KOLOKIUM PENYELIDIKAN 2020

SOCIO-ECONOMIC DETERMINANTS OF LIFE EXPECTANCY IN MALAYSIA

Intan Rahayu Bt Abu Bakar

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INTRODUCTION

INTRODUCTION

- Life expectancy at birth (LE) refers to average number of years that a new born is expected to live if the patterns of mortality at the time of its birth were stay the same throughout its life (WHO)
- LE is one of main indicator to measure the health status of the population
- LE is used by public and private decision making to determine the pension benefit, healthcare and social services
- This study examines the socio-economic determinants of life expectancy in Malaysia at the aggregate level

INTRODUCTION

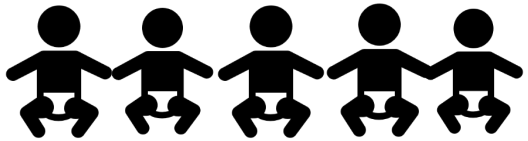
After independence, Malaysian recorded a tremendous changes in demographic trend…

POPULATION

9.32 million people in 1960s

32.6 million people in 2018

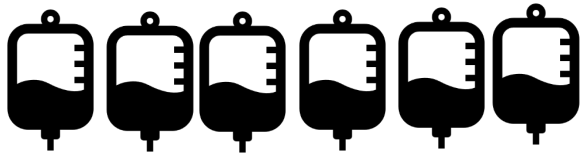
FERTILITY RATE



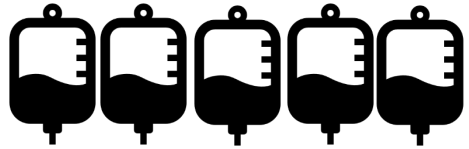
4.9 babies per woman in 1970

1.9 babies per women in 2017

CRUDE DEATH RATE



6.7 death per 1,000 population in 1970



5.3 death per 1,000 population in 2017

LIVE EXPECTANCY AT BIRTH

1970: 61.6 years
2018: 72.7 years

1970: 65.6 years
2018: 77.6 years

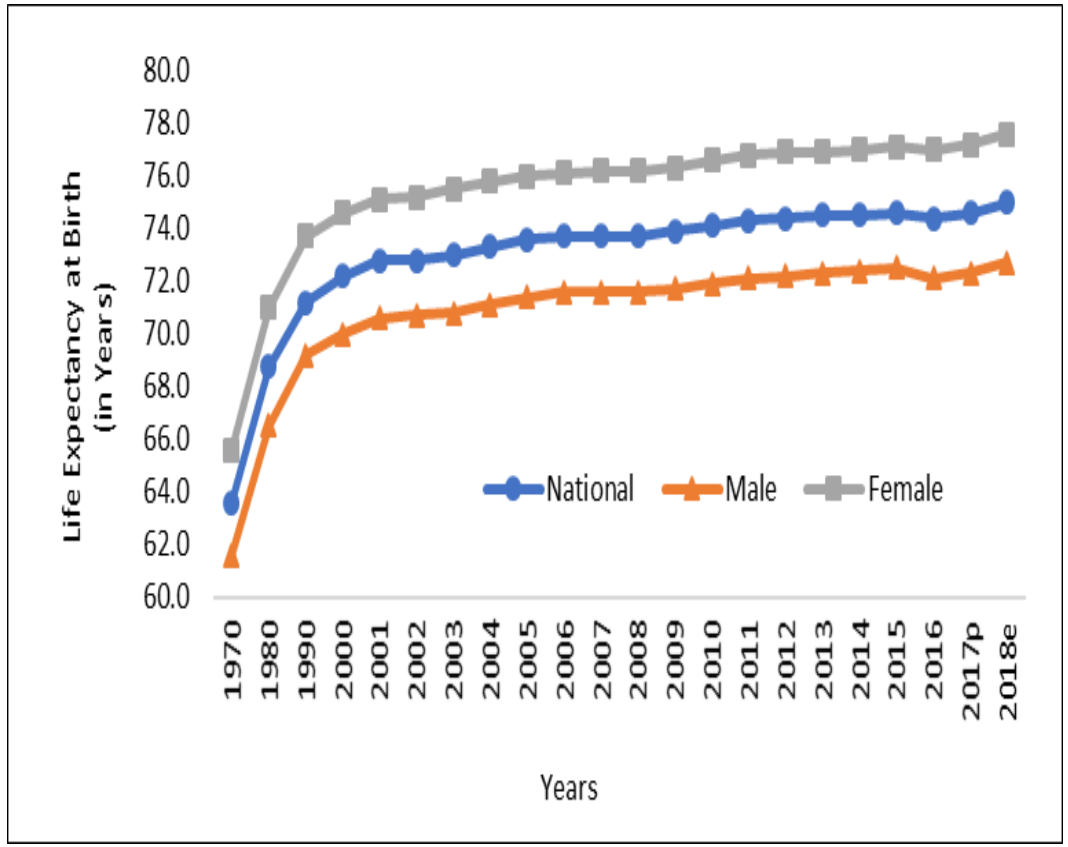
INFANT MORTALITY RATE

In 1970, the rate was 39.4 death per 1,000 population
In 2017 its improved tremendously to 7.3 death per 1,000 population

Source:
Department of Statistics, 2019

INTRODUCTION

Life Expectancy at Birth in Malaysia (1970-2018)



Source:
Department of Statistics

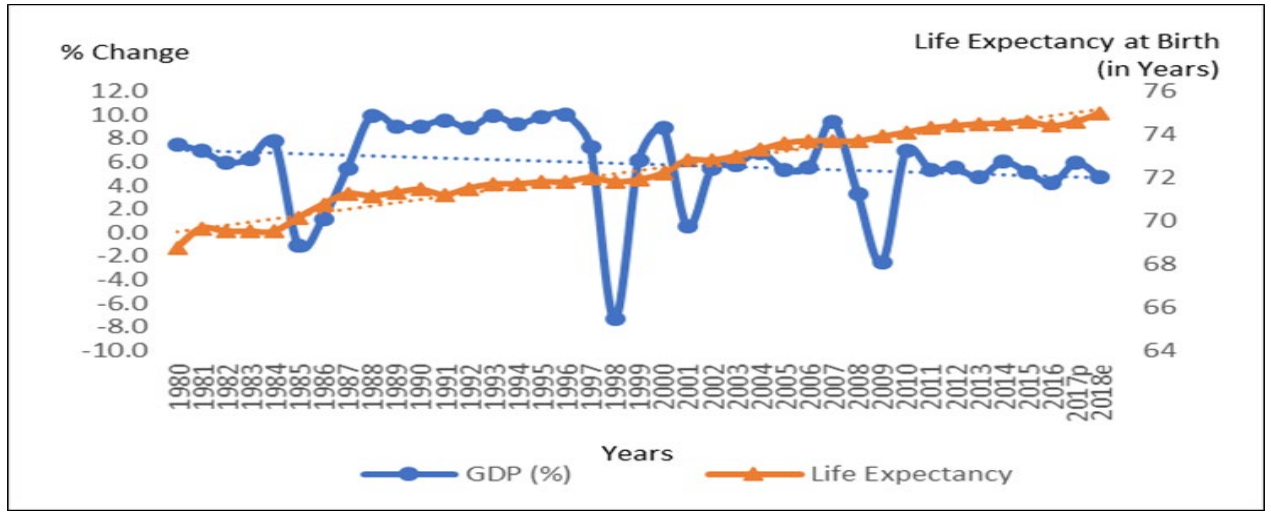
- Malaysia **LE has been improved for the past 48 years, from 63.6 years in 1970 to 75.0 years in 2018**

- Female has longer life span compared to male, where in 1970, male lives at 61.6 years and female 65.6 years, while in 2018, male can lives until 72.7 years and female until 77.6 years

- According to Karim (1997), factors that contributed to the demographic changes in Malaysia were due:
  - tremendous changes of economic growth of Malaysia from the post-independence
  - advance of medical technology

INTRODUCTION

Relationship between Life Expectancy at Birth and GDP Growth (1980-2018)



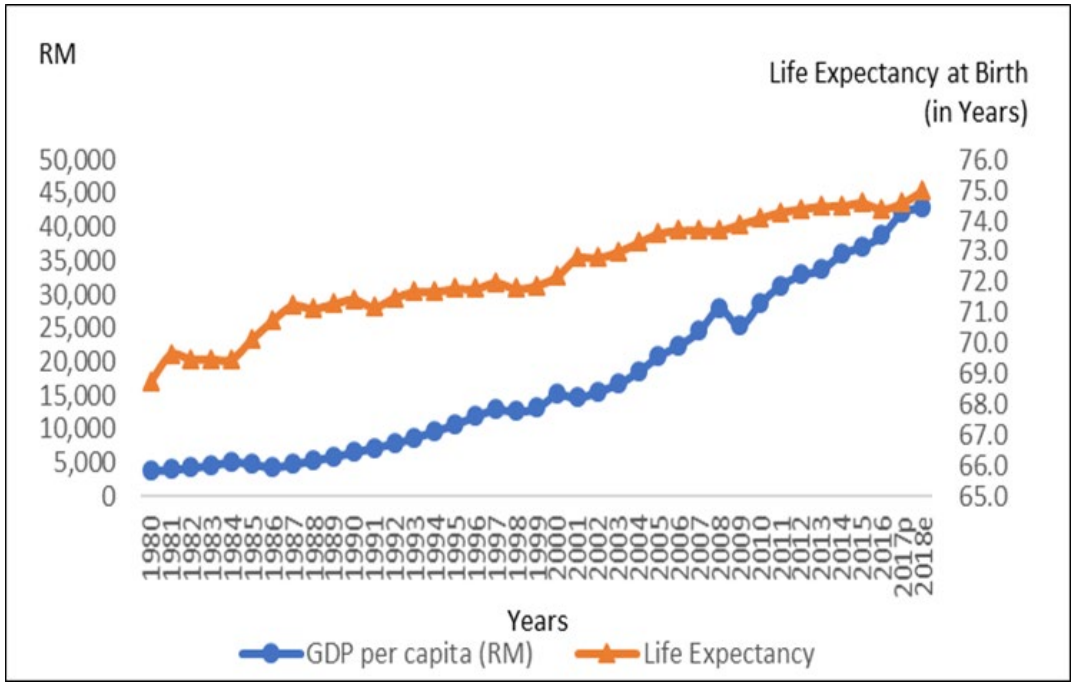
- Based on the trend line on the graph it shows that **GDP growth fluctuated meanwhile the life expectancy showed an increasing trend from 1980 to 2018**
- Malaysia experienced economic slump in 1985
- The economy of the country recovered in mid-1987
- The economic growth up to 10% in 1996 and at this point of time life expectancy improved to 71.9 in 1996

Sources:

Department of Statistics, 2019

- **Both Malaysia's GDP per capita and life expectancy move at the same direction**. As income increase the life expectancy also increases from 1980 to 2017

Relationship between Life Expectancy at Birth and GDP Per Capita (RM) at Current Prices (1980-2018)



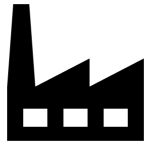
INTRODUCTION

Socio-economic determinant

- According to WHO (2019), **socio-economic determinant measures the economic conditions & sociocultural environment of people** for example income, health, environment & education aspects
- Focus on how social behaviour influence consumer behaviour & the economy
- In this context of the study, the socio-economic determinant will comprise both social & economic factor that influenced the life expectancy in Malaysia.
- The socio-economic determinants use in this study are as follows:

GDP per capita

Illiteracy rate



CO_2 emission

% prevalence of obesity

Cigarette consumption per capita

INTRODUCTION

Statistics on Selected Variables and Life Expectancy, 2005-2017

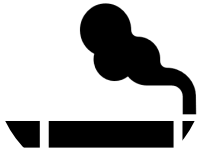
Year	Life Expectancy at Birth (Total)	GDP per capita (Current US$)	Illiteracy (%)	CO_2 Emission (metric tons per capita)	Cigarette Consumption per capita	Prevalence Obesity (%)
2005	73.6	5,594	7.6	6.80	822	9.4
2006	73.7	6,223	6.8	6.41	1,005	9.9
2007	73.7	7,269	6.9	6.94	825	10.4
2008	73.7	8,514	7.1	7.53	800	10.9
2009	73.9	7,327	6.7	7.20	758	11.5
2010	74.1	9,071	6.3	7.77	650	12.0
2011	74.3	10,405	5.6	7.70	687	12.6
2012	74.4	10,780	5.4	7.50	691	13.1
2013	74.5	10,882	5.5	7.96	582	13.7
2014	74.5	11,184	5.0	8.03	519	14.3
2015	74.6	9,655	5.3	8.16	433	14.9
2016	74.4	9,515	4.7	8.27	427	15.6
2017	74.6	9,952	4.5	8.38	421	15.3

Source: Ministry of Health, Department of Statistics, World Bank and World Health Organization, 2019

PROBLEM STATEMENT

Growing concern on increase in life expectancy shows the shift in demographic pattern in Malaysia towards the ageing society

DOSM (2016) estimated that Malaysia will achieve the ageing population by 2040 with them ageing 65 years reaching 14.5%



Malaysia also faces the escalating health problems of obesity and smoking

17.7% of the population are obese while 30% of the population categorised as overweight

22.8% of the population are smokers. Approximately a quarter of daily smokers consumed 15 to 24 sticks of cigarette per day

Limited studies have been explored on this health variables such as obesity and smoking using time series analysis

Studies on impact of smoking on life expectancy usually are done in limited time period at the individual level rather than the population level

RESEARCH QUESTION

Research Question

What is the relationship between GDP per capita, illiteracy rate, CO_2 emission, smoking and obesity with life expectancy?

OBJECTIVE OF THE STUDY

General Objective

to examine the socio-economic determinants of life expectancy in Malaysia

i.Specific Objective

i.To analyse the main socio-economic variables that determines life expectancy in Malaysia

SIGNIFICANCE OF STUDY

Contribute to the pool of academic research regarding the determinant of life expectancy in Malaysia

Gives direction to the policy maker to formulate appropriate policy on increasing trend of life expectancy that reflected the growing numbers of ageing population.

This study examines the impact of smoking and obesity on life expectancy to promote a healthy lifestyle of the people

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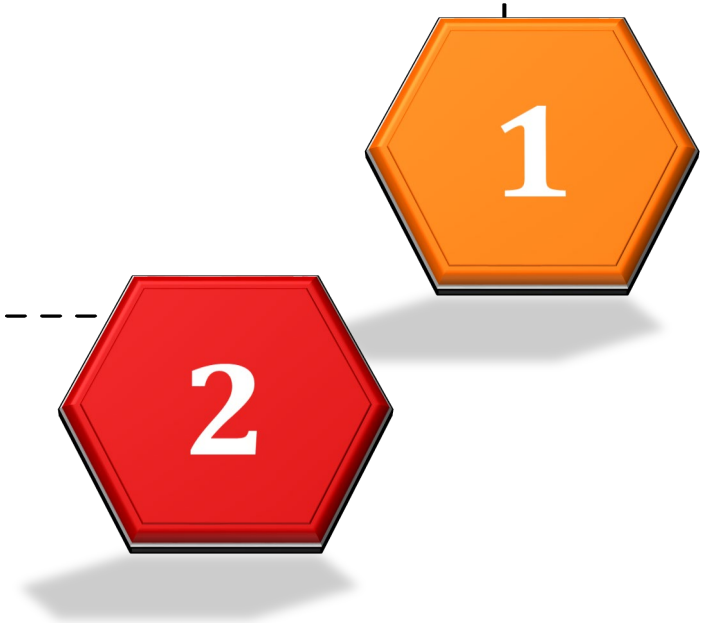
LITERATURE REVIEW

THEORETICAL FRAMEWORK



Mushkin's health-led growth hypothesis (1962)

- The healthcare is the main component of human capital investment, thus increasing the healthcare expenditure will increase the productivity, quality of life and welfare of the people
- Investment in health can also contribute to the lengthening the life expectancy, reducing morbidity and infant mortality rates

Grossman Theory (1972)

- Individuals invest in themselves through education, training and health to increase their earnings

EMPIRICAL FRAMEWORK (GDP per capita)

No.	Author	Title	Method	Relationship
1.	Lei et al. (2009)	Quantitative study on socioeconomic determinants of life expectancy in Beijing, China	Linear stepwise regression model	• Positive
2.	Shaw, Horrace and Vogel (2005)	The Determinants of Life Expectancy: An Analysis of the OECD Health Data	Ordinary least squares (OLS)	• Positive
3.	Delavari et al. (2016)	Life Expectancy and its Socioeconomic Determinants in Iran	Time series analysis using ARDL (1985 - 2013)	• Positive
4.	Subramaniam, Devadason and Loganathan (2013)	Life Expectancy Among the Indian Minority Group in Malaysia: A Study	Time series analysis using ARDL (1970-2005)	• Negative
5.	Sade and Ohemeng (2013)	Socio-economic determinants of life expectancy in Nigeria	Time series analysis using ARDL (1980-2011)	• Negative (not significant)

EMPIRICAL FRAMEWORK (Illiteracy Rate)

No.	Author	Title	Method	Relationship
1.	Lei et al. (2009)	Quantitative study on socioeconomic determinants of life expectancy in Beijing, China	Linear stepwise regression model	• Negative
2.	Shahbaz et al. (2015)	Determinants of Life Expectancy and its Prospects Under the Role of Economic Misery: A Case of Pakistan	Time series analysis using ARDL (1972–2012)	• Negative
3.	Delavari et al. (2016)	Life Expectancy and its Socioeconomic Determinants in Iran	Time series analysis using ARDL (1985 - 2013)	• Negative
4.	Subramaniam, Devadason and Loganathan (2013)	Life Expectancy Among the Indian Minority Group in Malaysia: A Study	Time series analysis using ARDL (1970-2005)	• Negative
5.	Sade and Ohemeng (2013)	Socio-economic determinants of life expectancy in Nigeria	Time series analysis using ARDL (1980-2011)	• Negative

EMPIRICAL FRAMEWORK (CO_2)

No.	Author	Title	Method	Relationship
1.	Balan (2016)	Environmental Quality and its Human Health Effects: A Causal Analysis for the EU-25	Causality relationships	• Negative
2.	Mariani et al. (2008)	Life Expectancy and the Environment	Overlapping generations (OLG)	• Negative
3.	Delavari et al. (2016)	Life Expectancy and its Socioeconomic Determinants in Iran	Time series analysis using ARDL (1985 - 2013)	• Positive (not significant)
4.	Amuka et al. (2018)	Climate change and Life Expectancy in a Developing Country: Evidence from Greenhouse Gas (CO_2) Emission in Nigeria	Ordinary least squares (OLS)	• Positive (not significant)

EMPIRICAL FRAMEWORK (SMOKING)

No.	Author	Title	Method	Relationship
1.	Welte, König and Leidl (2000)	The costs of health damage and productivity losses attributable to cigarette smoking in Germany	Attributable risks and the prevalence-based approach	• Negative 22% of all male and 5% of all female deaths as well as 1.5 million years of potential life lost were attributable to smoking
2.	Shaw, Horrace and Vogel (2005)	The Determinants of Life Expectancy: An Analysis of the OECD Health Data	Ordinary least squares (OLS)	• Negative
3.	Stewart, Cutler and Rose (2009)	Forecasting the Effects of Obesity and Smoking on U.S. Life Expectancy	Based on three surveys	• Negative • If all U.S. adults became non-smokers of normal weight by 2020, the life expectancy of an 18-year-old would increase by 3.76 life-years or 5.16 quality-adjusted years
4.	Sturm (2002)	The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs	Household telephone survey fielded in 1997–1998	• Negative

EMPIRICAL FRAMEWORK (OBESE)

No.	Author	Title	Method	Relationship
1.	Fontaine et al. (2003)	Years of Life Lost Due to Obesity	Survey data from the National Health and Nutrition Examination Survey (NHANES)	• Negative
2.	Stewart, Cutler and Rose (2009)	Forecasting the Effects of Obesity and Smoking on U.S. Life Expectancy	Based on three surveys	• Negative If all U.S. adults became non-smokers of normal weight by 2020, the life expectancy of an 18-year-old would increase by 3.76 life-years or 5.16 quality-adjusted years
3.	Kinge and Morris (2012)	Forecasting the Effects of Obesity and Smoking on U.S. Life Expectancy	Based on British Health and Lifestyle Survey (1984 to 1985)	• Negative Obese men have a lower predicted life expectancy For women, at younger ages, life expectancy has a negative relationship with obesity
4.	Sturm (2002)	The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs	Household telephone survey fielded in 1997–1998	• Negative Obesity appears to have a stronger association with the occurrence of chronic medical conditions, reduced health-related quality of life, and increased health care and medication spending

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METHODOLOGY

DESCRIPTION OF DATA

- This study employs annually frequency data, covering the period of 1980 to 2017.
- The number of observations is 38 years

Variable	Description	Sources of Data
LE	Average number of years that a new born is expected to live if the patterns of mortality at the time of its birth were to stay the same throughout its life	Department of Statistics (DOSM)
GDPC	Value of all goods produced and services provided in a country in a year divide with the number population in US($)	World Development Indicator, World Bank (WDI)
ILLIT	% of the population aged 10 years and over who cannot both read and write.	Department of Statistics (DOSM)
CO_2	Carbon dioxide emissions (metric tons per capita)	World Development Indicator, World Bank (WDI)
SMOKING	Number of cigarettes consumed by each population.	Ministry of Health (MOH)
OBES	% of adults aged 18+ years old who has body-mass index (BMI) that greater or equal to 30	Global Health Observatory, World Health Organization (GHO)

MODEL SPECIFICATION

Based on the theories and empirical studies, the model framework for this study is designated based on the study by Kabir (2008); Subramaniam, Devadason, & Loganathan (2013) and Delavari et al. (2016). The model specification is as follows:

$$lnLE_t = \beta_0 + \beta_1 lnGDPC_t + \beta_2 Illit_t + \beta_3 lnCO2_t + \beta_4\ lnSMOKING + \beta_5 OBES_t + \varepsilon_t$$

Where,

LE	=	life expectancy at birth
GDPC	=	GDP per capita
ILLIT	=	illiteracy rate
CO_2	=	CO_2 emission (metric tons per capita)
CIG	=	cigarette consumption per capita
OBES	=	percentage prevalence of obesity age more than 18 years old with body-mass index (BMI) ≥ 30

EXPECTED SIGN

Variable	Expected Sign	Supported by
GDPC	+	Lei et al. (2009) Delavari et al. (2016)
ILLIT	-	Lei et al. (2009) Subramaniam, Devadason, & Loganathan (2013) Delavari et al. (2016) Shahbaz et al. (2016)
CO_2	-	Mariani et al. (2008) Balan (2016)
SMOKING	-	Welte, König, & Leidl (2000) Shaw, Horrace, & Vogel (2005) Stewart, Cutler, & Rosen (2009)
OBES	-	Sturm (2002) Fontaine et al. (2003) Robroek et al. (2011) Kinge and Morris (2012)

ESTIMATION TECHNIQUE

Unit Root Test
Test for Stationary

- Augmented Dickey Fuller (ADF)
- Phillips Perron (PP)

Cointegration Test
Examining the LR & SR

- ARDL Bounds testing
- ARDL Level relations

Diagnostic Test
Test the Validity of a Model

- Heteroskedasticity Test: Breusch-Pagan-Godfrey
- Breusch-Godfrey Serial Correlation LM Test
- Jarque-Bera Normality test

Stability Test
Test Stability of a Model

- Recursive Estimates: CUSUM and CUSUMSQ

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RESULT & DISCUSSION

FINDINGS: UNIT ROOT TEST

VARIABLES	ADF		PHILIP PERRONS	
	Constant	With Trend	Constant	With Trend
		LEVEL		
LE	-1.5806	-3.3595*	-3.0755**	-3.2847*
GDPC	-0.5521	-2.2833	-0.5521	-2.4805
ILLIT	-1.1014	-1.5670	-1.2216	-1.3735
CO_2	-1.4024	-1.4922	-1.4246	-1.5844
SMOKING	0.4146	-1.8582	0.0647	-4.5412***
OBES	3.8438	-2.0709	3.6665	-1.9648
		FIRST DIFFERENT		
LE	-8.6686***	-8.7841***	-8.9212***	-11.1999***
GDPC	-5.1590***	-5.0846***	-5.1230***	-5.0441***
ILLIT	-7.8096***	-6.4028***	-7.9196***	-8.3767***
CO_2	-6.6733***	-6.7633***	-6.6412***	-6.7297***
SMOKING	-12.4217***	-12.4000***	-16.3328***	-31.5947***
OBES	-1.5983	-3.4807*	-1.9768	-4.3605***

Note: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

- All variables are integrated at first difference except SMOKING is integrated at level
- Thus, **unit root result confirmed the model can perform the ARDL** to exhibits long-run relationship

FINDINGS: COINTEGRATION TEST

F-statistics	5.290534	
K	5	
Critical Value	I(0): Lower bounds	I(1): Upper bounds
10%	2.483	3.708*
5%	2.962	4.338*
1%	4.045	5.898

Note: (1) The bounds critical values are obtained from Narayan (2005), Case III: unrestricted intercept and no trend with k = 5

(2) The asterisk (*) denotes that the statistics are significant at 5% and 10% level.

(3) The structural lags are determined by using Schwarz Info Criterion (SC).

- F-statistics = 5.290534 > critical upper bound I(1) at 5% and 10% significant level; thus reject null hypothesis
- There is a **long-run relationship between LE and its determinants**

FINDINGS: LONG-RUN COEFFICIENT

Dependent variable: LE				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
GDPC	*0.014768**	*0.007311*	*2.019987*	*0.0530*
ILLIT	*-0.008516****	*0.001296*	*-6.569720*	*0.0000*
CO_2	*-0.034639****	*0.010173*	*-3.405076*	*0.0020*
SMOKING	*-0.014090***	*0.005716*	*-2.464828*	*0.0201*
OBES	*-0.003088***	*0.001274*	*-2.424603*	*0.0220*

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

- **All variables are consistent with the expected sign of the coefficients**
- GDPC has a significant positive relationship with LE
- While ILLIT, CO_2, SMOKING and OBES have a negative relationship and significant with LE

FINDINGS: SHORT-RUN COEFFICIENT

Dependent variable: LE				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
DGDPC	0.014715**	0.006662	2.208794	0.0355
DILLIT	-0.003751**	0.001644	-2.281796	0.0303
DCO_2	-0.010732	0.009003	-1.192010	0.2433
DSMOKING	-0.013160***	0.003758	-3.501422	0.0016
DOBES	-0.002008	0.002169	-0.925945	0.3624
ECT (-1)	-0.867364***	0.150310	-5.770522	0.0000

Notes: (1) D =First difference operator.
(2) (*) Significant at the 10%; (**) Significant at the 5%; and (***) Significant at the 1%.
(3) The optimal lag-length is determined by the Schwarz Info Criterion (SC)

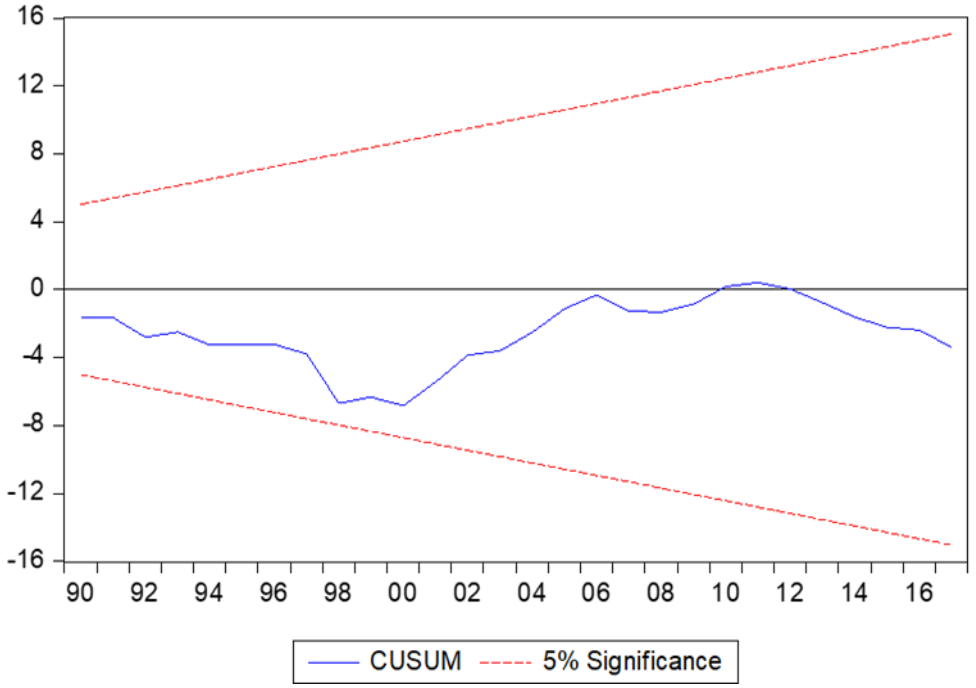
- GDPC has a significant positive relationship, while ILLIT and SMOKING have a negative relationship and significant with LE as in line with long-run coefficient.
- Meanwhile, CO_2 and OBES has a negative impact on LE but insignificant in the short-run
- **ECM is negative and statistically significant at 1% level**. The **adjustment to long run** equilibrium is about **1 year and 2 months**

FINDINGS: DIAGNOSTIC TEST

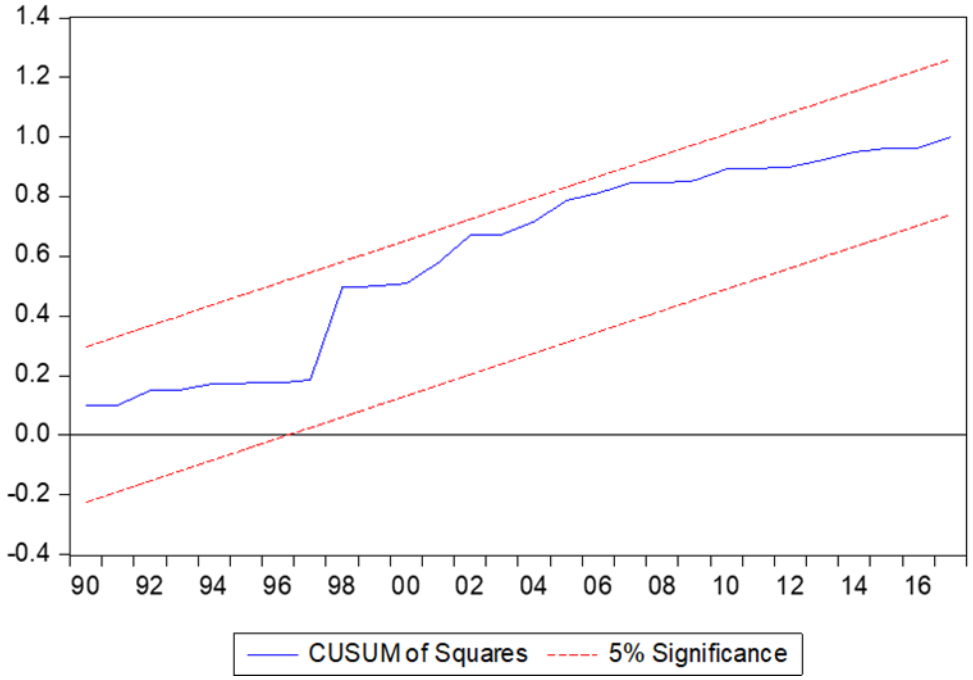
Assumption	Test	Prob.	Result
LM Serial Correlation	Breusch-Godfrey Serial Correlation LM Test	0.9986	H_0 failed to be rejected, therefore **no autocorrelation** problem existed
Heteroskedasticity	Breusch-Pagan-Godfrey	0.2854	H_0 failed to be rejected, therefore **homoscedastic**
Normality	Jacque-Bera	0.6851	H_0 failed to be rejected, therefore **normally distributed**

This has shown that the study has **economic significance and reasonable model**

FINDINGS: STABILITY TEST



Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals

The null hypothesis of parameter stability cannot be rejected at the 5% level of significance, indicating the **long-run parameter estimates is stable**

5

LIMITATION OF THE STUDY

LIMITATIONS OF THE STUDY

Availability of more frequent data.

The study is unable to estimate the impact of the selected socio-economic determinants on life expectancy from the gender perspective

The method used in this study is limited to the ARDL approach. As such, the results might be different if different model specifications and methodology approaches were used

6
CONCLUSION & RECOMMENDATION

CONCLUSION

The study examines the relationship between LE and socio-economic determinants in Malaysia during the period of 1980-2017 using the ARDL method. Based on the findings:

- **Income plays an important determinant** as the GDPC has a significant positive relationship on LE in the short-run & long-run

- **ILLIT and SMOKING have a significant negative relationship** with LE in the short-run & long-run

- Meanwhile, **CO_2 and OBES has a negative impact on LE in the long run but insignificant in the short-run**

POLICY RECOMMENDATION

- **Create more job opportunities** including to the ageing people to ensure sustainable income

- Reducing CO_2 emission by **promoting efficient growth** by using natural resources efficiently, minimizes pollution and its impact on the environment
  - Comply with environmental standards
  - Improve public transport

- **Education is an important element to reduce obesity and smoking**. Government and all related agencies need a proper plan to increase awareness on the dangerous effect of obesity and smoking to reduce this problem in Malaysia

POLICY RECOMMENDATION

- In line with various measures taken by the Government and other authorities to reduced smoking, the **enforcement aspect needs to be strengthened** to ensure all people follow all the rules to ensure the successful implementation of the plans
- The policymaker as well as the private sector are recommended to play a significant role in addressing the issue of the ageing population by **providing better facilities as well as financial, social and psychology to the ageing population to ensure they can have a better life**
- In addition, **long-term care services need to be improved** to enhances the quality of life of the ageing population
- The government also need to ensure the **successful execution of The National Policy for Older Persons and Plan of Action for Older Persons** to ensure a conducive environment for ageing persons

THANK YOU