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Factors Affecting Life Expectancy Comparative Study between Thailand and Japan (1990-2015)

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Abstract

Life expectancy reflects how long people live. This study examines data from 1995 to 2015 (26 observations) to identify factors that contribute to longer life expectancy. It compares Thailand and Japan, using the same factors for both countries. The three main factors considered are Gross National Income per capita (GNI), Mean Years of Schooling (SCH), and Infant Mortality Rate (INM). The findings reveal that GNI and INM are statistically significant factors for both Thailand and Japan, whereas Years of Schooling is not statistically significant in either country.

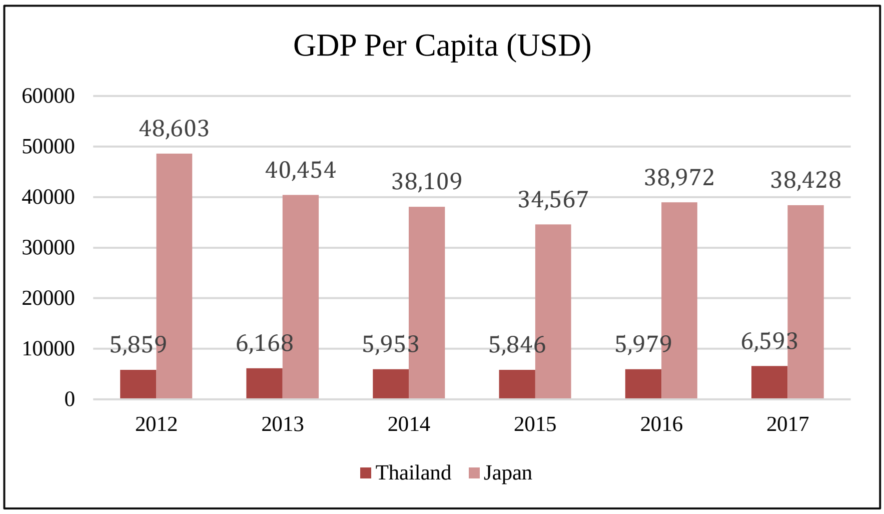
Keywords: Life Expectancy, Thailand, Japan

Introduction

Being a high-income country implies that it can afford better goods and services. According to the World Bank (n.d.), Thailand and Japan have notably different incomes (measured by GDP per capita). The graph and table show that Japan has a greater ability to purchase and consume goods and services.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Figure 1: GDP Per Capita (USD)



GDP per capita alone may not fully capture differences in quality of life. Agarwal (2017) explains that economic growth is crucial because it reflects national income, employment rates, and living standards. Additionally, higher economic growth allows the government to collect more taxes for national development, linking economic growth to various activities within the country.

Primarily, economic growth tends to improve the quality of life, as its benefits make living conditions more comfortable. Quality of life encompasses physical, material, social, emotional, and developmental well-being (Felce & Perry, 1995). Thus, economic growth impacts multiple dimensions of a country, especially its people.

Interestingly, statistical documents reveal that higher-income countries often have longer life expectancies, as shown in the graph of life expectancy at birth versus GDP per capita. Therefore, it appears that a better quality of life is statistically associated with longer lifespans.

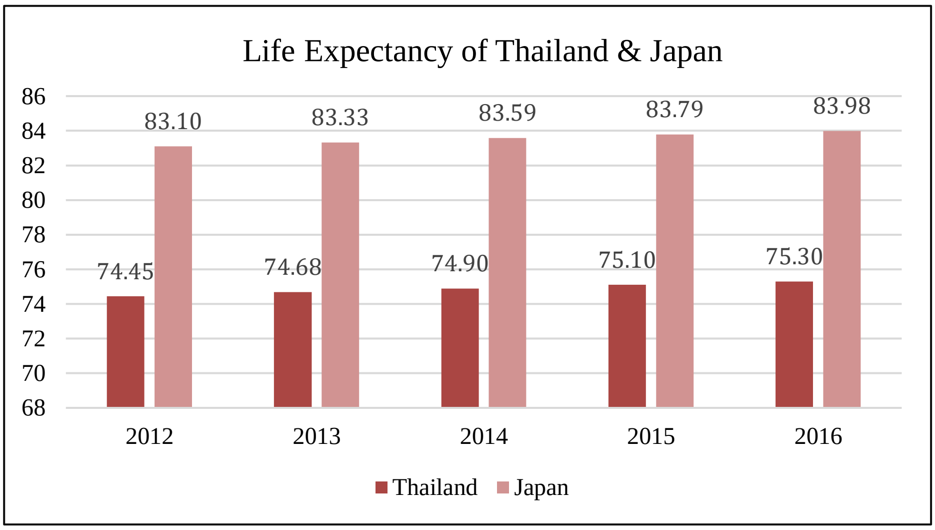


Figure 2: Life Expectancy of Thailand and Japan

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

The two graphs (Figure 1 & 2) above indicate that countries with higher incomes generally have longer life expectancies. Higher national income allows governments to build better hospitals, support research and development, and provide other services. For citizens, more income means a greater ability to purchase goods and services, such as effective medicine. While high income does not directly equate to better quality of life, it provides more opportunities to access resources that improve it. This observation leads to the study of factors that drive economic growth, with Thailand and Japan chosen for comparison to identify differences in the same factors.

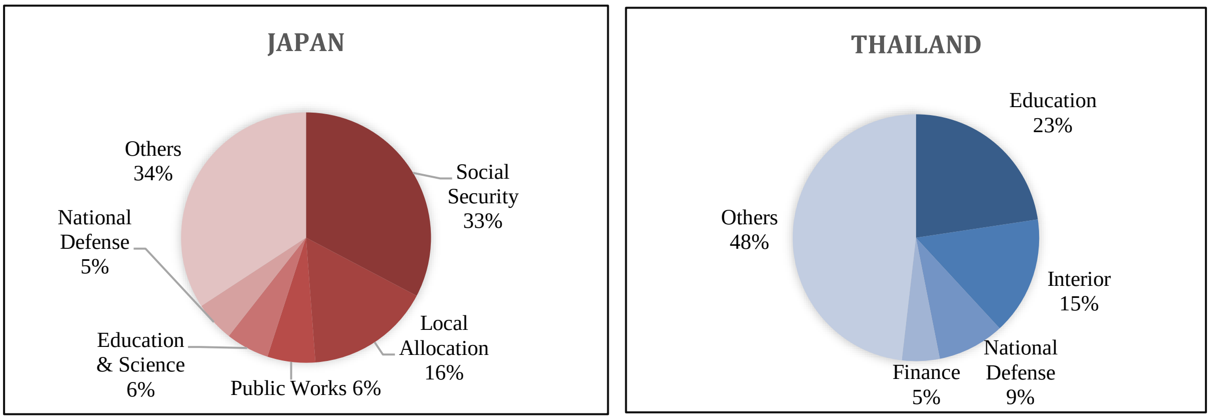


Figure 3: Budget breakdown 2015

As Figure 3 shows, the data shows significant differences between the GDP per capita of Japan and Thailand, highlighting a clear gap between the two countries. Additionally, government spending patterns differ markedly. According to Japan's Ministry of Finance (2015), Japan allocates about 33 percent of its expenditures to social security. In contrast, the Thai government prioritizes education spending (Saiyasombut, 2014). These differences illustrate how each country operates its system. Therefore, to understand what contributes to longer life expectancy through economic growth and other significant factors, it is important to compare the same factors for both countries.

Literature Reviews

Firstly, Lee and Kim (2017) investigated factors influencing life expectancy in South Korea, focusing on educational attainment, electric power consumption, education, and infant mortality. Their results showed that educational attainment, electric power consumption, and education positively impacted life expectancy, while infant mortality negatively affected it, indicating the level of healthcare provided.

Additionally, Base, Kim, and Lee (2017) concluded that socioeconomic factors, behaviors, and psychosocial factors significantly influence subjective life expectancy. They found that gender, household income, smoking habits, and stress affect the differences between subjective and actuarial life expectancy in South Korea. Chan and Devi (2012) noted that in Thailand, Malaysia, and Singapore, increased healthcare resources and socioeconomic factors could enhance life expectancy, while demographic changes could also boost it when combined with healthcare resources.

Ali and Ahmad (2014) showed that in the long run, food production and primary school enrollment positively and significantly relate to life expectancy, while population growth has a negative and significant relationship. This indicates that education, behaviors, and resource allocation impact life expectancy.

The Population Reference Bureau (2006) stated that higher life expectancies signify more developed countries. Upreti (2015) added that life expectancy reflects the effectiveness of disease prevention and the quality of healthcare, and improvements in healthcare can lead to economic development.

The Australian Institute of Health and Welfare (2016) found that cardiovascular diseases, external causes, and cancer significantly affect life expectancy, highlighting the importance of health behaviors. Amir (2016) emphasized that education is key to increasing life expectancy, citing examples of developed countries like Spain, Finland, and the USA.

The CDC's National Center for Health Statistics (2012) showed that higher income correlates with higher life expectancy. Hansen (2012) referred to Ben-Porath's 1967 study, noting that the benefits of education extend over a longer period as life expectancy increases.

According to the World Health Statistics (2009), countries with low life expectancy tend to have high infant mortality rates, such as the African region, which had an estimated life expectancy of only 52 years in 2007 compared to 76 years in the Americas.

Methodology

Secondary data from Japan and Thailand is used for analysis to understand factors affecting economic development. The study spans 26 years (from 1990 to 2015) to compare how a developed country and a developing country rely on different activities to influence life expectancy. According to the World Economic Situation and Prospects (2014), Thailand is classified as a developing economic region, while Japan is classified as a developed economic region. As noted in the introduction, GDP per capita and government budgets show significant differences between the two countries.

Various studies have identified multiple variables affecting life expectancy. Therefore, this study measures life expectancy using Gross National Income per Capita, Literacy, and Infant Mortality, with data sourced from the World Bank. To interpret the relationship between variables, it is essential to control for other factors and ensure that

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

both countries are studied using the same four independent factors. Life expectancy is set as the dependent variable, while the other three factors are set as independent variables.

Table 1 - Variables, Descriptions, and Units

Variable Name	Description	Unit
LIF	Life Expectancy at Birth	Year
GNI	Gross National Income Per Capita	US$
LIT	Literacy rate, adult total (% of people ages 15 and above)	Percent
INM	Mortality rate, infant (per 1,000 live births)	1 : 1000

Data from each country was collected and analyzed using multiple Ordinary Least Squares (OLS) regressions to explore relationships between economic conditions and life expectancy. The goal is to develop a forecasting model where life expectancy at birth is the dependent variable, and various factors affecting life expectancy are the independent variables.

The dependent variable, Life Expectancy at Birth (LIF), represents the average period a person can expect to live. The first independent variable, Gross National Income (GNI) per capita, is based on purchasing power parity and includes the total value added by all resident producers, including product taxes but excluding employee compensation and property income from abroad. This variable is denoted as GNI.

The second independent variable is the Adult Literacy Rate (LIT), which measures the percentage of people aged 15 and above who can read and write a simple statement about their everyday life. The third independent variable, the Infant Mortality Rate (INM), is the number of infants dying before reaching one year of age per 1,000 live births in a given year.

In addition, Data from 1990 to 2015 (26 observations) was used for this analysis. After adjusting all data to the same periods, the OLS model was applied. There was no need to transform the numbers into logarithmic forms to stabilize variances and prevent heteroscedasticity, as all models were checked for heteroscedasticity, with results shown in tables 5 and 6.

$$LIF_i = \beta_0 + \beta_1(GNI_i) + \beta_2(SCH) + \beta_3(INM_i) + e_i \qquad (1)$$

Where:
LIF_i = Life Expectancy
GNI_i = Gross National Income Per Capita
SCH_i = Mean years of Schooling
INM_i = Infant Mortality

However, when the regression was done. There was not an autocorrelation problem, and to reach our intention of the study, we separate data into two main sections which are Japan and Thailand, or it is called different two linear regression models.

Discussion and results

Table 2: Regression output for the data for 1990 to 2015 in Japan.
OLS: Using observation (n=26). Dependent Variable: Life Expectancy (LIF)

Variable	Coefficient	Std. Error	T-Ratio	P-Value	Significance
Constant	60.72727	10.56680	5.746986	0.0000	
GNI	0.000178	7.70E-05	2.308887	0.0307	**
SCH	0.766931	0.712441	1.076482	0.2934	
INM	1.712736	0.590825	2.898888	0.0083	***

R-Squared	0.361509	Mean dependent var	82.58025
Adjusted R-squared	0.274443	S.D. dependent var	0.697929
S.E. of regression	0.594494		
Sum squared resid	7.775305	Durbin-Watson stat	1.476868
F-statistic	4.152089	P-value(F)	0.017881

***, **, * demonstrate that each coefficient has p-v < 0.01, 0.05, and 0.10 respectively.

In Table 2, regression analysis was performed with LIF as the dependent variable and the three other factors as independent variables. The GNI and INM were found to be statistically significant, while SCH was not. The GNI and INM had low p-values, indicating they are likely meaningful additions to the model, with p-values of 0.0307 and 0.0083, respectively. In contrast, SCH had a p-value of 0.2934, indicating it is not statistically significant. Therefore, the study concludes that GNI and INM significantly affect life expectancy in Japan, while SCH does not. Additionally, this model does not have an autocorrelation problem.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Table 3: Regression output for the data for 1990 to 2015 in Thailand.
OLS: Using observation (n=26). Dependent Variable: Life Expectancy (LIF)

Variable	Coefficient	Std. Error	T-Ratio	P-Value	Significance
Constant	44.93723	4.299346	10.45211	0.0000	
GNI	0.000970	7.66E-05	12.66340	0.0000	***
SCH	1.540770	0.249343	6.179331	0.0000	***
INM	0.348925	0.075628	4.613729	0.0001	***

R-Squared	0.976719	Mean dependent var	71.93350
Adjusted R-squared	0.973544	S.D. dependent var	1.779404
S.E. of regression	0.289426		
Sum squared resid	1.842880	Durbin-Watson stat	0.697244
F-statistic	307.6541	P-value(F)	0.000000

***, **, * demonstrate that each coefficient has p-v < 0.01, 0.05, and 0.10 respectively.

In Table 3, regression analysis was conducted with LIF as the dependent variable and the three other factors as independent variables. As previously mentioned, this study aims to identify factors influencing life expectancy between two countries using similar variables but differing economic statuses (developed and developing). GNI, SCH, and IMN were found to be statistically significant. Each predictor with a low p-value is considered a meaningful addition to the model, with GNI, SCH, and IMN having p-values of <0.0000, 0.0000, and 0.0001, respectively. Therefore, the study concludes that these three independent variables (SCH, GNI, and IMN) significantly affect life expectancy in Thailand. However, this model exhibits an autocorrelation problem.

To solve the autocorrelation problem, we create a new model of Thailand.

$LIFi = \beta 0 + \beta 1(GNIi) + \beta 2(SCH) + \beta 3(INMi) + \beta 4(lagLIFi) + e_i$ ....*(2)*

Notice $LIF_i = lagLIF_{i+1}$

The result has come out as the table below (Table 4)

Table 4: Regression output for the data for 1991 to 2015 in Thailand.
OLS: Using observation (n=25). Dependent Variable: Life Expectancy (LIF)

Variable	Coefficient	Std. Error	T-Ratio	P-Value	Significance
Constant	-2.272492	1.832940	-1.239807	0.2294	
GNI	-4.83E-05	3.49E-05	-1.383289	0.1818	
SCH	0.198138	0.055826	3.549209	0.0020	***
INM	0.026537	0.015159	1.750537	0.0954	*
lagLIF	0.998008	0.033592	29.70999	0.0000	

R-Squared	0.999530	Mean dependent var	72.00084
Adjusted R-squared	0.999436	S.D. dependent var	1.781963
S.E. of regression	0.042321		
Sum squared resid	0.035822	Durbin-Watson stat	1.124994
F-statistic	10632.20	P-value(F)	0.000000

***, **, * demonstrate that each coefficient has p-v < 0.01, 0.05, and 0.10 respectively.

In Table 4, regression analysis was performed with LIF as the dependent variable and the other three factors as independent variables. This model was specifically designed to mitigate serial correlation or autocorrelation issues. SCH and IMN were found to be statistically significant, indicating that predictors with low p-values are likely meaningful additions to the model. However, GNI was not statistically significant. Therefore, in this study's model for Thailand, it is concluded that SCH and IMN significantly affect life expectancy.

To assess serial correlation, the Durbin-Watson statistic for this model was 1.124. Referring to the Durbin-Watson table with K=4 and a 5% significance level, the critical values are dL = 1.03 and dU = 1.767. Since the Durbin-Watson statistic falls between these values, it is inconclusive whether this model exhibits autocorrelation issues or not.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Table 5: Heteroscedasticity Test: Breusch-Pagan-Godfrey of Japan

Null hypothesis: Homoscedasticity			
F-statistic	2.103748	Prob. F(3,22)	0.1288
Obs*R-squared	5.796013	Prob.Chi-Squared(3)	0.1220
Scaled explained SS	8.031319	Prob.Chi-Squared(3)	0.0453

Test equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1990 2015
Included Observations: 26

Variable	Coefficient	Std.Error	t-Statistic	Prob.
Constant	15.37980	10.02358	1.534361	0.1392
GNI	-0.000134	7.30E-05	-1.830638	0.0807
SCH	-0.475805	0.675816	-0.704045	0.4888
INM	-1.321760	0.560452	-2.358382	0.0277

R-squared	0.222924	Mean dependent var	0.299050
Adjusted R-squared	0.116959	S.D. dependent var	0.600117
S.E. of regression	0.563932	Akaike info criterion	1.832872
Sum squared resid	6.996427	Schwarz criterion	2.026426
Log likelihood	-19.82734	Hannan-Quinn criter.	1.888609
F-statistic	2.103748	Durbin-Watson stat	0.866025
Prob(F-statistic)	0.128823		

In table 5, the Prob.Chi-Squared (3) value is 0.1220, and the significance level (alpha) is 5% (0.05). Therefore, the null hypothesis (H0) is set as "residuals are not heteroscedastic," and the alternative hypothesis (Ha) is "residuals are heteroscedastic." Since the p-value (0.1220) exceeds the alpha value (0.05), there is insufficient evidence to reject the null hypothesis. Thus, it can be concluded that the residuals exhibit homoscedasticity.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Table 6: Heteroscedasticity Test: Breusch-Pagan-Godfrey of Thailand

Null hypothesis: Homoscedasticity			
F-statistic	0.687467	Prob. F(4,20)	0.6091
Obs*R-squared	3.021852	Prob.Chi-Squared(4)	0.5542
Scaled explained SS	1.303664	Prob.Chi-Squared(4)	0.8608

Test equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1991 2015
Included Observations: 25

Variable	Coefficient	Std.Error	t-Statistic	Prob.
Constant	-0.102256	0.075535	-1.353755	0.1909
GNI	-1.91E-06	1.44E-06	-1.323897	0.2005
SCH	-0.002762	0.002301	-1.200709	0.2439
INM	-0.000618	0.000625	-0.989729	0.3341
lagLIF	0.002126	0.001384	1.535747	0.1403

R-squared	0.120874	Mean dependent var	0.001433
Adjusted R-squared	-0.054951	S.D. dependent var	0.001698
S.E. of regression	0.001744	Akaike info criterion	-9.688339
Sum squared resid	6.08E-05	Schwarz criterion	-9.444564
Log likelihood	126.1042	Hannan-Quinn criter.	-9.620726
F-statistic	0.687467	Durbin-Watson stat	1.808759
Prob(F-statistic)	0.609054		

In Table 6, the Prob. Chi-Square(3) value is 0.5542, and the significance level (alpha) is 5% (0.05). Therefore, the null hypothesis (H0) states "residuals are not heteroscedastic," while the alternative hypothesis (Ha) suggests "residuals are heteroscedastic." Since the p-value (0.5542) is greater than the alpha value (0.05), there is insufficient evidence to reject the null hypothesis. Thus, it can be concluded that the residuals in Table 6 also exhibit homoscedasticity, similar to Table 5.

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

The regression model aims to examine how specific variables impact life expectancy, analyzing each variable separately for Thailand and Japan.

In Japan, Gross National Income per capita (GNI), as shown in Table 2, significantly influences life expectancy. GNI reflects the country's economic capability, indicating that higher income levels enable citizens and businesses to access more opportunities, potentially leading to increased life expectancy. Similar findings are observed in Thailand, where GNI is also statistically significant (Tables 2 and 3), with p-values less than 0.0001.

Both countries also rely significantly on Infant Mortality (INM) rates to gauge life expectancy. Lower infant mortality rates signify advancements in healthcare, technology, and health awareness, contributing to higher life expectancy. Japan shows a p-value of 0.0083 (Table A) and Thailand 0.0001 (Table 3) or 0.954 (Table 4), indicating the critical role of this factor in both countries.

On the other hand, Years of Schooling (SCH) shows varying impacts between Thailand and Japan. In Thailand, SCH does not appear to significantly affect life expectancy, with p-values at 0.1818 (Table 4), while Japan shows a p-value of 0.2934 (Table 2), similarly not statistically significant. Despite this, education is crucial in enhancing health awareness, although the quality of education differs between the countries. Japan ranks higher in educational quality than Thailand, according to Topuniversities (2018), despite Thailand investing more in years of schooling.

Overall, the study underscores that Gross National Income per capita and Infant Mortality are pivotal indicators influencing life expectancy across both Japan and Thailand.

Recommendation

The results indicate that Infant Mortality (INM) and Gross National Income (GNI) are statistically significant factors influencing life expectancy in both Japan and Thailand, whereas Years of Schooling (SCH) does not show statistical significance in either country. Higher GNI levels are observed to correlate with increased life expectancy in both nations. This relationship may be attributed to GNI providing households with greater access to high-quality healthcare, medicines, and educational opportunities. Policies aimed at boosting GNI can benefit both the country and its citizens, as higher income levels lead to increased consumption and tax revenues, which can be invested in public goods. Education, represented by SCH, is crucial as it enhances overall quality of life and fosters innovation and professional capabilities within a country. Lower Infant Mortality rates, facilitated by advancements in innovation and technology, are also crucial for improving life expectancy.

Conclusion

To conclude, based on the study, secondary data spanning 26 observations from 1990 to 2015 were gathered to conduct regression analysis on three primary factors: gross national income per capita, years of schooling, and infant mortality. The aim was to identify which factors significantly affect Thailand and Japan statistically. These countries are categorized differently based on their economic development, with Thailand classified as a developing nation and Japan as a developed one. The study revealed that both Thailand and Japan show statistically significant correlations between gross national income per capita and infant mortality, despite their differing economic statuses.

References

Agarwal, P. (2017). What is Economic Growth? Retrieved from https://www.intelligenteconomist.com/economic-growth/

Ali, A., & Ahmad, K. (2014). The Impact of Socio-Economic Factors on Life Expectancy for Sultanate of Oman: An Empirical Analysis. Retrieved from https://mpra.ub.uni-muenchen.de/70871/1/MPRA_paper_70871.pdf

Australian Institute of Health and Welfare. (2016). Main contributors to the Indigenous life expectancy gap. Retrieved from https://www.aihw.gov.au/getmedia/5d39a104-a2d5-4ab5-900c-697ee0e5a1d8/ah16-5-8-main-contributors-indigenous-life-expectancy-gap.pdf.aspx

Bae, J., Kim, Y., & Lee, J. (2017). Factors Associated With Subjective Life Expectancy: Comparison With Actuarial Life Expectancy. *Journal of Preventive Medicine & Public Health, 50*(4), 240-250. doi:10.3961/jpmph.17.036

Chan, M. F., & Devi, M. K. (2012). Factors Affecting Life Expectancy: Evidence From 1980-2009 Data in Singapore, Malaysia, and Thailand. *Asia-Pacific Journal of Public Health, 27*(2), 136-146. doi:10.1177/1010539512454163

Felce, D., & Perry, J. (1995). Quality of life: Its definition and measurement. *Research in Developmental Disabilities*, 16(1), 51-74. doi:https://doi.org/10.1016/0891-4222(94)00028-8

Hansen, P. W. (2012). The effect of life expectancy on schooling: Evidence from the international health transition. Discussion Papers on Business and Economics. Retrieved from http://www.sdu.dk/-/media/files/om_sdu/institutter/ivoe/disc_papers/disc_2012/dpbe6_2012.pdf

Ministry of Finance. (2015). Fiscal Policy in Japan - Issues and Future Directions -. Retrieved from https://www.mof.go.jp/english/budget/budget/fy2015/20151009.pdf

Khan, A., Khan, S., & Khan, M. (2016). Factors effecting life expectancy in developed and developing countries of the world (An approach to available literature). International Journal of Yoga, *Physiotherapy and Physical Education, 1*(1), 4-6. Retrieved from https://www.researchgate.net/publication/310240265_Factors_effecting_life_expectancy_in_developed_and_developing_countries_of_the_world_An_approach_to_available_literature.

Mortality and burden of disease. (2009). *World Health Statistics,1*. Retrieved from http://www.who.int/whosis/whostat/EN_WHS09_Table1.pdf

Lee, C., & Kim, M. (2017). The Factors Affecting Life Expectancy in South Korea. *Ecoforum Journal, 6(3)*. Retrieved from http://www.ecoforumjournal.ro/index.php/eco/article/view/684

Journal of Modern Management
Shinawatra University
Vol. 2 No. 3 July – September 2024

Population Reference Bureau. (2006). The Future of Human Life Expectancy: Have We Reached the Ceiling or is the Sky the Limit? Retrieved from https://assets.prb.org/pdf06/NIA_FutureofLifeExpectancy.pdf

Saiyasombut, S. (2014). The Thai Junta's 2015 draft budget, explained in 4 graphs. Retrieved from https://asiancorrespondent.com/2014/08/thai-juntas-2015-draft-budget-infographics/

Topuniversities. (2018). QS Higher Education System Strength Rankings. Retrieved from https://www.topuniversities.com/system-strength-rankings/2018

World Bank. (n.d.). GNI per capita, PPP (current international $). Retrieved from https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD

World Economic Situation and Prospects. (2014). Country classification. Retrieved from http://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf