 were significantly associated with higher suicide rates. However, subsequent work by Kuncie (2021), expanding the dataset to cover 1990–2019, found that only distilled spirits consumption and household size were significant predictors, somewhat contradicting the earlier findings. Interestingly, Kuncie's (2021) finding that alcohol consumption positively related with suicide rates contrasts with Durkheim's (1897) social theory of suicide, which suggested that alcohol represents psychopathy rather than social disintegration.

In Brazil, Faria et al. (2006) investigated the socioeconomic, agricultural, and cultural determinants of suicide and found that agricultural factors were not related to suicide rates. A higher level of schooling had a protective effect against suicide for both genders,

emphasising the importance of education as a mitigating factor for mental health issues. Faria et al. (2006) also found that divorce rates significantly increased suicide risk for both males and females, which aligns with Durkheim's (1897) social theory of suicide, where higher divorce rates are indicators of social fragmentation and are linked to higher suicide rates. Additionally, single-resident households were negatively associated with male and female suicide rates, whereas traditional Protestantism was positively associated with male suicide rates.

Machado et al. (2015) also explored suicide in Brazil, focusing on income inequality. They argued that income inequality leads to social fragmentation, which is a risk factor for suicidal behaviour. Income inequality can create economic deprivation, reinforcing feelings of despair and helplessness, especially when individuals see others in much better financial situations. Thus, income inequality fosters a sense of unfairness, leading to resentment and, in some cases, personal bankruptcy, which can increase suicide rates. Jaen-Varas et al. (2019) took this further by focusing specifically on adolescent suicide, highlighting income inequality as a significant risk factor for adolescent suicide rates. Both studies by Jaen-Varas et al. (2019) and Machado et al. (2015) found that GDP per capita was negatively associated with suicide rates, suggesting that economic advancement might reduce poverty and exposure to suicidogenic factors. Interestingly, Jaen-Varas et al. (2019) found that female adolescent suicide rates were more influenced by economic factors than male adolescent suicide rates, which is a notable deviation from most previous studies.

Regarding public policy, Minoiu and Andrés (2008) and Ross et al. (2012) examined the influence of government spending on health and welfare on suicide rates in the US. The

difference was that Minoiu and Andrés (2008) used spending shares as variables, whereas Ross et al. (2012) used per capita expenditure. Both studies concluded that higher public health expenditure was significantly associated with lower suicide rates. However, public welfare expenditure was negatively associated with suicide rates only in Minoiu and Andrés (2008), and found to be insignificant in Ross et al. (2012).

Additionally, Jalles and Andresen (2015), using Canadian provincial data, found that socioeconomic factors such as unemployment and the Gini index were not universally significant across all suicide metrics. Their use of multiple econometric techniques demonstrated how methodological choices can influence results, especially when examining regional variations. Their study, along with others in this region, shows that while economic factors like unemployment or income inequality often play a critical role, their effects can differ significantly based on context, population, and methodology. Lau et al. (2016), also focusing on Canada, found that unemployment rate, GDP per capita, and fertility rate were key variables affecting the suicide rate in the long run.

2.3.2 Empirical Findings from Past Studies in Asia Region

Research in Asia on the relationship between socioeconomic factors and suicide offers diverse insights across various countries, highlighting both similarities and unique challenges faced in different cultural and economic contexts. Knipe et al. (2015) conducted a systematic review of suicide in South and Southeast Asian countries. Out of 31 studies included in the analysis, 70.97% were from China and India, while only 19.35% were from Southeast Asian countries. The review found that lower asset levels were generally

associated with higher suicide risk, although the strength of this association varied. Education was the most frequently reported socioeconomic indicator, with 20 studies analysing it, and results consistently showed that lower levels of education were associated with an increased risk of suicide. 12 studies investigated unemployment and various occupation types, but the association between unemployment and suicide was inconsistent. Additionally, measures of financial difficulty, including subjective financial distress and persistent financial problems, were strongly associated with suicide in several studies.

Aihara and Iki (2002) examined suicide rates in five cities in Osaka Prefecture, Japan, dividing their analysis into three models based on age groups: young people (15 – 39 years), middle-aged people (40 – 64 years), and the elderly (65 years and above). For young people, male and female suicide rates were positively associated with the public assistance rate for both periods studied, while job application and divorce rates were significant only in some areas for the period 1980 – 1999. In the middle-aged category, male suicide rates were positively associated with the public assistance rate, job application rate, and divorce rate, while female suicide rates showed positive associations with public assistance and household size, and negative associations with marriage, divorce, and job application rates for the period 1980 – 1997. Among the elderly, the number of persons per household was positively associated with both male and female suicide rates in some areas.

Watanabe et al. (2006), using pooled data from Japan's 47 prefectures, found that the unemployment rate was a risk factor for suicide. This result aligns with studies that focused on Japanese country- or municipal-level data (Andrés et al., 2011; Koo & Cox, 2008; Kuroki, 2010). Specifically, Kuroki (2010) and Watanabe et al. (2006) showed that the positive effect

of unemployment was more significant for male suicide rates. Unemployment, as a proxy for worsening economic conditions, creates a more stressful atmosphere, leading to higher suicide rates. Koo and Cox (2008) also found that the divorce rate was positively associated with suicide rates, with Andrés et al. (2011) and Watanabe et al. (2006) reporting this effect as more pronounced among men. Fertility rate, however, was found to be a protective factor against suicide (Andrés et al., 2011; Koo & Cox, 2008), indicating that both divorce and fertility rates may impact social integration, thus influencing the likelihood of suicide.

Extending this analysis to Taiwan, Chuang and Huang (1997, 2007) and Lin (2006) explored the influence of income per capita on suicide across 23 Taiwanese cities. Their findings supported the economic theory of suicide proposed by Hamermesh and Soss (1974), which suggests that higher incomes, by promoting consumption and satisfaction, reduce the likelihood of suicide. Unemployment rate was also found to be a risk factor for suicide in Taiwan (Lin, 2006; Tsai, 2010). Interestingly, Lin (2006) found that higher education levels were associated with an increased risk of suicide in Taiwan, a pattern contrasting with Faria et al.'s (2006) findings in Brazil. This discrepancy may suggest that in Taiwan, where societal pressure for academic and professional success is intense, highly educated individuals experience greater stress, increasing suicide risk. Furthermore, Chuang and Huang (2007) found that male suicide in Taiwan was more influenced by economic factors than female suicide, in contrast to Jaen-Varas et al. (2019) in Brazil.

Most studies support Hamermesh and Soss's (1974) theory that income is inversely associated with suicide. However, studies from India, such as Mitra and Shroff (2006) and Rajkumar et al. (2015), found that economic development was positively associated with

suicide rates, suggesting that rapid economic growth, often accompanied by increased income inequality and social disconnection, may exacerbate feelings of isolation and emotional deprivation, in line with Durkheim's (1897) theory of egoistic suicide. These findings highlight the complex relationship between economic advancement and social fragmentation, which can have unintended consequences for mental health.

Other studies in Asia found a negative association between economic advancement and suicide rates, such as Cai et al. (2022) in China, Emamgholipour et al. (2021) in Iran, and Lin (2006) in seven Asia-Pacific countries. Interestingly, Chansarn (2017) found a U-shaped relationship between GPP per capita and suicide rates across Thailand's 76 provinces, indicating that higher income initially reduces suicide but eventually increases it once a certain income level is reached. Furthermore, the unemployment rate was negatively associated with suicide rates in Thailand, a result contrasting with findings from Emamgholipour et al. (2021) and Lin (2006). Chansarn (2017) explained that this could be due to underemployment, where individuals earn low wages, experience stress and dissatisfaction, and may contemplate suicide. Higher unemployment rates, however, may reflect people seeking new and better positions, thus increasing contentment and reducing suicide likelihood.

Cai et al. (2022) found that employment positively affected suicide rates in China in 1990, likely due to high stress levels among workers. However, recent data indicate that employment has become negatively related with suicide, suggesting that having a job now offers economic security and protects against suicide. Other socioeconomic factors, such as health expenditure and literacy rate, showed negative associations with suicide rates

(Emamgholipour et al., 2021; Lin, 2006), while divorce rate was positively associated with suicide rates in Emamgholipour et al. (2021).

2.3.3 Empirical Findings from Past Studies in Europe Region

Studies on suicide and its socioeconomic determinants in Europe cover a broad range of countries, providing comparative insights into how different economies and welfare systems influence suicide risk. Andrés (2005), using data from 15 European countries, found that suicide rates were negatively associated with economic growth and fertility rates but positively associated with alcohol consumption. However, suicide rates were not significantly associated with the Gini index, GDP per capita, female labour force participation rate, or unemployment rate. In contrast, studies by Andrés and Mostafa (2023) and Kõlves et al. (2013) in Eastern Europe found that suicide rates were positively associated with the Gini index and negatively associated with GDP per capita. These findings align with other regional studies indicating that economic instability increases socioeconomic stressors, contributing to suicide.

Moreover, Näher et al. (2020) found a strong link between lower income, higher unemployment, and suicide rates in Germany. Kõlves et al. (2013) reported that unemployment was positively associated with suicide rates, whereas Andrés and Mostafa (2023) found a negative association. Both Andrés (2005) and Andres and Mostafa (2023) found that higher divorce rates significantly increased suicide rates, supporting Durkheim's (1897) theory that social integration affects suicide. Kõlves et al. (2013) found that the presence of children strengthened family ties, reducing suicide risk. Interestingly, unlike

prior studies, Andrés and Mostafa (2023) and Kôlves et al. (2013) found that alcohol consumption appeared to decrease suicide rates, potentially due to the underreporting of alcohol consumption statistics.

2.3.4 Empirical Findings from Past Studies in Mixed-Region

Studies examining suicide rates across multiple regions provide broader insights into how global socioeconomic trends influence suicide risk. Most studies indicate that higher GDP and income reduce suicide rates (Gültekin & Emsen, 2023; Şenol & Akbulut, 2023; Ying & Chang, 2009). However, Erdem and Dinç (2022) found that GDP per capita was positively associated with suicide rates, similar to findings by Mitra and Shroff (2006) and Rajkumar et al. (2015). Consistent with Chansarn (2017), Neumayer (2003) found a U-shaped relationship between GDP per capita and suicide rates in 68 countries. Additionally, unemployment was generally positively associated with suicide rates (Dmitriev, 2023; Erdem & Dinç, 2022; Lari & Sefiddashti, 2023; Milner et al., 2012; Neumayer, 2003; Şenol & Akbulut, 2023; Ying & Chang, 2009), as joblessness increases financial hardship and social isolation, leading to psychological distress. However, the insignificant result between unemployment and suicide rate was found in the study of Gültekin and Emsen (2023).

Brainerd (2001), who focused on 22 transition economies, found that both divorce rates and alcohol consumption per capita were positively associated with suicide rates, a finding also supported by Erdem and Dinç (2022) and Neumayer (2003). Brainerd's (2001) study revealed that male suicide rates were more influenced by economic variables, similar to Chuang and Huang's (2007) study in Taiwan. Neumayer (2003) found that female suicide

rates were more influenced by social variables, contrasting with Jaen-Varas et al. (2019), who found that female suicide in Brazil was more affected by economic factors. Also, Neumayer (2003) concluded that higher birth rate and marriage rate, as well as lower divorce, which will increase the family ties and support, decreased the suicide rate. This supported the Durkheim's (1897) theory that stronger family ties increased the social integration and then reduced the occurrence of suicide.

Regarding female labour force participation rate, past studies have shown mixed results. Milner et al. (2012) and Neumayer (2003) found that female labour force participation rate was significantly positively associated with both male and female suicide rates. For men, increased female participation in the labour market was perceived as a challenge to their status at work and led to a loss of social support, which in turn increased male suicide rates. For women, the stress and burden of work were seen to outweigh the benefits of social ties in the workplace, leading some to suicide. Furthermore, Ying and Chang (2009) found that female labour force participation rate was positively associated with male suicide but negatively associated with female suicide. They explained that male counterparts experienced greater peer pressure as a result of increased female labour force participation. In contrast, female employment might boost women's self-confidence, thereby reducing their risk of suicide. Surprisingly, Erdem and Dinç (2022) reported findings that differed from those of Ying and Chang (2009), showing that higher female labour force participation rate reduced male suicide rates but increased female suicide rates. They suggested that women's workforce participation might increase family stress, reduce social cohesion, lower the quality of family life, and strain parent-child relationships, ultimately contributing to higher suicide rates among women. Meanwhile, Lari and Sefiddashti (2023)

analysed suicide rates in 17 Eastern Mediterranean countries and found that female labour force participation was insignificant in relation to suicide rates.

The variable of health expenditure has been shown in past studies to significantly affect suicide rates. Milner et al. (2012) examined the socioeconomic determinants of suicide in 35 countries, finding that higher health expenditure led to more resources being allocated to healthcare, resulting in more treatment for depression and subsequently reducing the likelihood of suicide. This protective effect was supported by studies in other regions (Lin, 2006; Minoiu & Andrés, 2008; Ross et al., 2012). Additionally, the study by Miladinov (2023) found a negative relationship between health expenditure and suicide rates in LMICs. However, this relationship turned positive in HICs, a finding that was consistent with Rajkumar et al. (2015) in India and Shah et al. (2008) in 87 countries. Gültekin and Emsen (2023) and Lari and Sefiddashti (2023) used the prevalence of cancer cases and mental disorders, respectively, instead of health expenditure as proxies for health variables, and both studies found these variables to be positively associated with suicide rates. Furthermore, past studies appear to support the theory of Hamermesh and Soss (1974) that suicide rates increase with age (Dmitriev, 2023; Milner et al., 2012; Shah et al., 2008).

2.4 Research Gaps

Based on the empirical reviews in Section 2.3, several research gaps remain regarding suicide in ASEAN countries. First, there is a lack of empirical studies exploring the socioeconomic aspects of suicide specifically in ASEAN countries. While studies such as Knipe et al. (2015) examine the association between socioeconomic factors and suicide in

South and Southeast Asia, they remain limited in scope. Of the 31 studies included in Knipe et al. (2015), 70.97% focused on China and India, while only 19.35% focused on Southeast Asian countries. Moreover, Knipe et al. (2015) lacks comprehensive, region-specific investigations that consider the full range of socioeconomic variables relevant to ASEAN. The diverse cultural, economic, and social contexts of ASEAN countries highlight the need for focused research to inform region-specific suicide prevention policies.

Additionally, most previous studies have investigated only linear relationships between socioeconomic factors and suicide rates. However, it is important to examine potential non-linear associations, given conflicting theoretical perspectives on the impact of income on suicide. Therefore, this study includes a quadratic term for GDP per capita, a common proxy for socioeconomic status (Bhandarkar & Shah, 2008; Shah et al., 2008), to observe the non-linear relationship between socioeconomic factors and suicide in ASEAN countries.

Furthermore, this study is the first to employ panel ARDL estimation to analyse both linear and non-linear relationships between socioeconomic variables and suicide rates in ASEAN. Panel ARDL does not require large samples to ensure the robustness of estimators and the effectiveness of statistical tests (Andrés et al., 2011). Also, it can handle variables that are non-stationary, allowing for the inclusion of integrated series. This is particularly relevant when dealing with economic time series, which often exhibit non-stationarity.

Lastly, this study addresses gaps in the measurement of suicide rates. Previous studies often use crude suicide rates, which do not account for differences in population structures.

This study uses age-standardised suicide rates, providing a more accurate basis for cross-country comparisons, particularly for countries with varying age distributions. The focus on age-standardisation is justified because age is a key determinant of suicide risk, with older populations generally exhibiting higher suicide rates. Hence, age-standardisation controls for demographic variations, reducing the need to include control variables such as the proportion of elderly people in the regression models. This approach enhances analytical accuracy and fills a significant gap in the literature, where crude suicide rates have been commonly used.

2.5 Concluding Remarks

To summarise, there are two main theories of suicide: Durkheim's (1897) social theory of suicide and Hamermesh and Soss's (1974) economic theory of suicide. The social theory posits that social integration and regulation influence societal suicide rates, while the economic theory suggests that suicide rates increase when income decreases. The findings from past studies vary, showing different relationships between socioeconomic factors and suicide across regions.

Table 2.2: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Americas Region

Author(s)	Data	Methodology	Finding(s)
Kunce & Anderson (2002)	• U.S. • 1985 – 1995 • Panel data (state-level)	• LSDV estimator	• The percentage of housing units occupied by one person in a state and the percentage of the population aged 15 – 24 years were positively significant with suicide rate.
Faria et al. (2006)	• Rio Grande do Sul, Brazil • 1994 – 1998 • Time series data (state-level)	• Multivariate regression	• Agricultural factors were not related with suicide rate. • Schooling level was significantly negative to both male and female suicide rate. • Both male and female suicide rate were significantly positive related to divorce rate, while significantly negative related to single resident household. • Traditional protestants was positively significant with male suicide rate.
Minoiu & Andrés (2008)	• U.S. • 1982 -1997 • Panel data (state-level)	• System GMM	• The share of public health and welfare spending in total state budget were negatively related with both total and male suicide rates. • Divorce rate was positively related to all suicide rates. • Income per capita was negatively related with male suicide rate.
Ross et al. (2012)	• U.S. • 1997 – 2005 • Panel data (state-level)	• System GMM	• Public health expenditure per capita was negatively significant to male suicide rate. • Personal income per capita and public mental health expenditure per capita were insignificant to male and female suicide rates.

Table 2.2: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Americas Region (continued)

Author(s)	Data	Methodology	Finding(s)
Jalles & Andresen (2015)	• 10 provinces in Canadian • 2000 -2008 • Panel data (province-level)	• PVAR estimator • Fixed-effect estimator • Difference Generalised Method of Moments	• GDP growth and alcohol consumption sales per capita were negatively significant with both total and male suicide rates. • Share of low-income people was positively significant with both total and male suicide rates. • Immigration rate was positively significant with female suicide rate.
Machado et al. (2015)	• 5507 municipalities in Brazil • 2000 – 2011 • Panel data (municipality-level)	• Fixed-effect negative binomial regression	• Income inequality was significantly positive linked to suicide rate. • Income per capita was related to suicide rate negatively.
Lau et al. (2016)	• Canada • 1970 – 2008 • Time series data (country-level)	• Johansen cointegration test • VECM based Granger causality test • Pairwise Granger causality test • Variance decomposition test	• The models with female labour force participation rate as independent variable showed that there were at least one cointegrating vector, and the finding of VECM based Granger causality test showed that fertility rate Granger cause female suicide rate. • The models with alcohol consumption rate as independent variable showed that there were no cointegrating vector, and the result of pairwise Granger causality test showed that alcohol consumption rate Granger cause female suicide rate.

Table 2.2: Literature Reviews’ Summary Based on Empirical Findings from Past Studies in Americas Region (continued)

Author(s)	Data	Methodology	Finding(s)
Jaen-Varas et al. (2019)	• 6 cities in Brazil • 2006 – 2015 • Panel data (city-level)	• Generalised estimating equation model	• Income inequality was positively significant with total adolescent suicide rate. • Adolescent suicide rate of female aged 10 – 19 years was positively associated with income inequality and unemployment rate, while negatively related with GDP per capita. • Income inequality had significant relationship with both total and female adolescent suicide rate in aged 15 – 19 years.
Kunce (2021)	• U.S. • 1990 – 2019 • Panel data (state-level)	• Fixed-effects estimator • Hausman-Taylor estimator	• Distilled spirits consumption and household size were significant with suicide rate.

Table 2.3: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Asia Region

Author(s)	Data	Methodology	Finding(s)
Chuang & Huang (1997)	• 23 cities in Taiwan • 1983 – 1993 • Panel data (city-level)	• Multiple regression (OLS and GLS)	• Income per capita was significantly negative link with total, male and female suicide rate.
Aihara & Iki (2002)	• 5 cities of Osaka Prefecture, Japan • 1980 – 1997 and 1980 – 1999 • Time series data (city-level)	• Time-series regression	• For young person category and middle-aged person category, public assistance rate was positively significant with both male and female suicide rate for both periods 1980 – 1997 and 1980 – 1999 in some areas. • For elderly person category, the number of persons per household was positively significant with both male and female suicide rate for the periods 1980 – 1997 in some areas.
Lin (2006)	• 23 cities in Taiwan, 1979 – 2002 • 7 Asia-Pacific countries, 1976 – 2000 • Panel data (city-level and country-level)	• Fixed-effect estimation	• For 23 cities in Taiwan, suicide death rate was positively significant with unemployment rate, percentage of male population, percentage of elderly population and percentage of population college graduate, while negatively significant with percentage of population senior high graduate and personal income per capita. • For 7 Asia-Pacific countries, suicide death rate was positively significant with unemployment rate, while negatively significant with public health expenditure.

Table 2.3: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Asia Region (continued)

Author(s)	Data	Methodology	Finding(s)
Mitra & Shroff (2006)	• 22 major states in India • 1975 – 2001 • Panel data (state-level)	• Fixed-effect estimation • Random-effect estimation	• Income per capita was positively significant to total, male and female suicide rate. • Sex ratio was positively significant to total suicide rate.
Watanabe et al. (2006)	• Japan • 1997 – 2004 • 1993 – 2004 (by prefecture) • 1970 – 2002 (by middle-aged group) • Times series data (country-level) • Panel data (prefecture-level)	• Multivariate regression • Pooled regression (by prefecture and middle-aged group)	• Unemployment rate was positively correlated with male suicide rate in all regressions. • Divorce rate was positively correlated with male suicide rate in pooled regression by middle-aged group. • Personal bankruptcy was positively correlated with male and female suicide rate in both multivariate regression and pooled regression by prefecture.
Chuang & Huang (2007)	• 23 cities in Taiwan • 1983 – 2001 • Panel data (city-level)	• Multiple regression (OLS and GLS)	• Total, male and female suicide rate were negatively significant with income per capita, while positively significant with divorce. • Female labour force participation rate was insignificant with total, male and female suicide rate.
Koo & Cox (2008)	• Japan • 1950 – 2003 • Time series data (country-level)	• OLS estimation with de-trended methods (random walk, Hodrick-Prescott, Band-Pass)	• Unemployment rate and female labour force participation rate had positive association with both male and female suicide rates. • Fertility rate had negative linkage with both male and female suicide rates. • Divorce rate was positive related with male suicide rate.

Table 2.3: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Asia Region (continued)

Author(s)	Data	Methodology	Finding(s)
Kuroki (2010)	• Japan • 1983 – 2007 • Panel data (municipal-level)	• Fixed-effect estimator	• Unemployment rate was positively significant with male suicide rate, while negatively significant with female suicide rate.
Tsai (2010)	• 19 cities in Taiwan • 1998 – 2006 • Panel data (county-level)	• Stepwise multiple regression	• The variables of no spouse and aged were positively significant with total, male and female suicide rates. • The variable of temperature was negatively significant with total, male and female suicide rate.
Andrés et al. (2011)	• Japan • 1957 – 2009 • Time series data (country-level)	• ARDL cointegration procedure	• Real income per capita was significantly negative related to total, male and female suicide rates. • Unemployment rate had positively relationship with total, male and female suicide rates. • Divorce rate was significantly positive link to male suicide rate. • Fertility rate was negatively significant to total suicide rate.
Knipe et al. (2016)	• Bangladesh, China, India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam • Systematic review • 31 studies include in this study	• Search strategy • Inclusion criteria • Quality Assessment (Newcastle-Ottawa Scale)	• Lower asset levels were associated with higher suicide risk. • Lower levels of education increased risk of suicide. • The association between unemployment and suicide was inconsistent. • Financial difficulty was strongly associated with suicide in several studies.

Table 2.3: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Asia Region (continued)

Author(s)	Data	Methodology	Finding(s)
Rajkumar et al. (2015)	• India • 1980 – 2005 (time series data) • 2005 (cross-sectional data) • National- and state-level	• Spearman's rank-order correlation • IRLS regression	• National suicide rate was positively significant to population, CPI, GDP per capita, foreign exchange, crop production index, total health expenditure and number of doctors. • National suicide was significantly linked to trade balance and gross savings. • State-wise suicide rate was positively connected to literacy rate.
Chansarn (2017)	• 76 provinces in Thailand • 2006 – 2013 • Panel data (province-level)	• FGLS regression • Newey-West regression	• GPP per capita was significantly U-shaped related with all suicide rates. • Unemployment rate was negatively significant with all suicide rates.
Emam-gholipour et al. (2021)	• 30 provinces in Iran • 2001 – 2016 • Panel data (province-level)	• GLS estimation	• Both male and female suicide rate were positively significant to unemployment rate and divorce rate, while negatively significant to household income per capita and literacy rate. • Urbanisation was significantly negative related to male suicide rate, while positive linked to female suicide rate. • Industrialisation index was negatively significant to male suicide rate, while insignificant to female suicide rate.

Table 2.3: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Asia Region (continued)

Author(s)	Data	Methodology	Finding(s)
Cai et al. (2022)	• 31 provinces in China • 1990 – 2015 • Panel data (province-level)	• SAR model	• GDP per capita was negatively significant to male suicide rate. • Urbanisation was negatively significant to female suicide rate. • Proportion of children was negatively significant to all suicide rates. • Employment was positively significant to suicide rate in 1990 and became negatively significant in recent year.

Table 2.4: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Europe Region

Author(s)	Data	Methodology	Finding(s)
Andrés (2005)	• 15 European countries • 1970 – 1998 • Panel data (country-level)	• Fixed-effects estimator	• Without country-specific trends, both male and female suicide rate were positively significant with GDP per capita, unemployment rate and female labour participation rate, while negatively significant with economic growth and fertility rate. • With country-specific trends, both male and female suicide rate were positively significant to alcohol consumption rate, while negatively significant to economic growth and fertility rate.
Kölves et al. (2013)	• 13 Eastern European countries • 1990 – 2008 • Panel data (country-level)	• Fixed-effect estimator	• Unemployment rate was significantly positive associated with both male and female suicide rates. • GDP per capita had negative linkage with both male and female suicide rates. • General practitioner and birth rate were negatively significant with male suicide rate. • Female suicide rate was related to Gini index positively, while related to alcohol consumption per capita negatively.

Table 2.4: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Europe Region (continued)

Author(s)	Data	Methodology	Finding(s)
Näher et al. (2020)	• 390 districts in Germany • 1997 – 2010 • Panel data (district-level)	• SEM estimation	• Suicide rate was positively related to CASMIN score and unemployment rate, while negatively related to income. • Suicide rate was positively associated to person living in one-person-household, while negatively associated to persons moving throughout last year. • Suicide rate increased when CASMIN score among the person moving throughout last year and income among single individuals decreased, while decreased when income among those living in one-person households decreased.
Andres & Mostafa (2023)	• 21 Eastern European countries • 1991 – 2014 • Panel data (country-level)	• Fixed-effect estimator	• All suicide rates were negatively significant to real GDP per capita, total alcohol consumption and unemployment rate, while positively significant to crude suicide rate. • Total and male suicide rate were significantly positive related to Gini index, while significantly negative linked to fertility rate and female labour force participation rate. • Female suicide rate was insignificant to female labour force participation rate, Gini index, and fertility rate.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region

Author(s)	Data	Methodology	Finding(s)
Brainerd (2001)	• 22 transition economies countries • 1988 – 1998 • Panel data (country-level)	• Fixed-effect estimation	• Divorce rate was positively significant with both male and female suicide rate. • Gross National Product per capita and employment ratio were negatively significant with male suicide rate. • Female suicide rate was negatively significant to male life expectancy at age 65, while insignificant to female life expectancy at age 65. • Alcohol consumption per capita had significantly positive nexus to female suicide rate.
Neumayer (2003)	• 68 countries • 1980 – 1999 • Panel data (country-level)	• Fixed-effect estimation • Random-effect estimation	• Both male and female suicide rate were positively significant to female labour force participation rate and divorce rate, while negatively significant to birth rate. • GDP per capita was U-shaped related with male suicide rate. • Male suicide rate had significantly positive link to unemployment rate and alcohol consumption, while significantly negative link to marriage rate.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region (continued)

Author(s)	Data	Methodology	Finding(s)
Shah et al. (2008)	• 87 countries • Year 2002 • Cross sectional data (country-level)	• Spearman's rank correlation coefficient	• The elderly population size, proportion of elderly in population and health expenditure per capita had significantly positive correlation with suicide rate. • Gini coefficient and child mortality rate had negative significant correlation to suicide rate. • Proportion of GDP spent on health and life expectancy significantly positive correlation to male and female suicide rate, respectively.
Ying & Chang (2009)	• 7 industrialised countries • 1982 – 2002 • Panel data (country-level)	• FMOLS	• Unemployment rate was significantly positive link to male suicide rate. • GDP was significantly negative linked to male and female suicide rates. • Female labour force participation rate was positively and negatively linked to male and female suicide rate, respectively.
Milner et al. (2012)	• 35 countries • 1980 – 2006 • Panel data (country-level)	• LSDV (fixed-effect)	• Unemployment rate, female in labour force and the proportion of elderly over 65 years old in population were positively significant to male and female suicide rates. • Health expenditure per capita was negatively significant with both male and female suicide rates. • Fertility rate was significantly negative linked to male suicide rate.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region (continued)

Author(s)	Data	Methodology	Finding(s)
Erdem & Dinç (2022)	• 47 countries • 1996 – 2015 • Panel data (country-level)	• Panel ARDL estimation	• Household debt had significantly positive link to age-adjusted suicide rate, while negative to male and female suicide rate. • Crude suicide rate showed significantly positive nexus to age-adjusted, male and female suicide rate. • Alcohol consumption per capita and fertility rate were positive and negative associated to all suicide rates, respectively. • GDP per capita positively significant to age-adjusted, male, and young suicide rate, while negatively significant to female suicide rate. • Unemployment rate was positively significant to age-adjusted and young suicide rate, while significantly negative related to male suicide rate. • Female labour force participation rate was negatively significant to age-adjusted, male and young suicide rate, while positively significant to female suicide rate.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region (continued)

Author(s)	Data	Methodology	Finding(s)
Dmitriev (2023)	• 173 countries • 2006 • Cross sectional data (country level)	• BMA approach	• Life expectancy at birth was negatively significant to all suicide rates. • Life expectancy at aged 65 was positively significant to age-standardised suicide rate. • Unemployment was positively significant to age-standardised total and male suicide rates, while negatively significant to total and male crude suicide rates. • Average annual temperature was negatively significant to all suicide rates. • Age dependence ratio was negatively significant to both crude and age-standardised total and male suicide rate. • Alcohol consumption was positively significant to total and male crude suicide rate, while insignificant to all age-standardised suicide rate. • Muslims and Christian were negatively significant to female crude suicide rate, while only Muslims was negatively significant to age-standardised male suicide rate. • Population employed in agriculture was negatively significant to age-standardised female suicide rate. • Population aged 65+ was positively significant to all suicide rates.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region (continued)

Author(s)	Data	Methodology	Finding(s)
Gültekin & Emsen (2023)	• 10 middle-income countries • 1990 – 2017 • Panel data (country-level)	• Panel ARDL estimation	• GDP per capita and mean school showed significantly negative link to suicide rate. • The share of cancer cases in the population was positively significant to suicide rate. • There was no association between unemployment rate and suicide rate.
Lari & Sefiddashti (2023)	• 17 Eastern Mediterranean • 1990 – 2019 • Panel data (country-level)	• Random-effect estimation	• Both age-standardised male and female suicide rates were positively significant to inflation rate, mental disorders prevalence and urbanisation, while negatively significant to individuals using internet. • Unemployment rate significantly positive linked to age-standardised male suicide rate, while insignificant to female rate. • Education index had a significantly negative association to age-standardised female suicide rate, while no relationship to male suicide rate. • Economic growth and female labour force participation rate were insignificant to both age-standardised male and female suicide rate.

Table 2.5: Literature Reviews' Summary Based on Empirical Findings from Past Studies in Mixed-Region (continued)

Author(s)	Data	Methodology	Finding(s)
Miladinov (2023)	• LMICs and HICs • 2000 – 2019 • Time series data (country-level)	• Auto-Search/Gets estimation • Max R-squared Increment method of Swapwise estimation	• Regarding Auto-Search/Gets estimation, female unemployment rate and health expenditure per capita were negatively significant to LMICs' suicide rate, while positively significant to HICs' suicide rate. • Male unemployment rate had significantly negative linkage to HICs' suicide rate. • Regarding Swapwise estimation, health expenditure per capita was significantly negative related to LMICs' suicide rate. • Female unemployment rate was positively significant to HICs' suicide rate.
Şenol & Akbulut (2023)	• 28 developed countries • 2003 – 2018 • Panel data (country-level)	• Random-effect estimation with Driscoll and Kraay standard errors	• Gini index, unemployment, and poverty level were positively significant to suicide rate. • Income per capita was negatively significant to suicide rate.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This study analyses the impact of socioeconomic factors on suicide rates in ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam) from 2000 to 2019. Panel unit root tests, correlation analysis, panel cointegration test, panel ARDL estimation, turning point estimation, and goodness-of-fit tests will be employed in this study.

3.2 Conceptual Framework

The conceptual framework for this study on the influence of socioeconomic factors on ASEAN's suicide rates is shown in Figure 3.1. The selection of socioeconomic variables is based on both the economic and social theories of suicide: Durkheim's (1897) theory and the extended theory of Hamermesh and Soss (1974) by Koo and Cox (2008). Past research studies have presented varied conclusions regarding the impacts of socioeconomic factors on suicide rates across different countries and regions. Therefore, in Chapter 4, this study aims to provide additional empirical evidence, detailing the results and elucidating the connections between each socioeconomic variable and suicide rates for ASEAN countries.

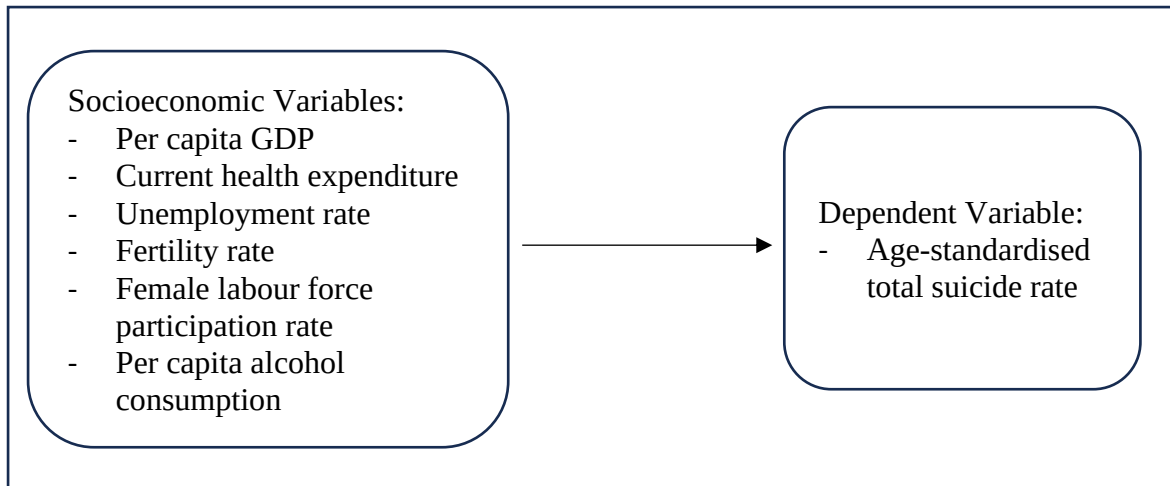


Figure 3.1: Conceptual Framework of the Study

3.3 Data Descriptions

The study employs ASEAN’s annually data for from the 2000 to 2019. All data are extracted from The World Bank and WHO. A description of the variables is presented in Table 3.1:

Table 3.1: Data Description of the Variables

Variables	Description	Source
Dependent Variable		
SR	Age-standardized total suicide rate (per 100,000 population)	WHO
Independent Variables		
GDP	GDP per capita (constant 2015 in thousand USD)	The World Bank
HE	Current health expenditure (% of GDP)	
UR	Unemployment rate (% of total labour force)	
FR	Fertility rate (bpw)	
FLB	Female labour force participation rate (%)	WHO
AC	Alcohol consumption per capita (ℓ)	

In this study, the dependent variable is the age-standardised total suicide rate, while the independent variables are per capita GDP, current health cost, unemployment rate,

fertility rate, female labour force participation rate, and per capita alcohol consumption. The age-standardised total suicide rate is calculated by dividing the number of suicides in a country in a year by the WHO standard population, and then multiplying by 100,000. Focusing on age standardisation is justified, as age is a primary factor influencing suicide risk based on the theory of Hamermesh and Soss (1974), with older populations generally showing higher suicide rates. By applying age-standardised rates, this study accounts for demographic differences across ASEAN countries, minimising the need to include control variables like the proportion of elderly individuals in regression models. Therefore, this study uses the age-standardised total suicide rate rather than crude rates, offering a more accurate basis for comparison among countries with varying age distributions.

GDP per capita is calculated as GDP divided by the midyear population. GDP represents the market value of all final goods and services, plus any product taxes, and excludes any subsidies that are not included in product values. Both economic and social theories of suicide present inconsistent findings regarding the association between economic development and suicide. Additionally, empirical studies have shown further inconsistencies, with some reporting a negative relationship (Andres & Mostafa, 2023; Emamgholipour et al., 2021; Şenol & Akbulut, 2023), a positive relationship (Erdem & Dinç, 2022; Mitra & Shroff, 2006; Rajkumar et al., 2015), and a non-linear relationship (Chansarn, 2017; Neumayer, 2003). Thus, it is crucial to include GDP per capita in the study to investigate its relationship with suicide in ASEAN countries.

Current health expenditure represents a country's investment in healthcare services, including preventive and mental health care. Higher health expenditure is often linked to

improved mental health support infrastructure, which may reduce suicide rates (Lin, 2006; Milner et al., 2012; Minoiu & Andrés, 2008; Ross et al., 2012). By including this variable, the study aims to explore whether increased healthcare spending in ASEAN countries relates to a reduction in suicides.

The unemployment rate refers to the percentage of the labour force that is unemployed but actively seeking work. According to Koo and Cox (2008), who extended the suicide theory of Hamermesh and Soss (1974), the unemployment rate can lead to financial hardship and a loss of purpose, both of which are significant risk factors for suicide. Most previous studies also support this outcome (Dmitriev, 2023; Kuroki, 2010; Lari & Sefiddashti, 2023; Näher et al., 2020; Watanabe et al., 2006; Ying & Chang, 2009). Including the unemployment rate allows the study to assess the extent to which economic insecurity influences suicide trends in ASEAN countries.

The fertility rate is the number of children a woman would have if she were to survive to the end of her reproductive years and bear children in line with age-specific fertility rates of a given year. According to Durkheim's (1897) theory, fertility rates increase family ties and social support, which contribute to greater social integration. Conversely, lower fertility rates may indicate weaker social ties, which can contribute to increased loneliness and isolation, factors associated with higher suicide risk. Previous studies have reported similar findings in line with this theory (Andrés, 2005; Andrés et al., 2011; Koo & Cox, 2005). Hence, this study includes fertility rate to examine whether changes in family structure and social support impact suicide rates in the ASEAN context.

Female labour force participation rate is the proportion of women in the population who are economically active and contribute to the creation of goods and services over a given period. This variable is included to capture the effect of economic participation on suicide risk. Higher female participation in the workforce may reduce suicide risk by promoting economic independence and social integration (Ying & Chang, 2009). However, conflicting findings suggest that increased workforce participation for women can also contribute to heightened stress levels among both men and women (Milner et al., 2012; Neumayer, 2003), making it essential to analyse this variable within ASEAN's socioeconomic environment.

Alcohol consumption per capita is the amount of alcohol consumed per person per year. According to Durkheim's (1897) theory, alcohol consumption has an insignificant link to suicide. However, more recent studies have found a significant positive association with suicide (Andrés, 2005; Brainerd, 2001; Erdem & Dinç, 2022; Kuncze, 2021; Neumayer, 2003). By including alcohol consumption per capita, this study seeks to understand how substance use may influence suicide rates in ASEAN countries, where drinking patterns and cultural attitudes towards alcohol vary widely.

In summary, the selection of these independent variables is grounded in both economic and social theories, as well as findings from previous studies. This approach allows the study to explore how these socioeconomic and behavioural factors contribute to suicide risk in the ASEAN context. It aims to provide comprehensive insights into the relationship between socioeconomic determinants and suicide, offering valuable implications for policymakers in ASEAN countries.

3.4 Empirical Model

This study investigates two models, both linear and non-linear, covering ASEAN countries over the period from 2000 to 2019. Both the linear and non-linear models are estimated using panel ARDL to examine the relationship between suicide rates and socioeconomic factors. The analysis begins with the linear model, specified as follows:

$$SR_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 HE_{it} + \beta_3 UR_{it} + \beta_4 FR_{it} + \beta_5 FLB_{it} + \beta_6 AC_{it} + \varepsilon_{it}$$

Equation 3.1

where SR_{it} is the age-standardised total suicide rate in country i and years t ($i = 1, 2, 3, \dots, N; t = 1, 2, 3, \dots, T$), GDP_{it} represents GDP per capita in country i and year t , HE_{it} is current health expenditure in country i and year t , UR_{it} is the unemployment rate in country i and year t , FR_{it} is the fertility rate in country i and year t , FLB_{it} is the female labour force participation rate in country i and year t , and AC_{it} is alcohol consumption per capita in country i and year t . Next, this study continues with the non-linear model by adding a quadratic term for GDP per capita as an explanatory variable. The non-linear model is specified as follows:

$$SR_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 HE_{it} + \beta_4 UR_{it} + \beta_5 FR_{it} + \beta_6 FLB_{it} + \beta_7 AC_{it} + \varepsilon_{it}$$

Equation 3.2

GDP per capita is anticipated to have a U-shaped relationship with suicide rates, implying that GDP per capita is initially negatively associated with suicide rates but becomes positively associated once it reaches a certain turning point.

3.5 Empirical Testing Procedures

3.5.1 Panel Unit Root Tests

This study employs the LLC and IPS unit root tests to determine the stationarity of the variables. The LLC test, proposed by Levin et al. (2002), assumes homogeneity in the AR coefficients across all panel members. Specifically, it assumes that each individual panel member shares a common AR(1) coefficient but allows for individual effects, time effects, and a possible time trend. The model permits heterogeneity only in the intercept and is represented as follows:

$$\Delta Y_{it} = \alpha_i + \gamma Y_{it-1} + \sum_{j=1}^{P_i} \beta_j \Delta Y_{it-j} + \varepsilon_{it} \quad \text{Equation 3.3}$$

where ΔY_{it} is the differenced series for country i over time t ($i = 1, 2, 3, \dots, N; t = 1, 2, 3, \dots, T$), P_i is the lags' number in the ADF regression, and ε_{it} is the error term, assumed to be independent and normally distributed with zero mean and finite heterogeneous variance. The hypotheses of the LLC unit root test are as follows:

$$H_0: \gamma = 0$$

$$H_1: \gamma < 0$$

where the null hypothesis means that each series in the panel has a unit root, while the alternative hypothesis means that all individual series in the panel are stationary. The null hypothesis is rejected when the p -value is smaller than the significance level (1%, 5%, or 10%).

The IPS test, proposed by Im et al. (2003), is less restrictive than the LLC test, allowing for heterogeneous coefficients. It also permits individual effects, time trends, and common

time effects. Therefore, the IPS test is considered to have greater power than other unit root tests. The IPS model is specified as:

$$\Delta Y_{it} = \alpha_i + \gamma_i Y_{it-1} + \sum_{j=1}^{P_i} \beta_{ij} \Delta Y_{it-j} + \varepsilon_{it} \quad \text{Equation 3.4}$$

The hypotheses for the IPS unit root test are:

$$H_0: \gamma_i = 0$$

$$H_1: \gamma_i < 0 \text{ for all } i$$

where the null hypothesis means that the panel is not stationary, while the alternative hypothesis means that at least one of the individual series in the panel is stationary. The null hypothesis is rejected when the p -value is smaller than 1%, 5% or 10% of significance level.

3.5.2 Correlation Analysis

The correlation between two variables can be quantified using a correlation coefficient, which ranges from -1 to 1. A value of 0 indicates no correlation, meaning the variables are independent. A coefficient close to -1 or 1 suggests a strong linear relationship, indicating high correlation and the presence of multicollinearity. This reduces the reliability of the coefficients and weakens the validity of p -values in identifying significant independent variables. Thus, this study employs the Pearson correlation coefficient (Pearson, 1895) to check for multicollinearity, calculated as follows:

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}} \quad \text{Equation 3.5}$$

where n is the observations' number, x_i and y_i are i th individual sample points, and $\bar{x}$ and $\bar{y}$ are the mean of input feature and target output, respectively. Multicollinearity is indicated if the correlation coefficient is close to 0.8 (Shrestha, 2020).

3.5.3 Panel Cointegration Test

The panel cointegration test adopted in this study is the Pedroni cointegration test, developed by Pedroni (1999), to examine the long-run equilibrium relationship between variables. The Pedroni test provides seven different statistics, grouped into within-dimension (panel v -statistic, panel ρ -statistic, panel PP -statistic, panel ADF -statistic) and between-dimension (group ρ -statistic, group PP -statistic, group ADF -statistic) categories. These 7 statistics can be constructed as follows:

Panel v -statistic:

$$Z_v = \left(\sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-1} \quad \text{Equation 3.6}$$

Panel ρ -statistic:

$$Z_\rho = \left(\sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-1} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i) \quad \text{Equation 3.7}$$

Panel PP -statistic:

$$Z_t = \left(\hat{\sigma}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-\frac{1}{2}} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i) \quad \text{Equation 3.8}$$

Panel ADF -statistic:

$$Z_t^* = \left(\hat{s}^{*2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^{*2} \right)^{-\frac{1}{2}} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^* \Delta \hat{\varepsilon}_{it}^* \quad \text{Equation 3.9}$$

Group ρ -statistic:

$$\tilde{Z}_\rho = \sum_{i=1}^N \left(\sum_{t=1}^T \hat{\varepsilon}_{it-1}^2 \right)^{-1} \sum_{t=1}^T (\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i) \quad \text{Equation 3.10}$$

Group PP -statistic:

$$\tilde{Z}_t = \sum_{i=1}^N \left(\hat{\sigma}^2 \sum_{t=1}^T \hat{\varepsilon}_{it-1}^2 \right)^{-\frac{1}{2}} \sum_{t=1}^T (\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i) \quad \text{Equation 3.11}$$

Group ADF -statistic:

$$\tilde{Z}_t^* = \sum_{i=1}^N \left(\sum_{t=1}^T \hat{s}_i^{*2} \hat{\varepsilon}_{it-1}^{*2} \right)^{-\frac{1}{2}} \sum_{t=1}^T \hat{\varepsilon}_{it-1}^* \Delta \hat{\varepsilon}_{it}^* \quad \text{Equation 3.12}$$

where ε_{it} is the estimated residual from Equation 3.1, and $\hat{L}_{11i}^{-2}$ is the estimated long-run covariance matrix for $\Delta\hat{\varepsilon}_{it}$. Besides, $\hat{\sigma}^2$, $\hat{s}^{*2}$ and $\hat{s}_i^{*2}$ are individual contemporaneous and long-run variances for individual i .

3.5.4 Panel ARDL Estimation

The panel ARDL estimation developed by Pesaran and Shin (1999) and Pesaran et al. (2001) is used in this study to estimate the long-run cointegration relationships and to extract the ECM for short-term dynamics. According to Pesaran et al. (2001), panel ARDL provides consistent estimates of long-run coefficients that are asymptotically normal, regardless of whether the variables are I(0), I(1), or mixed. The general long-run model is:

$$Y_{it} = \mu_i + \beta_i' X_{it} + \varepsilon_{it} \quad \text{Equation 3.13}$$

where Y_{it} is the dependent variable for country i over time t ($i = 1, 2, 3, \dots, N; t = 1, 2, 3, \dots, T$), μ_i is the country-specific intercept, β_i is the vector of coefficients, X_{it} is the vector of independent variables, and ε_{it} is the error term. The ARDL for bound test is shown as follows:

$$Y_{it} = \mu_i + \sum_{i=1}^k \delta_{ij} Y_{j,t-i} + \sum_{i=0}^q \beta_{it}' X_{j,t-i} + \varepsilon_{it} \quad \text{Equation 3.14}$$

The Equation 3.13 is then reparametrized as follows:

$$\begin{aligned} \Delta SR_{it} = & \beta_1 + \sum_{i=1}^k \delta_{ij} \Delta SR_{j,t-i} + \sum_{i=0}^k \alpha_{ij} \Delta GDP_{j,t-i} + \sum_{i=0}^k \partial_{ij} \Delta GDP_{j,t-i}^2 \\ & + \sum_{i=0}^k \vartheta_{ij} \Delta HE_{j,t-i} + \sum_{i=0}^k \phi_{ij} \Delta UR_{j,t-i} + \sum_{i=0}^k \sigma_{ij} \Delta FR_{j,t-i} \\ & + \sum_{i=0}^k \tau_{ij} \Delta FLB_{j,t-i} + \sum_{i=0}^k \varphi_{ij} \Delta AC_{j,t-i} + \theta_1 SR_{j,t-1} + \theta_2 GDP_{j,t-1} \\ & + \theta_3 GDP_{j,t-1}^2 + \theta_4 HE_{j,t-1} + \theta_5 UR_{j,t-1} + \theta_6 FR_{j,t-1} + \theta_7 FLB_{j,t-1} \\ & + \theta_8 AC_{j,t-1} + \varepsilon_{it} \end{aligned}$$

$$\text{Equation 3.15}$$

where i is countries, t is time, Δ is the first variation factors, and k is the ideal lag length.

The hypotheses of panel ARDL estimation are shown as follows:

$$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = \theta_8$$

$$H_1: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq \theta_6 \neq \theta_7 \neq \theta_8$$

where the null hypothesis indicates that there is no cointegration whereas alternative hypothesis represents that there is cointegration between the variables. After determining the long-run correlation between the variables, the long- and short-run models will be investigated which are specified as follows, respectively:

$$\begin{aligned} SR_{it} = & \beta_2 + \sum_{i=1}^k \delta_{i2} SR_{j,t-i} + \sum_{i=0}^k \alpha_{i2} GDP_{j,t-i} + \sum_{i=0}^k \partial_{i2} GDP_{j,t-i}^2 \\ & + \sum_{i=0}^k \vartheta_{i2} HE_{j,t-i} + \sum_{i=0}^k \phi_{i2} UR_{j,t-i} + \sum_{i=0}^k \sigma_{i2} FR_{j,t-i} + \sum_{i=0}^k \tau_{i2} FLB_{j,t-i} \\ & + \sum_{i=0}^k \varphi_{i2} AC_{j,t-i} + \varepsilon_{it2} \end{aligned}$$

Equation 3.16

$$\begin{aligned} \Delta SR_{it} = & \beta_3 + \sum_{i=1}^k \delta_{i3} \Delta SR_{j,t-i} + \sum_{i=0}^k \alpha_{i3} \Delta GDP_{j,t-i} + \sum_{i=0}^k \partial_{i3} \Delta GDP_{j,t-i}^2 \\ & + \sum_{i=0}^k \vartheta_{i3} \Delta HE_{j,t-i} + \sum_{i=0}^k \phi_{i3} \Delta UR_{j,t-i} + \sum_{i=0}^k \sigma_{i3} \Delta FR_{j,t-i} \\ & + \sum_{i=0}^k \tau_{i3} \Delta FLB_{j,t-i} + \sum_{i=0}^k \varphi_{i3} \Delta AC_{j,t-i} + \lambda ECT_{j,t-i} + \varepsilon_{it3} \end{aligned}$$

Equation 3.17

where $ECT_{j,t-i}$ is ECT which is the lagged residual from the long-run cointegrating relationship. It represents how far the system is from its long-run equilibrium. λ is the speed of adjustment coefficient, which indicates how quickly the dependent variable adjusts to deviations from the long-run equilibrium. λ should be negative and significant to indicate convergence back to equilibrium.

3.5.5 Differential Calculus Approach Turning Point Estimation

The study investigates the relationship between socioeconomic factors and suicide rates in ASEAN countries using both linear and non-linear models. The GDP per capita variable is expected to exhibit a U-shaped nexus with suicide rates. Therefore, the turning point is estimated using the differential calculus approach. The real quadratic function is given by:

$$f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = ax^2 + bx + c \quad \text{Equation 3.18}$$

where a , b , and c are the real numbers, and $a \neq 0$. Then, the tuning point can be capture by taking the first derivative in the Equation 3.16 and letting the equation to zero:

$$f'(x) = 2ax + b \quad \text{Equation 3.19}$$

$$x^* = \frac{-b}{2a} \quad \text{Equation 3.20}$$

The Equation 3.18 is then rewritten as follow:

$$GDP^* = \frac{-\beta_1}{2\beta_2} \quad \text{Equation 3.21}$$

where GDP^* represents the turning point of GDP per capita, and β_1 and β_2 are the coefficients of the linear and quadratic term of GDP per capita, respectively.

3.5.6 Goodness-of-Fit Tests

This study employs both linear and non-linear model to investigate the nexus between socioeconomic variables on age-standardised total suicide rate in ASEAN nations. Hence, to analyse which model provides a significantly better fit to the data, the goodness-of-fit tests, namely log likelihood, LR test and SER, will be obtained in the study. The log likelihood is a natural logarithm of the likelihood function which indicates how well the

model fits the data by quantifying the likelihood of observing the given data under the assumed model. The log likelihood function is shown as follows:

$$\ln L(\mu, \sigma^2 | x_1, \dots, x_n) = -\frac{n}{2} \ln(2\pi\sigma^2) - \frac{1}{2\sigma^2} \sum_{i=1}^n (x_i - \mu)^2 \quad \text{Equation 3.22}$$

where μ is the mean, σ^2 is the variance, n is the observations' number, and x_i is one observed value in dataset. The model better fits the data if it has a higher log likelihood than another model.

The LR test is a statistical method used to compare two competing models, typically restricted and unrestricted models, to see if the unrestricted model significantly improves the fit to the data. In this study, the linear model is restricted model, while the non-linear model, which adding the quadratic term of GDP per capita, is unrestricted model. The formula of LR test is shown as follows:

$$LR \text{ test} = -2(\ell_0 - \ell_1) \quad \text{Equation 3.23}$$

where ℓ_0 and ℓ_1 are the log likelihood values of restricted and unrestricted models, respectively. The hypothesis of LR test is as follows:

H_0 : The restricted model is sufficient to explain the data.

H_1 : The unrestricted model is sufficient to explain the data.

The LR test statistic approximately follows a chi-square, χ^2 distribution with degrees of freedom equal to the difference in the number of parameters between restricted and unrestricted models. The null hypothesis of the restricted model is sufficient to explain the data will be rejected if the value of LR test is larger than the critical value of χ^2 at the significance level of 1%, 5% or 10%.

The SER is a measure of the typical size of the residuals (the difference between the actual and predicted values) in the regression model. It indicates the average distance that the observed data points fall from the regression line, in terms of the dependent variable. The formula of SER is presented as follows:

$$SER = \sqrt{\frac{\sum(y_i - \hat{y}_i)^2}{df}} \quad \text{Equation 3.24}$$

where y_i is the actual observed value of the dependent variable, $\hat{y}_i$ is the predicted value from the regression model, and df is degrees of freedom. A smaller SER indicates that the model has less prediction error, meaning the fitted model is closer to the actual data points. Otherwise, a larger SER suggests the model does not explain the variation in the dependent variable well.

3.6 Concluding Remarks

This study examines the influence of socioeconomic variables on suicide rates in ASEAN countries. Panel unit root tests, correlation analysis, panel cointegration tests, panel ARDL estimation, turning point estimation, and goodness-of-fit tests are employed in this study. Both linear and non-linear models are used in the panel ARDL estimation, with turning point estimation in the non-linear model. The data analysis and results will be discussed in Chapter 4.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This study aims to assess the impact of socioeconomic factors on suicide rates in ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) over the period from 2000 to 2019. Both linear and non-linear models are covered in this empirical analysis. The panel unit root tests, namely the LLC test and IPS test, correlation analysis (Pearson correlation coefficient), panel cointegration test (specifically the Pedroni cointegration test), panel ARDL estimation, differential calculus approach for turning point estimation, and goodness-of-fit tests (log-likelihood LR test and SER) are employed. The findings are discussed in the following sections.

4.2 Panel Unit Root Tests

Table 4.1 presents the results of the panel unit root tests. Based on the findings of the LLC unit root test, at level $I(0)$, the age-standardised total suicide rate and female labour force participation rate are stationary with intercept, while current health expenditure, unemployment rate, fertility rate, and alcohol consumption per capita are stationary with intercept and with trend and intercept. GDP per capita is not stationary at $I(0)$. At first

difference $I(1)$, all variables are stationary, except that alcohol consumption per capita is stationary only with intercept.

Next, based on the results of the IPS unit root test, at $I(0)$, the age-standardised total suicide rate is stationary with intercept, while current health expenditure and unemployment rate are stationary with trend and intercept. Fertility rate and alcohol consumption per capita are stationary with intercept and with trend and intercept, while GDP per capita and female labour force participation rate are not stationary. At $I(1)$, all variables are stationary with intercept and with trend and intercept. In summary, the findings of both unit root tests indicate mixed results among the variables, meaning that all variables are stationary at $I(0)$, $I(1)$, or both levels.

Table 4.1: Panel Unit Root Tests' Results

Variables	LLC Unit Root Test		IPS Unit Root Test	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
At level				
SR	-4.953***	2.281	-1.853**	3.486
GDP	8.818	-1.216	10.249	0.922
HE	-2.377***	-1.893**	-0.552	-1.358*
UR	-2.882***	-1.722**	0.466	-1.335*
FR	-6.461***	-7.405***	-6.685***	-8.342***
FLB	-1.699**	0.627	0.407	0.032
AC	-2.651***	-2.717***	-1.300*	-2.977***
First Difference				
SR	-4.913***	-6.017***	-5.040***	-6.128***
GDP	-3.386***	-5.463***	-4.054***	-3.567***
HE	-9.880***	-8.123***	-9.079***	-8.163***
UR	-5.867***	-5.683***	-7.952***	-7.281***
FR	-6.045***	-1.283*	-5.152***	-2.628***
FLB	-2.507***	-2.096**	-5.913***	-3.739***
AC	-1.958**	-0.863	-4.099***	-1.738**

Note: Asterisk ***, ** and * denotes as rejection at 1%, 5% and 10% significant level, respectively.

4.3 Correlation Analysis

The Pearson correlation coefficient analysis is utilised in this study to analyse multicollinearity among the variables, and the results are shown in The age-standardised total suicide rate is positively correlated with per capita GDP, current health spending, female labour force participation rate, and per capita alcohol consumption, while it is negatively correlated with unemployment rate and fertility rate. GDP per capita shows a positive correlation with unemployment rate and a negative correlation with current health expenditure, fertility rate, female labour force participation rate, and per capita alcohol consumption. Current health expenditure is negatively correlated with unemployment rate, but positively correlated with fertility rate, female labour force participation rate, and per capita alcohol consumption. The unemployment rate is negatively correlated with fertility rate, female labour force participation rate, and per capita alcohol consumption. Fertility rate has a positive correlation with both female labour force participation rate and alcohol consumption per capita. The female labour force participation rate is positively correlated with alcohol consumption per capita. The highest and lowest values of correlation coefficients are 0.594 and 0.113, respectively. Since all correlation coefficient values are lower than 0.8, this indicates that multicollinearity does not occur between the variables.

Table 4.2: Pearson Correlation Coefficient Test's Results

	SR	GDP	HE	UR	FR	FLB	AC
SR	1.000						
GDP	0.131	1.000					
HE	0.279	-0.225	1.000				
UR	-0.412	0.533	-0.470	1.000			
FR	-0.329	-0.594	0.178	-0.210	1.000		
FLB	0.514	-0.166	0.488	-0.543	0.181	1.000	
AC	0.360	-0.350	0.258	-0.577	0.113	0.475	1.000

4.4 Panel Cointegration Test

The Pedroni cointegration test is conducted to assess whether a long-term equilibrium relationship exists between socioeconomic factors and suicide rates across ASEAN countries. This test includes different specifications, namely individual intercept, individual intercept with individual trend, and no intercept or trend. Examining these variations helps to determine if socioeconomic factors consistently relate to suicide rates over the long term across different configurations, thereby validating the robustness of the relationship. The results of the Pedroni cointegration test are presented in Table 4.3.

In the specification with an individual intercept, 2 out of 4 within-dimension statistics, the Panel *PP*-Statistic (-6.880) and the Panel *ADF*-Statistic (-2.969), are statistically significant at the 1% level, suggesting strong evidence of a long-run relationship among variables within ASEAN countries. The between-dimension statistics also show significance, with the Group *PP*-Statistic (-8.728) and Group *ADF*-Statistic (-2.210) significant at the 1% and 5% levels, respectively. This supports the existence of a long-run association between the variables.

In the specification with individual intercept and individual trend, the results further confirm the long-run relationship. Here, the Panel *PP*-Statistic (-2.547) and Panel *ADF*-Statistic (-2.341) are significant at the 1% level, indicating that socioeconomic factors and suicide rates are linked over time. The Group *PP*-Statistic (-3.837) and Group *ADF*-Statistic (-1.977) remain significant at the 1% and 5% levels, respectively, suggesting a long-term association across ASEAN countries, despite unique socioeconomic trends in each country.

In the final specification, with no intercept or trend, the Panel *PP*-Statistic (-1.309) and Panel *ADF*-Statistic (-1.606) are significant at the 10% level, providing some support for a long-term association between the variables. The Group *PP*-Statistic (-10.461) shows strong significance at the 1% level, while the Group *ADF*-Statistic (-1.398) is significant at the 10% level, indicating that even without assuming intercept or trend, a long-term relationship exists, although with lower statistical confidence.

Table 4.3: Pedroni Cointegration Test's Results

Pedroni Cointegration Test	Test Statistics
Individual Intercept	
Test Statistics (Within Dimension):	
Panel ν -Statistic	-3.132
Panel ρ -Statistic	3.858
Panel <i>PP</i> -Statistic	-6.880***
Panel <i>ADF</i> -Statistic	-2.969***
Test Statistics (Between Dimension):	
Group ρ -Statistic	5.748
Group <i>PP</i> -Statistic	-8.728***
Group <i>ADF</i> -Statistic	-2.210**
Individual Intercept and Individual Trend	
Test Statistics (Within Dimension):	
Panel ν -Statistic	-3.139
Panel ρ -Statistic	4.119
Panel <i>PP</i> -Statistic	-2.547***
Panel <i>ADF</i> -Statistic	-2.341***
Test Statistics (Between Dimension):	
Group ρ -Statistic	5.177
Group <i>PP</i> -Statistic	-3.837***
Group <i>ADF</i> -Statistic	-1.977**
No Intercept or Trend	
Test Statistics (Within Dimension):	
Panel ν -Statistic	-3.288
Panel ρ -Statistic	2.279
Panel <i>PP</i> -Statistic	-1.309*
Panel <i>ADF</i> -Statistic	-1.606*
Test Statistics (Between Dimension):	
Group ρ -Statistic	4.055
Group <i>PP</i> -Statistic	-10.461***
Group <i>ADF</i> -Statistic	-1.398*

Note: Asterisk ***, ** and * denotes as rejection at 1%, 5% and 10% significant level, respectively.

In short, across the different test specifications, there is consistent evidence of a long-run relationship between socioeconomic factors and suicide rates. With 4 out of 7 test statistics being significant in these specifications, the Pedroni cointegration test supports the rejection of the null hypothesis of no cointegration. This suggests that socioeconomic factors such as per capita GDP, current health spending, unemployment rate, fertility rate, female labour force participation rate, and per capita alcohol consumption have long-run impacts on the age-standardised total suicide rate in ASEAN countries.

4.5 Panel ARDL Estimation and Turning Point Estimation

The panel ARDL estimation is employed in this study since all variables are stationary at $I(0)$, $I(1)$ or both according to the panel unit root tests. The outcomes of the panel ARDL estimation and turning point estimation are exhibited in Table 4.4. Columns (1) and (2) present the results for the linear and non-linear models, respectively.

Based on the outcomes in Table 4.4, all socioeconomic variables in both columns (1) and (2) show a significant association with the age-standardised total suicide rate in the long run. The results in column (1) indicate that GDP per capita is negatively associated with the age-standardised total suicide rate, with a 1% increase in GDP per capita leading to a 0.29% decrease in the age-standardised total suicide rate, holding other factors constant. This suggests that as GDP per capita increases, individuals have greater access to resources to meet their personal and family financial obligations. When the people are better able to afford essential need, their financial stress diminishes, reducing a major risk factor associated with suicidal behaviour.

Table 4.4: Results of Panel ARDL Estimation and Turning Point Estimation

Dependent Variable (SR)	Panel ARDL Estimation	
	(1)	(2)
Long Run Equation:		
GDP	-0.285 (0.041)***	-1.303 (0.089)***
GDP²	-	0.010 (0.001)***
HE	-0.043 (0.022)*	-0.231 (0.008)***
UR	0.232 (0.023)***	0.088 (0.006)***
FR	-0.957 (0.103)***	-1.993 (0.194)***
FLB	0.117 (0.009)***	0.067 (0.002)***
AC	0.144 (0.015)***	0.062 (0.011)***
Turning Point of GDP*	-	65.15
Short Run Equation:		
ECT	-0.795 (0.237)***	-0.563 (0.293)*
GDP	-0.086 (0.944)	4.359 (3.475)
GDP²	-	-1.116 (1.382)
HE	-0.201 (0.186)	0.095 (0.110)
UR	-0.803 (0.761)	0.247 (0.242)
FR	-8.138 (6.104)	-12.089 (15.481)
FLB	-0.275 (0.927)	-0.181 (0.065)
AC	-0.720 (0.471)	0.251 (0.263)
Goodness-of-Fit Tests:		
Log Likelihood	279.493	292.873
SER	0.166	0.164

Note: The column (1) and (2) present the findings of linear model and non-linear model, respectively. Asterisk ***, ** and * denotes as rejection at 1%, 5% and 10% significant level, respectively. Amount in parentheses denote as standard error.

Nonetheless, given the divergent views on the influence of GDP per capita on suicide between economic and social theories, a quadratic term of GDP per capita is included to test for a non-linear relationship. Column (2) reveals a U-shaped relationship between GDP per capita and the suicide rate, indicating that an increase in GDP per capita initially reduces the suicide rate but eventually leads to an increase after reaching a certain threshold. The turning point is calculated using Equation 3.19 and is as follows:

$$\begin{aligned}
 GDP^* &= \frac{-\beta_1}{2\beta_2} \\
 &= \frac{-(-1.303)}{2(0.01)} \\
 &\approx \$65,150.00 \text{ USD}
 \end{aligned}
 \tag{Equation 4.1}$$

This result suggests that the turning point is around \$65,150.00 USD, beyond which higher GDP per capita is linked to an increase in the age-standardised total suicide rate in ASEAN countries. This U-shaped relationship implies that suicide rates decrease only up to a certain level of GDP per capita, after which further economic growth might lead to moral deregulation and reduced social integration, ultimately increasing suicide rates. This finding aligns with studies by Chansarn (2017) and Neumayer (2003).

The results also show a significantly negative relationship between current health expenditure and the age-standardised total suicide rate in both models. A 1% increase in health expenditure is associated with a 0.04% decrease in the age-standardised total suicide rate in column (1) and a 0.23% decrease in column (2), all else being equal. This inverse relationship aligns with Lin (2006), Milner et al. (2012), Minoiu and Andrés (2008) and Ross et al. (2012), which observed that investments in health services tend to mitigate suicide rates by expanding access to mental health care, counselling and preventive services. Higher health expenditure often translates into better healthcare infrastructure, increased availability of treatment options, and improved public awareness campaigns. These resources provide individuals facing mental health issues with support networks and intervention services, reducing the risk of suicide and underscoring the importance of continued investment in public health as a strategy for suicide prevention in ASEAN countries.

The unemployment rate is positively associated with the age-standardised total suicide rate in ASEAN countries. A 1% increase in the unemployment rate corresponds to a 0.23% increase in the age-standardised total suicide rate in column (1) and a 0.09% increase in column (2), others remain constant. This aligns with the theory of Koo and Cox (2008) and

studies such as Dmitriev (2023), Lari & Sefiddashti (2023), and Näher et al. (2020), indicating that unemployment leads to financial strain and social isolation, which are risk factors for suicide. The lack of employment can lead to a loss of self-worth and confidence, further exacerbating stress and psychological distress. For many individuals, employment is not only a means of income but also a source of identity and social engagement. Hence, unemployment can disrupt both personal and social stability, increasing vulnerability to suicidal thoughts and behaviours.

The fertility rate shows a significantly negative relationship with the ASEAN's age-standardised total suicide rate, as an increase of 1% in the fertility rate is linked to a 0.96% decrease in column (1) and a 1.99% decrease in column (2), others remain unchanged. This supports Durkheim's (1897) social theory that the presence of children encourages a sense of responsibility and purpose among parents. Having children fosters deeper connections within families and communities, potentially serving as a buffer against suicidal tendencies. The demands and responsibilities associated with parenting may provide emotional fulfilment and a heightened sense of belonging, factors that can mitigate the risk of suicide. This relationship has also been supported by past studies which confirm that social integration resulting from family responsibilities may lower the risk of suicide (Andrés, 2005; Andrés et al., 2011; Erdem & Dinç, 2022; Koo & Cox, 2008).

Female labour force participation rate has a significantly positive association with the age-standardised total suicide rates, increasing the suicide rate by 0.12% in column (1) and 0.07% in column (2) for each 1% increase, others remain unchanged. This association could be due to role conflict and stress stemming from balancing work responsibilities with family

duties, which may contribute to reduced social integration for working women. Besides, higher female labour force participation rate makes the working men feel pressure to adapt to changing household dynamics or feel a diminished role in family finances, which can affect self-worth. This shift may lead to increased stress, isolation and mental health challenges for men, particularly in societies with strong expectations around male breadwinning and traditional family roles, thereby contributing to a rise in suicide rates. This finding is in line with studies like Andrés (2005), Milner et al. (2012), and Neumayer (2003), which suggest that while employment can be empowering, it may also lead to feelings of isolation or reduced support systems, factors that increase susceptibility to suicide.

Alcohol consumption per capita demonstrates a positive and significant relationship with the age-standardised total suicide rate in ASEAN countries. A 1% increase in alcohol consumption per capita is associated with an increase in the age-standardised total suicide rate of 0.14% in Column (1) and 0.06% in Column (2), holding other factors constant. Although Durkheim's social theory (1897) posits that alcohol consumption is insignificant in relation to suicide, the positive relationship found in this study aligns with previous findings by Andrés (2005), Brainerd (2001), Erdem and Dinç (2022), Kuncze (2021), and Neumayer (2003), which link alcohol use to an elevated risk of suicide. Alcohol consumption is associated with a higher likelihood of psychological issues, impaired judgement, and impulsive behaviours, which can increase the risk of suicidal actions. Additionally, heavy alcohol use often reduces social cohesion and increases isolation, weakening social support networks. Alcohol addiction within communities can also lead to mental health issues and financial difficulties, both of which contribute to a higher suicide risk.

In the short run, the ECT is significant and negative in both linear and non-linear models, with values of -0.79 and -0.56 in the linear and non-linear models, respectively. This indicates that approximately 79.50% and 56.30% of any disequilibrium from the long-run relationship is corrected in the subsequent period, demonstrating a stable adjustment process towards long-run equilibrium. The significant ECT values suggest that even if short-term shocks disrupt the equilibrium, the socioeconomic factors are likely to realign with suicide rates in the long run. However, none of the socioeconomic variables are statistically significant in the short run for ASEAN's age-standardised total suicide rate. This may indicate that the effects of these socioeconomic factors on suicide rates require time to manifest and do not have an immediate impact in the short term.

The goodness-of-fit tests further validate the reliability of the panel ARDL estimation model. The log likelihood values of 279.49 and 292.87 in the linear and non-linear models, respectively, indicate a robust model fit, with the non-linear model showing a slightly better fit. The log likelihood of both linear and non-linear models is then used to calculate the LR test statistic using Equation 3.23 as follows:

$$\begin{aligned}
 LR \text{ test} &= -2(\ell_0 - \ell_1) \\
 &= -2(279.493 - 292.873) \\
 &= 26.76
 \end{aligned}
 \tag{Equation 4.2}$$

The LR test statistic is 26.76, which is larger than the critical value of χ^2 at the 1% significance level (6.63). Hence, this result suggests that the non-linear model significantly improves the fit, meaning that the non-linear model provides a better representation of the relationship between the variables compared to the linear model. The SER values of 0.17 in the linear model and 0.16 in the non-linear model confirm that the residuals, or unexplained

variations, are relatively low, further reinforcing the model's accuracy. These goodness-of-fit indicators suggest that the model specification is appropriate for capturing the long-run dynamics between socioeconomic factors and suicide rates in ASEAN countries. Additionally, the higher log-likelihood, significant LR test statistic, and lower SER in the non-linear model imply that it provides a better fit than the linear model. This underscores the importance of considering non-linear effects in understanding the socioeconomic determinants of suicide.

4.6 Concluding Remarks

This chapter presents the findings and discussions based on the empirical testing procedures proposed in Chapter 3. The results of the panel unit root tests indicate that all variables are significant at $I(0)$, $I(1)$, or both levels. The correlation analysis finds no multicollinearity between the variables. The results of the panel cointegration test reveal that a long-run relationship exists among all variables. The panel ARDL estimation shows that all independent variables are significantly related to the ASEAN's age-standardised total suicide rate in both the linear and non-linear models in the long run. GDP per capita demonstrates a U-shaped relationship with the age-standardised total suicide rate. Additionally, the suicide rate is positively related to unemployment rate, female labour force participation rate, and per capita alcohol consumption, while it is negatively related to current health expenditure and fertility rate. The results of the goodness-of-fit tests indicate that the non-linear model provides a better fit than the linear model for investigating the socioeconomic determinants of suicide in ASEAN countries.

CHAPTER 5

CONCLUSION

5.1 Introduction

This study examines the impact of socioeconomic factors on the suicide rate in ASEAN countries over the period from 2000 to 2019. Both linear and non-linear models were analysed using panel data analysis techniques. The results indicate that all independent variables are significantly related to the age-standardised total suicide rate in the long run, with GDP per capita showing a significant U-shaped relationship with the suicide rate. This chapter includes seven sections: findings' summary, theoretical implications, policy implications, strengths of the study, limitations of the study, directions for future research, and closing remarks.

5.2 Findings' Summary

This study aims to assess the impact of socioeconomic factors on suicide rates in ASEAN countries from 2000 to 2019. Age-standardised total suicide rate is used as the dependent variable, while per capita GDP, current health spending, unemployment rate, fertility rate, female labour force participation rate, and per capita alcohol consumption are the independent variables. The tests conducted include panel unit root tests (LLC and IPS), Pearson correlation coefficient, the Pedroni cointegration test, panel ARDL estimation, turning point estimation, and goodness-of-fit tests (log likelihood, LR tes, and SER). Both

linear and non-linear models were employed, with a quadratic term for GDP per capita included in the non-linear model. The turning point was estimated using the differential calculus approach in the non-linear model.

The panel unit root tests (LLC and IPS) indicate that all variables are integrated at $I(0)$, $I(1)$, or both levels. The Pearson correlation coefficient shows no multicollinearity between variables. The Pedroni cointegration test results confirm a long-run association among the variables. The panel ARDL estimation results for both the linear and non-linear models indicate that all explanatory variables are significantly associated with the age-standardised total suicide rate in the long run, while they are insignificant in the short run. Specifically, the suicide rate is positively associated with unemployment rate, female labour force participation rate, and per capita alcohol consumption, while it is negatively associated with current health expenditure and fertility rate.

GDP per capita initially shows a negative relationship with suicide rates, but the inclusion of a quadratic term reveals a U-shaped relationship. The turning point occurs at approximately \$65,150.00 USD, beyond which further increases in GDP per capita are associated with higher suicide rates in ASEAN countries. The significant and negative ECT in both models indicates a long-run equilibrium relationship between socioeconomic factors and ASEAN's age-standardised total suicide rates. Additionally, the non-linear model demonstrates a better fit, as shown by a higher log likelihood, significantly LR test statistic, and lower SER.

5.3 Theoretical Implications

The findings of this study have significant theoretical implications for the literature on socioeconomic determinants of suicide. First, the U-shaped relationship observed between GDP per capita and age-standardised total suicide rate supports both the economic theory of suicide by Hamermesh and Soss (1974) and the social theory of suicide by Durkheim (1897). The initial negative association between GDP per capita and suicide aligns with the economic theory, which suggests that improved economic conditions reduce financial strain and enhance overall life satisfaction, thereby lowering suicide risk. However, as GDP per capita increases further, suicide rates begin to rise, supporting Durkheim's (1897) view that economic prosperity can lead to social disintegration, thereby increasing suicide risk. This finding bridges the two theoretical frameworks, highlighting the complex interplay between economic conditions and societal well-being.

Additionally, the positive relationship between unemployment rate and suicide supports the extension of Hamermesh and Soss's (1974) theory by Koo and Cox (2008), which suggests that unemployment leads to human capital depreciation, reducing lifetime utility and increasing suicide risk. The significant negative association between health expenditure and suicide underscores the protective role of public health investment in reducing suicide risk. Furthermore, the negative relationship between fertility rate and suicide supports Durkheim's (1897) theory that family ties foster social integration, thereby providing a buffer against suicide.

The positive relationships between per capita alcohol consumption, female labour force participation rate, and suicide add depth to existing theories by highlighting the stresses associated with societal roles and behavioural factors. Increased female participation in the workforce, while reflecting economic progress, may also lead to role conflict and stress, increasing suicide risk. Similarly, the significant effect of alcohol consumption challenges Durkheim's (1897) theory that alcohol is insignificant in relation to suicide. In summary, these findings reinforce the importance of considering a range of socioeconomic variables as critical components of suicide risk, not just only using the economic or social variables to analyse suicide.

5.4 Policy Implications

Based on the results, there is a significant U-shaped connection between GDP per capita and age-standardized total suicide rate. Recognising the U-shaped connection between the variables, ASEAN policymakers should be cautious of the potential negative impacts of both extreme poverty and excessive wealth. The policymakers should adopt an inclusive economic growth agenda to address both extreme poverty and wealth inequality. Besides, the progressive taxation policies, social safety nets, and programs that foster economic opportunities for marginalised populations should be implemented so that can contribute to a more balanced and equitable distribution of wealth. Additionally, measures to promote financial literacy and responsible wealth accumulation can help to prevent the negative impacts associated with extreme affluence. In essence, policies aiming for a balanced and inclusive economic growth that addresses income inequality may contribute to prevent moral deregulation and social integration reduction and then decrease the suicide rates.

Besides, based on the negative relationship between current health expenditure and age-standardised total suicide rate, the governments in ASEAN countries should focus on enhancing accessibility and affordability of mental health services by increasing budget for health services and reducing the barriers to accessing health resources. Also, the government should focus on the mental health issues by allocating resources to mental health programs, community-based interventions, and destigmatising mental health issues which can help to mitigate the influence of inadequate health expenditure on suicide rates in ASEAN countries. In short, policies aiming for public access to health resources easily and affordability can reduce the likelihood to commit suicide.

Apart from this, the positive linkage between unemployment rate and age-standardized total suicide rate implies that the ASEAN governments should implement comprehensive job creation initiatives that focus on sectors with growth potential. This involves collaborating with industries to identify emerging markets and promoting entrepreneurship. Tailored programs for vulnerable populations, such as youth and long-term unemployed individuals, should be developed to enhance their employability. Also, the policies that support SMEs such as providing financial incentives, reducing bureaucratic hurdles, and offering technical assistance can play a significant role in job creation and help these enterprises thrive. The government also may invest in vocational training and reskilling programs aligned with industry needs to empower individuals with the skills required for contemporary job markets. This not only increases employment opportunities but also enhances the overall competitiveness of the workforce. In a word, policies aiming to create more job opportunities can reduce the suicide rate.

In addition, the ASEAN policymakers should consider comprehensive family planning education programs that provide individuals with information on contraceptive methods, family planning options and maternal healthcare. Accessible and affordable family planning services should be made widely available to empower individuals to make informed choices about family size. The policymakers also may consider introducing incentives for family planning such as tax benefits or other financial incentives for families who choose to plan their family size responsibly. Also, the governments should conduct community outreach programs and awareness campaigns to address cultural or societal norms that may influence perceptions about family size so that can create an environment where individuals can make choices without undue pressure. In precis, policies promoting family planning and addressing the associated stressors can contribute to suicide prevention.

Furthermore, the policymakers should address the unique challenges faced by women such as wage gaps and barriers to career advancement. The governments can carry out educational programs that encourage female to pursue careers in diverse fields and equip them with skills relevant to the modern job market can contribute to greater female workforce participation and economic empowerment. Also, policies that provide assistance for female workers like flexible work arrangements, affordable childcare services and parental leave policies can empower women to facilitate their work-life balance, potentially reducing stressors linked to suicide rates. In a nutshell, policies promoting gender equality in the workplace, ensuring fair wages and establishing supportive work environments for female can narrow the risks of committing suicide.

Moreover, the policymakers should implement strategies to regulate alcohol consumption like higher taxation on alcoholic beverages and restrictions on advertising to curb excessive alcohol consumption. Besides, the governments can carry out public awareness campaigns to educate the population about the risks associated with excessive alcohol consumption, particularly its impact on mental health and suicide risk. These campaigns can also help to reduce the stigma around seeking help for alcohol-related issues. Also, the screening programs in healthcare settings can be implemented to help identify individuals at risk of alcohol-related issues early on. Early intervention through counselling and support services can prevent the escalation of problems and reduce the associated mental health risks. In summary, policies regulating alcohol consumption and addressing the mental health implications of excessive drinking are needed to reduce the happen of suicide.

5.5 Strengths of the Study

This study has several notable strengths that enhance its contribution to the academic and policy-making communities. One major strength is its comprehensive approach, incorporating both linear and non-linear models to capture a more detailed understanding of the relationship between socioeconomic factors and suicide rates. By including a quadratic term for GDP per capita in the non-linear model, the research is able to identify a U-shaped relationship that reveals complexities missed by purely linear analyses. This dual-model approach provides a more nuanced perspective and helps reconcile conflicting theoretical views on economic expansion and suicide risk.

The study's focus on age-standardized suicide rates is another strength, as it ensures cross-country comparability and controls for demographic variations, making the findings relevant across diverse ASEAN countries. The analysis spans a 20-year period from 2000 to 2019, providing longitudinal insights into the evolving socioeconomic landscape and its effects on suicide rates. Moreover, this research contributes unique insights to ASEAN countries which often underrepresented in suicide studies, adding valuable empirical evidence specific to the ASEAN context.

Finally, the research enriches the theoretical discourse by integrating and validating different theories of suicide with empirical data. It supports the economic theory of suicide in demonstrating how improved GDP can initially reduce suicide risk but simultaneously aligns with Durkheim's social theory by illustrating how continued economic growth past a certain point can increase suicide rates. This theoretical integration provides a comprehensive foundation for future studies and policy development in understanding the multifaceted nature of suicide.

5.6 Limitations of the Study

Several limitations are identified in this study. Firstly, the findings may primarily apply to the contexts of ASEAN countries, which are mostly lower- and upper-middle-income nations. Although the study identifies a significant U-shaped relationship between GDP per capita and age-standardised total suicide rate in ASEAN, this relationship may not be universally applicable across all countries, as each region has unique cultural and socioeconomic backgrounds.

Another limitation arises from data availability, which affects both the sample size and the range of variables considered. The panel dataset covers 20 years, which is relatively small from a statistical perspective. Additionally, missing data for some variables means that potentially influential factors were excluded from the study to avoid bias, rather than employing interpolation techniques.

Lastly, the study is the inability to precisely ascertain the exposure of individuals who encountered the suicide, as the available data is only accessible at an aggregate level. Thereupon, the findings of the study are unable to show that which individual effects of independent variables, such as reasons of unemployment and types of healthcare service, are influencing more to suicide rate. The aggregate level of data will make the study become more constraint, whereas the disaggregate level of data will make the results more specific and robust.

5.7 Directions for Future Research

Future research could enhance this analysis by incorporating a broader range of countries with varied historical and socio-economic backgrounds. Additionally, future studies could use quarterly or even monthly data, rather than annual data, to capture changes and trends in suicide rates at a finer temporal scale. Consequently, the analysis and empirical discovery become more significant and instructive for implementing policies.

Furthermore, future studies may involve expanding the sample size used in the study. Employing sufficiently large sample sizes has the potential to yield more significant findings,

as they can capture more information and mitigate the risk of uncertainty in the study. Also, the future study may develop a structural model that encompasses additional factors influencing suicide rates beyond socioeconomic variables. These supplementary factors may include psychological, geographical, and religious variables, which have the potential to impact suicide rates.

Moreover, the future research could conduct a disaggregate level of analysis for suicide rates. This approach allows for a more thorough examination of the influence of socioeconomic factors on suicide rates. Thus, it can offer a comprehensive comparative evaluation of these factors, facilitating the formulation of a robust policy framework aimed at decreasing suicide rates.

5.8 Closing Remarks

This study demonstrates that per capita GDP, current health spending, unemployment rate, fertility rate, female labour force participation rate, and per capita alcohol consumption are significantly related to the age-standardised total suicide rate in ASEAN countries over the study period. The study's limitations provide directions for future research to enhance findings with more detailed and accurate data. By addressing these limitations, future studies may develop more effective instruments for understanding the impacts of socioeconomic factors on suicide rates in ASEAN countries. In summary, this study has achieved its objectives and provides valuable insights for both theory and policy development.

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