GEOGRAFIA Online™ Malaysian Journal of Society and Space 14 issue 4 (65-73)
© 2018, e-ISSN 2680-2491 https://doi.org/10.17576/geo-2018-1404-06

Ageing population and health care expenditure: Evidence using time series analysis

Roziana Baharin, Suhaila Saad

Faculty of Economics and Management, Universiti Kebangsaan Malaysia

Correspondence: Roziana Baharin (emel: roziana.baharin@ukm.edu.my)

Abstract

This study is conducted to examine the relationship between population agieng and its effects on total health expenditure since there has been less attention given in analysing this issue particularly in developing countries. Thus, the study covers a period from 1995 to 2014 and was analysed in 3 countries in Southeast Asia; Malaysia, Indonesia, and Thailand. This study applies Autoregressive Distributed Lag (ARDL) method with Bound test approach to examine the existance of cointegration in the model. Apart from that Vector Error Correction Model (VECM) was also estimated to investigate the short run nexus. For validation and appropriate model specification purpose, different econometric diagnostic tests were applied. The motivation of this study is to shed some light on the growing concern of raising ageing population across the world and the burden carried with it, namely health expenditure. The result of this study supports previous studies where increasing numbers of ageing population has significantly affect health expenditure in Malaysia and Indonesia while in the case of Thailand its remains insignificant. The ageing does not affect health expenditure in Thailand probably due the fact that major healthcare provider in Thailand is private sector which implies that health expenditure are mostly determined by the affordability of population to pay for health services. Thus, in order to ensure that raising of ageing population would not increase the burden via health expenditure, the government should embark on the education campaign to encourage a healthy life style among adulthood since they were young.

Keywords: ageing population, ARDL, expenditure, growth, health, public spending

Introduction

There are three categories of society that are classified based on the proportion of the elderly population of the entire population that exist in a country (Coulmas, 2007). The first agieng category refers to countries with 7 percent to 13 percent of people aged 65 and above. The next category is when the elderly population dominates the country by 14 percent to 20 percent while for the last category the ageing category of hyper-aged has a population of 65 years and above by 21 percent or more. The nexus of ageing and health has extensively discussed on previous literatures. Mahal and McPake (2017) indicate two major factors contributing to the rising number of elderly are mainly due to the decline in adult mortality rates along with lower fertility rates where both are certainly achieved through the improvement in health sector. Health can be determined by multi-dimensional factors that

include people's lifestyle, their perception of health and illness, and their health-seeking behaviour. Social support generally shows a favourable impact and the maintenance of health and coping with stress and illness (Yew & Noor Azlan, 2014).

According to Hamid (2015a, 2015b), Malaysia will be an agieng country by 2020 where Malaysians age 65 years and over will reach 7 percent. However, when it reaches 7 percent, the rate of agieng will be faster which anticipate that it would take merely 23 years for Malaysia to double its total population to 14 percent by 2043, a much faster rate compared to the developed countries such as France which takes 115 years to double the elderly population from 7 percent to 14 percent (Kinsella & He, 2009).

The projection by the Department of Statistics, Malaysia shows that in 2040, the total of population aged 65 years and above is estimated at around 14.5 percent. Population ageing will be high when the lifespan of the population increases while the fertility rate of the population decreases. This phenomenon is reflected in the changing demographics of Malaysia over time. According to the World Bank (2014), in 1970, Malaysia's elderly population was only 3.3 percent but increased to 5.4 percent in 2013. At the same time, the proportion of young people aged less than 14 years decreased from 44.8 percent in 1970 to 26.1 percent in 2013, while the population increased from 51.9 percent in 1970 to 68.5 percent in 2013. The increase in the percentage of the elderly and the fall in the proportion of the population aged 14 years and below was feared to result in a long-term disruption if the pattern of change is continuous.

This study was conducted to estimate the relationship between the elderly population and health expenditure in Malaysia, Thailand and Indonesia. More specifically, the objective of this study is to estimate the effect of increasing elderly population on health spending among the three countries. The result indicates that there was a significant correlation between the elderly population and health expenditure. The discussion in the next section will discuss the methodology which is about the method of analysis used in this study. The next part is the result of the study that summarizes the results of the analysis and the final part discussing the policy implications and conclusions of the study.

Literature review

Issues about spending on the elderly especially for health purposes should be emphasized by all parties whether individuals or governments. This is because, in general, when age is growing or reaching the age 65 years and above, health spending will increase even if the allocation for health purposes is higher than the allocation for other requirements (Eiras & Niepelt, 2012). The rising number of elderly in Malaysia should be given attention by the government and not to underestimate this issue as it affects the pension scheme. According to Ibrahim (2012) the pension recipients are gradually increasing. Hence, the government should look for alternatives to reduce the pension liability if the elderly continues to increase. Additionally, the dependency burden on these groups will also increase if older populations continue to rise while birth rates decline. As a consequence, the ratio of the young and the elderly will be unbalanced (Eliska, 2015). The imbalance ratio of young to elderly will give a significant impact to the worker's participation in labour market which eventually would affect the economic performance of a country (Knickman & Snell, 2002). On the other hand, the expenditure on health would also increase as age increases. Ogawa et al. (2009) reveal that age structural transformation have effected the public and private healthcare cost in several Asia countries such as Thailand, Taiwan and Japan. In addition, Fredrik (2013) found identical research findings as the health expenditure per capita is growing steeper as the age increases after 50 years old.

Although many of previous studies emphasize on the significance of elder population to the health expenditure but there are also several studies against this. Thus, while it can be said with some confidence that an ageing population will increase healthcare spending, there is greater uncertainty as to how great the burden on public expenditures will be, or what policymakers can do to respond to these changes (Townsend, 2016).

Ikeda et al. (2011) reveals that the rising number of ageing population does not necessarily cause higher health spending. In Japan, health spending was approximately only 8.5 percent per Gross Domestic Product which is in 20th position compared to other developed countries with lower number of ageing population. Moreover, there is also a past study that shows the improper increase in health spending was due to the increase in the elderly population. The study by Seshamani and Gray (2004) shows the health allocation for individuals approaching deaths regardless of age or youth is much higher than the health provisions for agieng. In fact, the increase in monthly health spending for the elderly increases significantly with age but this increase is actually more primarily driven by rising mortality rates due to high health spending when approaching death (Yang et al., 2003).

This study was conducted to estimate the relationship between the elderly population and health expenditure in Malaysia, Thailand and Indonesia. More specifically, the objective of this study is to estimate the effect of increasing elderly population on health spending among the three countries. The result indicates that there was a significant correlation between the elderly population and health expenditure. The discussion in the next section will discuss the methodology which is about the method of analysis used in this study. The next part is the result of the study that summarizes the results of the analysis and the final part discussing the policy implications and conclusions of the study.

Methods

The study was conducted to estimate the impact of the elderly population on healthcare expenditure in Malaysia and its neighboring countries, Thailand and Indonesia. The data for the relevant variables was obtained from the Department of Statistics, Malaysia (DOS) and World Bank. The variables used for this analysis include total health expenditure, total numbers of population age 65 and above, total numbers of population age below 14, gross domestic product, infant mortality (Getzen, 1992; Dang et al., 2001; Ang, 2010; Lakshmi et al., 2012). All the data for these variables were collected from 1995 to 2014, which covers a period of 20 years.

This study was carried out by modifying the model developed by some previous researchers such as Ang (2010) and Nordin et al. (2016). Specification of health expenditure model for this study is as follows:

$$LnTHE_t = \beta_0 + \beta_1 LnPOP65_t + \beta_2 LnPOP14_t + \beta_3 LnGDP_t + \beta_4 IM_t + \varepsilon_t \qquad (1)$$

where THE represents the total health expenditure per capita acting as the variable to be described in the model. Other variables are LPOP65, LPOP14, LGDP and IMR referring to the number of population over 65 years old, total population below 15 years old, gross domestic product constant 2010, and number of infant mortality respectively.

In this study, the analysis was conducted using the Autoregressive Distributed Lag Approach (ARDL) model approach. The first focus of analysis was to examine the long-run relationships between elderly and health expenditure. Hence, the Bound Test developed by

Pesaran et al. (2001) has been applied to estimate the possible co-integration between the variables. Model specification for Bound Test is as follows:

$$\Delta LnTHE_t = C_1 + \pi_i \sum_{i=1}^{p} \Delta LnTHE_{t-i} + \delta_i \sum_{i=0}^{p} \Delta LnPOP65_{t-i} + \gamma_i \sum_{i=0}^{p} \Delta LnPOP14_{t-i} + \varphi_i \sum_{i=0}^{p} \Delta LnGDP_{t-i} + \omega_i \sum_{i=0}^{p} \Delta IM_{t-i} + \theta_1 LnTHE_{t-1} + \theta_2 LnPOP65_{t-1} + \theta_3 LnPOP14_{t-1} + \theta_4 LnGDP_{t-1} + \theta_5 IM_{t-1} + \mu_t \quad (2)$$

where, Δ is the differentiation operator, p and μ_t are lag numbers and error terms respectively. The parameter containing the Σ sign indicates the short-run relationship between the variable and the dependent variable. Whereas the parameters θ_1, θ_2, θ_3, θ_4,and θ_5 also indicate the long-run relationship between the variables in the model.

According to Pesaran et al. (2001) all of these variables are said to be cointegrated or have long-run relationships if all the variables in equation (2) are simultaneously at the same level of lag. The F-Statistics from Bound Test can be used to determine the existence of co-integration in the model. In general, the Bound Test has two critical values called upper bound, I (1) and lower bound, I (0). Upper bound assumes that all variables are integrated at the first or non-stationary level while the lower bound assumes all the variables are integrated at the ground level or stationary. If the F-statistic value is greater than the upper bound value, all variables are said to be cointegrated or have long-run relationships.

The error correction model (ECM) is then generated from the ARDL model above. The analysis using this ECM is aimed at simultaneously obtaining budget values for long run and short-run parameters for all variables in the model. Finally, the models were checked by diagnostic tests to ensure that the models were free from unnecessary problems such as serial correlation, heterokedasticity and misspesification.

Results and discussion

The issue of ageing population is always being associated with the health expenditure requirements. Health expenditure is high for the age below 14, diminish at the middle age and start to rise again when reach the age of 65 and above (Yu et al., 2013). Therefore, this study has been conducted to examine the relationship of ageing population and healthcare expenditure in the context of Malaysia and its neighboring countries Indonesia and Thailand.

ARDL approach was required to determine appropriate lag (p) before the analysis conducted. In this study, the appropriate lag number used was determined by *Akaike Info Criterion* (AIC), *Schwarz Criterion* (SC) and R-square. A model with small AIC and SC but has high value of R-square is preferred. Based on Table 1, the appropriate lag was chosen for all countries based on the smallest AIC and SC but highest R-square.

Table 1. Co-Integration Test

Country	No. of lag	AIC	SC	R-square	F-statistic
Malaysia	2	-3.3946	-2.8505	0.9618	5.3098**
Indonesia	2	-5.0239	-4.3313	0.9962	17.4739***
Thailand	1	-3.4289	-3.0312	0.8380	5.6772**

Note: *** Significant at 1% level,** significant at 5% level, *significant at 10% level

After fitting the lag , the next step is testing for co-integration between ageing population and health expenditure to estimate the long-run relationship using equation (2). Based on result in Table 1 for Malaysia, F-statistic of Bound-test indicates its value is greater than critical value upper bound (5.3098) at 5 percent significant level. The similar result shows in the case of Thailand with F-statistic also lies higher than upper bound (5.6772) at 5 percent significant level, followed by Indonesia that indicates the highest significant p-value (17.4739) at 1 percent level. Hence, this result indicates the existence of co-integration among all variables in the model. This finding describes that a stable long-run relationship appears among health expenditure, ageing population and other control variables.

Equation (2) is used to estimate long run and short run value of parameters using the chosen lag and the result is showed in Table 2. According to the t-statistics, ageing population parameter indicates a long run stable relationship with health expenditure in Malaysia and Indonesia at 1 percent level of significance. This association indicates that in the long run, 1 percent increase in the population age 65 and above, will increase total heath expenditure 2.8648 percent in Malaysia and 9.9787 percent in Indonesia. This finding is in line with many of previous studies which reveal that rising of elderly population in a country will increase the allocation for social security and medical system more than expenses allocated for other (Eiras & Niepelt, 2012; Lisenkova et al., 2012). However, the relationship of these two variables was not significant in the case of Thailand. In addition, gross domestic product and infant mortality also denote significant relationship with total health expenditure in Indonesia and Malaysia while LnPOP14 only exhibits significant relationship with total health expenditure in Indonesia. The negative sign in LnGDP describes there is a negative relationship establishes among gross domestic product and total health expenditure which is contrary with existing the existing theory which stated otherwise. There are not many literatures showing the increasing of income will decrease health spending (Moore et al., 1992). However, according to Catalan et al. (2010), the tax perspective where increment of income will normally increase the tax. Hence, the rising of tax will decrease the consumption and welfare for elderly because the rising income is used to pay the increasing tax.

Table 2. Estimation of long-run coefficient value for health expenditure

Country	Variables	Coefficient	t-statistics
Malaysia	LPOP65	2.8648	4.9281***
	LPOP14	-0.7523	-0.3649
	LIM	-0.3592	-2.0123**
	LGDP	-2.4521	-4.5106***
	C	40.0731	1.2840
Indonesia	LPOP65	9.9787	6.1353***
	LPOP14	-38.9483	-3.7684**
	LIM	9.8647	5.1125***
	LGDP	8.0878	4.1911**
	C	205.4454	2.0953
Thailand	LPOP65	0.7456	0.2000
	LPOP14	-8.2515	-1.7537
	LIM	2.6311	0.7208
	LGDP	0.5517	2.1335*
	C	85.5594	1.7075

Note:*** Significant at 1% level,** significant at 5% level, *significant at 10% level.

Apart from that, this study also examined short-run relationship that appeared between main variable, LnPOP65 and dependent variable, LnTHE. Based on VECM model's result given in table 3, population age 65 and above have signficant short run relationship with total health expenditure in two countries; Indonesia and Thailand while in Malaysia, changes in number of population age 65 above does not significantly shift total health expenditure in a short run. Further, the result of Error Correction Term (ECT) that used to measure the rate of convergence to the long run equilibrium suggests 212.58 percent a year is required in Malaysia to restore to the equilibrium in long run. In comparison, Indonesia and Thailand respectively needs 98.46 percent and 107.93 percent a year to restore to the equilibrium in a long run. In terms of achieving long run equilibrium, Indonesia is more responsive compared to the other two neighboring countries. This finding has confirmed many of the previous studies' outcome regarding the significant effect of agieng population to the total health expenditure.

Table 3. Estimation of short-run coefficient value for health expenditure

Country	Variables	Coefficient	t-statistics
Malaysia	ΔLTHE (-1)	0.5821	3.0720**
	ΔLPOP65	0.3675	0.2731
	ΔLPOP14	-1.8020	-0.7408
	ΔLIM	0.9469	2.7083**
	ΔLGDP	-2.1815	-6.9629***
	ΔLGDP(-1)	1.8763	3.9784
	ECT(-1)	-2.1258	-6.1927***
	C	0.0030	0.0550
Indonesia	ΔLTHE (-1)	-0.9474	-10.9969***
	ΔLPOP65	25.6867	14.6667***
	ΔLPOP65(-1)	11.1598	7.6689***
	ΔLPOP14	95.7343	15.4898***
	ΔLPOP14(-1)	8.2288	3.1195**
	ΔLIM	-6.2008	-14.6190***
	DLGDP	-4.5086	-14.6867***
	DLGDP(-1)	0.8048	5.4091***
	ECT(-1)	0.9846	13.2189***
	C	-0.0030	-0.0528
Thailand	ΔLPOP65	12.2013	2.8624**
	ΔLPOP14	-6.1483	-1.4112
	ΔLIM	1.0080	0.2958
	ΔLGDP	-0.2262	-1.0237
	ECT(-1)	-1.0793	-5.9489***
	C	-0.0004	-0.0059

Note:*** Significant at 1% level,** significant at 5% level, *significant at 10% level.

In order to validate the model, this study also underwent three diagnostic tests namely Breusch Godfrey Serial Correlation LM test, ARCH test and Ramsey RESET test as showed in Table 4. The result implies that all models used in this study were free from serial correlation, heterokedasticity and misspesification of linear model. Finally, the graph from Cusum test and Cusum of square test as showed in Table 5 and Table 6 indicate the parameter were stable over the period of investigation.

Table 4. Diagnostic Checking Malaysia

Diagnostic Test	Malaysia	Indonesia	Thailand
Breush Godfrey Serial Correlation LM Test	0.1489	0.1165	0.1942
ARCH Test	0.4405	0.6278	0.2796
Ramsey RESET Test	0.1629	0.3703	0.6754

Table 5. Cusum test

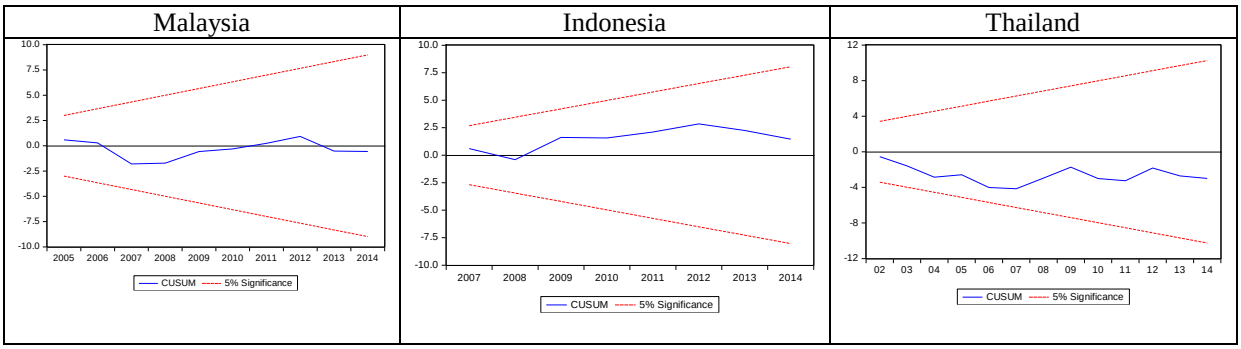
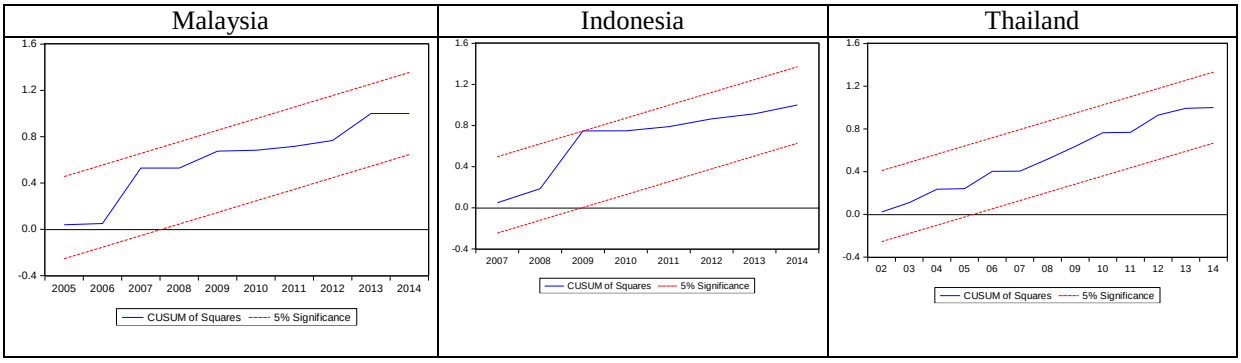


Table 6. Cusum of square



Conclusion

This paper aims to measure the relationship between the ageing population and healthcare expenditure both in the short-run and long-run estimations in Malaysia, Thailand, and Indonesia by using time series data. The result of two out of the three countries in the Southest Asia confirms that population ageing does affect health expenditure. Apart from societal factors such as income, health expenditure has proved to increase accordingly with the increase of ageing population. Health expenditure has increased mainly because of the advancement usage of medical technology that has benefited the elderly more than other age groups. Moreover, rising in ageing population has gradually increased acute care expenditure and strongly increased health expenditure (Meijer et al., 2013).

Nevertheless, the increased elderly population of a country should not be seen as a burden to a country's spending as they also have a positive impact on the economy. It can be seen that more and more elderly people are able to contribute to the economy. The development of technology, especially in medical technology and the public's awareness of the importance of healthcare, have led to the growing lifespan of the population. Therefore, it is not uncommon to see that elderly people who have reached the pension age are still contributing to organizations. These are the ones who need to be given the defense by

providing conducive working environment and other necessary facilities to suit their age so that they continue to contribute to the country and are no longer regarded as a burdensome community.

The findings of this study are expected to give an overview to the government in a way to bridge the gap in the healthcare sector with the need for cooperation from the public and private sectors. In the context of the current situation it is found that the gap is still large between the need for healthcare services and the capabilities of the healthcare system. In addition, the government needs to increase its commitment to address current issues in the healthcare sector as well as to allocate investments for rural healthcare services, emphasizing on healthcare cost control, and developing plans for the construction of national health infrastructure.

Although there are many recent studies that discuss on agieng population and healthcare expenditure but these works do not always obtain similar results (Lopreite & Mauro, 2017). What distinguishes this study from existing studies is that this study is conducted in the context of comparing Malaysia, Indonesia and Thailand. Due to the limited data in the health sector, the analysis can also be quite limited. Hence, not many of such studies have been conducted in Malaysia. However, in the future, studies on elderly populations and health spending should be continued as the country's sociodemographic structure has begun to show drastic changes. The impact on public health is clear. Therefore, in order to maintain the well-being of the Malaysian economy, the role of government and individuals in all aspects are very crucial and necessary.

References

Ang, J.B. (2010). The determinants of health care expenditure in Australia. *Applied Economics Letters*, *17*(7), 639-644.

Catalan, M., Guajardo, J., & Hoffmaister, A.W. (2010). Dealing with global ageing and declining world interest rates: Fiscal costs and pension reform in small open economies. *Pensions: An International Journal*, *15*(3), 191-213.

Coulmas, F. (2007). *Population decline and ageing in Japan: The social consequences*. London, Routledge.

Dang, T.T., Antolin, P., & Oxley, H. (2001). Fiscal implication of ageing: Projection of age-related spending (Working Paper No. 305). Retrieved from OECD Economics Department.

Eiras, M., & Niepelt, D. (2012). Ageing, government budgets, retirement and growth. *European Economic Review*, *56*, 97-115.

Eliska, O. (2015). Impact of population ageing and elderly poverty on macroeconomic aggregates. *Procedia Economics and Finance*, *30*, 598-605.

Fredrik, A.G. (2013). The impact of ageing on health care expenditures: A study of steepening. *European Journal Health Economics*, *15*, 979-989.

Getzen, T.E. (1992). Population ageing and the growth of health expenditure. *Journal of Gerontology*, *47*(3), 98-104.

Hamid, T.A. (2015a). Population ageing in Malaysia: A mosaic of issues, challenges and prospects. Serdang, UPM Press.

Hamid, T.A. (2015b). Population ageing in Malaysia: A Mosaic of issues, challenges and prospects. Inaugural Series. Serdang, UPM Press.

Ibrahim, R.I. (2012). Impact of increasing retirement age on longevity factor: An empirical study for government pensioners in Malaysia. *Jurnal Ekonomi Malaysia*, *46*(2), 29-35.

Ikeda N., Saito, E., & Kondo, E. (2011). What has made the population of Japan healthy? *The Lancet*, *378*(9796), 1094-1105.

Knickman, J.R., & Snell, W.E. (2002). The 2030 problem: Caring for aging baby boomers. *Health Services Research, 37*(4), 849-884.

Kinsella, K., & He, W. (2009). An Aging World 2008. Washington D.C., U.S. Census Bureau International Population Reports.

Lakshmi, T.S., Panda, P.K., & Rout, H.S. (2012). An analysis of pattern and determinants of public expenditure on health in Andhra Pradesh, India. *IUP Journal of Public Finance*, 22-35.

Lisenkova, K., Merette, M., & Wright, R. (2012). The impact of population ageing on the labour market: Evidence from overlapping generations computable general equilibrium (olg-cge) model of Scotland (Discussion paper). Retrieved from Economic, Strathclde.

Lopreite, M., & Mauro, M. (2017). The effects of population ageing on health care expenditure: A Bayesian VAR analysis using data from Italy. *Health Policy, Elsevier*, *121*(6), 663-674.

Mahal, A., & McPake, B. (2017). Health system for aging societies in Asia and the pacific. *Health System & Reform*, *3*(3), 149-153.

Meijer, C.D., Wouterse, B., Polder, J., & Koopmanschap, M. (2013). The effect of population aging on health expenditure growth: A critical review. *European Journal of Ageing, 10*(4), 353-361.

Moore, W.J., Newman, W.J., & Fheili, M. (1992). Measuring the relationship between income and NHEs. *Healthcare Financial Review, 14*(1), 133-139.

Nordin, N.H., Ismail, N.W., & Nordin, N.N. (2016). Ageing population and healthcare expenditure: Study based on ardl model on developing countries. *Journal of Global and Social Entrepreneurship*, *4*(5), 70-80.

Ogawa, N., Chawla, A., Matsukura, R., & Tung, A.C. (2009). Health expenditure and ageing in selested asian countries. *Expert Group Meeting on Population Ageing, Intergenerational Transfer and Social Protection. Santiago, Chile.*

Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bound testing approach to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289-326.

Seshamani, M. & Gray, A. (2004). Aging and health care expenditure: The Red Herring argument revisited. *Health Economic*, *23*(2), 217-235.

Townsend, M. (2016). The impact of an ageing population on end of life care costs (Discussion Paper 2912). Retrieved from Personal Social Services Research Unit, London School of Economics.

World Bank. (2014). World Bank Report 2014. Retrieved from: http://worldbank.org.

Yang, Z., Norton, E.C., & Stearns, S.C. (2003). Longevity and health care expenditure: The real reasons older people spend more. *Journal of Gerontology and Social Sciences, 58*(1), 2-10.

Yew, W.C., & Noor Azlan, M.N. (2014). Sociocultural determinants of health and illness: A theoretical inquiry. *Geografia Malaysian Journal of Society and Space*, *10*(1), 49-59.

Yu, Y., Zhang, L., Li, F., & Zheng, X. (2013). Determinant of public health expenditure in Chinese cities: A spatial econometrics perspective. *Social Science Journal*, *48*, 458-467.