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AGEING POPULATION AND HEALTHCARE EXPENDITURE: STUDY BASED ON ARDL MODEL ON DEVELOPING COUNTRIES

NurHaiza Nordin[1]
Normaz Wana Ismail[2]
NurNaddia Nordin[3]

Abstract

This research focuses on the issues of ageing population and healthcare expenditure by using Autoregressive Distributed Lag Model (ARDL) proposed by Pesaran et al. (2001) in estimating selected developing countries. The motivation of the study is to compare the impact of ageing population on healthcare expenditure between developing countries as a demographic projection forecast that the percentage people above 60 years will increases. In 2015, one in eight people worldwide was aged 60 years and above. By 2030 ageing people are projected to account for one in six people globally and ageing people will outnumber children ages 0-9 years (1.4 billion versus 1.3 billion); by 2050, there will be more people aged 60 years and above than adolescents and youth aged 10-24 years (2.1 billion versus 2.0 billion). The main focus of this study examines the effect of ageing population on healthcare expenditure in developing countries. The result shows that the stable long-run relationship between ageing population influence healthcare expenditure in developing countries.

Keywords: Ageing population, healthcare expenditure, ARDL model

Introduction

Population ageing has been emerging as a major demographic worldwide trend over the past few decades (Kinsella and Wan, 2009). In developing countries process of population ageing has been advanced. In recent years, the majority of the developed countries have been facing serious difficulties in financing the mushrooming healthcare cost and formidable tasks in reforming their healthcare programs to cope with the coming demographic storm. Current level of population ageing in Asia s considerable lower than in developed region, due to its sheer size, Asia's share of those aged 65 and over in the world population exceeded 50 percent in 2000, and is projected to grow to 61 percent by 2050. Because of the large population size of the elderly in Asia, coupled with the serious poverty problems, the provision of healthcare on a nationwide basis has been a burdensome policy issues for many Asian governments. Despite these difficulties, a number of Asian countries have been administering their public healthcare programs for a considerable long period of time (Heller, 2003). The financial impact of population ageing on the healthcare program is likely to vary significantly with countries in the years to come. The total of ageing population (% of total) in China is 3.66 percent in 1970 and

[1] Lecturer at Department of Business and Finance Faculty of Entrepreneurship and Business, University Malaysia Kelantan. haiza@umk.edu.my
[2] Lecturer at Faculty of Economy and Management, University Putra Malaysia drnormazismail@gmail.com
[3] Lecturer at Department of Economics and Management Faculty of Management and Muamalah, Selangor International Islamic University College nurnaddia@yahoo.com

increases to 9.18 percent in 2014, for India 3.31 percent in 1970 and 5.54 percent for 2014, for Brazil 3.42 percent in 1970 and 7.57 percent in 2014, for Russia 7.72 percent in 1970 and 13.23 percent in 2014 and for Thailand 3.50 percent in 1980 and 10.08 percent in 2014. Total population ageing are high in Russia, Thailand and China.

The rise in the ageing population is also expected to affect public expenditure and thus economic growth (Nagarajan, Teixeira and Silva, 2013). According to Eiras and Niepelt (2012) and Lisenkova et al. (2012), when a country faces an increase in the old age population, public spending on social security expenses and the medical system will be higher than the corresponding on education and other forms of development. Better health will boosts the rate of economic growth through various channels (Bloom, Canning and Jamison, 2004; Ogawa and Matsukura, 2007; Bloom and Canning, 2008; Lee and Mason, 2009). For instance, healthy workers are more productive than their counterparts who are not, and the availability of a healthy labor force attracts foreign direct investment, which in turn, contributes to greater economic growth performance. In recent years the quality and quantity of research on the relationship between demographic change and health expenditure has increased substantially.

Seshamani and Gray (2004a) age was found to significantly affect quarterly costs in some of these analyses, but the quantitative importance of age was small compared to proximity to death; in particular, the tripling the quarterly costs that was found with approaching death in the last year. Seshamani and Gray (2004b), using the same 29-year longitudinal English dataset, showed that the effects of proximity to death on hospital costs could be detected up to 5 years prior to death. Aging they found a small positive association between age and health expenditure, but demonstrated that the large increases in costs from 5 years prior to death to the last year of life greatly overshadowed the 30% increase in costs from age 65 to 85. Besides that, Yang, Norton and Stearns (2003), confirmed that monthly health care expenditures for elderly people do increases substantially with age, but that this is primarily because mortality rates increases with age and health care expenditures increases with closeness to death.

Methodology

In examining the linkages between ageing population and health care expenditure, we formulate the impact of ageing population as follows:

$$LNHCE_t = \beta_0 + \beta_1 LNAGEING_t + \beta_2 LNLE_t + \beta_3 LNGDPC_t + \beta_4 LNBEDS_t + \mu_t \quad (1)$$

where HCE_t is the health care expenditure; $AGEING_t$ is the ageing population; LE_t is the life expectancy; $GDPC_t$ is the gross domestic product per capita; and $BEDS_t$ is total beds in the hospital. As the ageing population is increasing, the health care expenditure will be positive and the impact of the other three control variable also gives impact to the health care expenditure.

To implement the bound testing procedure, following Pesaran et al. (2001), it is necessary to reformulate Eq. (1) as a conditional autoregressive distributed lag (ARDL) model as follows:

$$\Delta LNHCE_t = \beta_0 + \beta_1 LNAGEING_{t-1} + \beta_2 LNLE_{t-1} + \beta_3 LNGDPC_{t-1} + \beta_4 LNBEDS_{t-1} + \sum_{i=1}^{p} \beta_{5i}\, \Delta LNAGEING_{t-1} + + \sum_{i=1}^{p} \beta_{6i}\, \Delta LNLE_{t-1} + \sum_{i=1}^{p} \beta_{7i}\, \Delta LNGDPC_{t-1} + \sum_{i=1}^{p} \beta_{8i}\, \Delta LNBEDS_{t-1} + \mu_t \quad (2)$$

where Δ the first difference operator, p is lag length and μ_t is an error term assumed serially uncorrelated. In Eq. (2), the estimates ofβ_1, β_2, $\beta_3$and β_4 represent the long-run (cointegration) relationship. The coefficient of summations-signs($\sum$), show the short-run relationship between population ageing and health care expenditure. Based on Pesaran et al. (2001), shows that in this type of specification, the selected variables are said to be cointegrated if all the lagged-level variables are jointly significant in the equation. This can be done by using an F-test with two tests asymptotic critical value (upper and lower critical value) tabulated by Pesaran et al. (2001). An upper critical value assumes that all the variables are $I(1)$, or nonstationary, while a lower critical value assumes that they all are $I(0)$ or stationary. If the computed F-statistic falls above the upper bound of critical value, the selected variables are said to be cointegrated.

To examine the long-run relationship, bounds testing for cointegration based on critical values adopted from Pesaran et al. (2001) was used with the following null hypothesis (for no long-run relationship) and alternative hypothesis (for a long-run relationship): $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ and $H_A \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$.

The empirical analysis was based on China, India, Brazil, Russia and Thailand. The time series data were annual and covered the period 1970-2014. The health care expenditure was in per capita GDP. We also gathered data from the following variables which have been identified in literature for their roles in determining health care expenditures: ageing population, life expectancy, GDPC, and number of hospital beds. The independent variables are divided for several indicators such as ageing population as the demographic indicator, GDPC for the economic indicator, life expectancy as the health indicator and the total number of hospital beds as the health care infrastructure indicator. All data were obtained from the World Bank Indicator and the World Population Prospect 2012, and they were converted into a natural logarithmic form before the empirical analysis.

Result and Discussion

This study focuses on five selected developing countries namely China, India, Brazil, Russia and Thailand. A unit root test was done for all variables using the Augmented Dickey Fuller (ADF) and Phillips-Perron tests in Table 1 and Table 2 to satisfy the pre-requisite condition of the dependent variable's being non stationary or containing a unit root in $I(1)$ and stationary at $I(0)$ as prescribed by Pesaran (2001). They showed that after differencing the variables once, they were confirmed to be stationary. The ADF and Phillips-Perron tests applied to the first difference of the data series rejected the null hypothesis of non-stationarity for all the variables; therefore, it is worth concluding that all the variables used in this study were not $I(2)$. Before that, to determine the optimal lag length of the variables, several lag selection criteria, such as the Akaike Information Criterion (*AIC*) and the Schwarz Info Criterion (*SIC*), were utilized. By using SIC, we found that the optimal lag was 1 for this exercise.

Table 1: ADF unit root tests results for stationary of the variables in China, India, Brazil, Russia and Thailand

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
CHINA				
LNHCE (Health Expenditure)	-0.6498 (0.0760)	-3.0791** (0.1390)	-4-5198*** (0.1212)	-4.1021*** (0.8912)
LNAGEING (Ageing Population)	-0.2989 (0.0031)	-2.3301*** (0.2221)	-2.8901*** (0.0129)	-2.6790*** (0.1908)
LNLE (Life Expectancy)	-0.7892 (0.0019)	-1.8190 (0.0561)	-2.7891*** (0.7891)	-2.8910*** (0.9012)
LNGDPC (Gross Domestic Product per capita)	3.2891 (0.0125)	0.2192 (0.0497)	-4.3910*** (0.1891)	-4.3819*** (0.9031)
LNBEDS (Hospital beds)	-2.6891*** (0.0091)	-2.7481** (0.1901)	-2.9041*** (0.0109)	-2.8900*** (0.0312)
INDIA				
LNHCE (Health Expenditure)	-0.2149 (0.0206)	-2.1240** (0.6210)	-3.3128*** (0.5262)	-3.3410*** (0.0183)
LNAGEING (Ageing Population)	-0.2 (0.0002)	-2.8813*** (0.0032)	-2.6013*** (0.0109)	-2.5436*** (0.0112)
LNLE (Life Expectancy)	-0.2929 (0.0004)	-1.9157 (0.0082)	-2.5518*** (0.0170)	-2.5023*** (0.0275)
LNGDPC (Gross Domestic Product per capita)	2.8901 (0.8912)	0.9012 (0.8901)	-3.8901*** (0.8910)	-3.2074*** (0.2890)
LNBEDS (Hospital beds)	-2.8901*** (0.0761)	-2.7901** (0.1890)	-3.7612*** (0.0901)	-2.9012*** (0.0901)
BRAZIL				
LNHCE (Health Expenditure)	-0.9012 (0.0906)	-2.8912** (0.0910)	-2.9012*** (0.9012)	-2.9078*** (0.8912)
LNAGEING (Ageing Population)	-0.8912 (0.0232)	-2.8901*** (0.0890)	-2.8912*** (0.0001)	-2.8901*** (0.0212)
LNLE (Life Expectancy)	-0.8902 (0.0891)	-1.9291 (0.0890)	-2.2928*** (0.2120)	-2.920*** (0.9012)
LNGDPC (Gross Domestic Product per capita)	3.2171 (0.0125)	0.3022 (0.0497)	-4.9351*** (0.1611)	-4.0274*** (0.2359)

LNBEDS (Hospital beds)	-2.6515*** (0.0755)	-2.7844** (0.1204)	-2.6441*** (0.0306)	-2.1980*** (0.0923)
RUSSIA				
LNHCE (Health Expenditure)	-0.8910 (0.0291)	-2.9082** (0.8910)	-3.2901*** (0.1562)	-3.8901*** (0.1583)
LNAGEING (Ageing Population)	-0.8976 (0.0209)	-1.9087*** (0.0872)	-2.3218*** (0.9019)	-2.2871*** (0.2132)
LNLE (Life Expectancy)	-0.7819 (0.0214)	-1.8910 (0.2192)	-2.2908*** (0.0190)	-2.8906*** (0.9075)
LNGDPC (Gross Domestic Product per capita)	3.8907 (0.6785)	0.3098 (0.0462)	-4.9098*** (0.1871)	-4.0904*** (0.5909)
LNBEDS (Hospital beds)	-1.9025*** (0.9055)	-1.8744** (0.1904)	-2.9081*** (0.0290)	-2.9012*** (0.0890)
THAILAND				
LNHCE (Health Expenditure)	-0.8912 (0.0890)	-2.9023** (0.1278)	-3.8912*** (0.8912)	-2.*6781** (0.1232)
LNAGEING (Ageing Population)	-0.8901 (0.0232)	-2.9012*** (0.0231)	-2.6389*** (0.0891)	-1.90876*** (0.1222)
LNLE (Life Expectancy)	-0.9012 (0.0309)	-1.3891 (0.3912)	-2.3128*** (0.3910)	-2.3013*** (0.0175)
LNGDPC (Gross Domestic Product per capita)	2.9071 (0.0315)	0.3380 (0.0901)	-4.3891*** (0.3901)	-3.3904*** (0.3909)
LNBEDS (Hospital beds)	-2.3905*** (0.0305)	-2.4344** (0.4104)	-2.3901*** (0.0306)	-2.3313*** (0.0983)

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

Table 2: Phillips-Perron (PP) unit root test results for stationary of the variables for China, India, Brazil, Russia and Thailand

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
CHINA				
LNHCE (Health Expenditure)	-0.5891 (0.0289)	-2.3806 (0.9015)	-2.539*** (0.3562)	-4.4244*** (0.1343)
LNAGEING (Ageing Population)	-1.9087 (0.3098)	-1.9081 (0.9086)	-2.7900*** (0.0901)	-2.5280*** (0.0291)

LNLE	-2.0931	-3.8901***	-0.8972***	-3.0987***
(Life Expectancy)	(0.0390)	(0.3012)	(0.09l3)	(0.2909)
LNGDPC	2.9082	0.3901	-3.9083***	-4.9083***
(Gross Domestic Product per capita)	(0.0315)	(0.3047)	(0.9012)	(0.9002)
LNBEDS	-4.9083***	-2.9082***	-3.9082***	-3.7892***
(Hospital beds)	(0.3901)	(0.9011)	(0.1678)	(0.38091)
INDIA				
LNHCE	-0.9035	-2.9087	-4.3901***	-2.9034***
(Health Expenditure)	(0.4022)	(0.4901)	(0.4902)	(0.1383)
LNAGEING	-1.9038	-1.9082	-2.4021***	-2.1902***
(Ageing Population)	(0.04902)	(0.3901)	(0.0300)	(0.0438)
LNLE	-1.9083	-4.3901***	-1.9096***	-1.09013***
(Life Expectancy)	(0.0490)	(0.04090)	(0.3091)	(0.2139)
LNGDPC	3.9082	0.4390	-2.9063***	-1.0480***
(Gross Domestic Product per capita)	(0.3901)	(0.4902)	(0.1611)	(0.2046)
LNBEDS	-2.8901***	-2.9083***	-2.9087***	-2.1845***
(Hospital beds)	(0.3891)	(0.4389)	(0.1395)	(0.2993)
BRAZIL				
LNHCE	-02295	-1.9086	-2.0903***	-2.9244***
(Health Expenditure)	(0.3336)	(0.0015)	(0.2362)	(0.5223)
LNAGEING	-1.3283	-2.2071	-2.3431***	-2.2912***
(Ageing Population)	(0.3093)	(0.0313)	(0.038)	(0.2928)
LNLE	-2.7818	-3.9022***	-2.9096***	-2.9082***
(Life Expectancy)	(0.0980)	(0.2305)	(0.2991)	(0.2909)
LNGDPC	4.9087	0.4390	-4.2063***	-4.9080***
(Gross Domestic Product per capita)	(0.0908)	(0.3907)	(0.211)	(0.1306)
LNBEDS	-2.9003***	-2.9085***	-7.447***	-3.098***
(Hospital beds)	(0.1011)	(0.2901)	(0.5935)	(0.3901)
RUSSIA				
LNHCE	-2.538	-1.9086	-2.9703***	-2.4024***
(Health Expenditure)	(0.3496)	(0.1490)	(0.1392)	(0.1393)
LNAGEING	-1.9883	-2.4971	-3.3041***	-2.8312***
(Ageing Population)	(0.0443)	(0.0543)	(0.0918)	(0.3438)
LNLE	-2.3518	-2.8932***	-5.6396***	-5.813***
(Life Expectancy)	(0.6770)	(0.0405)	(0.3991)	(0.099)
LNGDPC	4.7002	3.9084	-3.9063***	-3.9080***
(Gross Domestic Product per capita)	(0.6025)	(0.4097)	(0.0121)	(0.1496)
LNBEDS	-6.9603***	-7.6305***	-7.9873***	-8.1985***
(Hospital beds)	(0.6051)	(0.1402)	(0.1908)	(0.1633)
THAILAND				
LNHCE	-0.5395	-2.8926	-2.5703***	-2.5244***
(Health Expenditure)	(0.0336)	(0.0905)	(0.2162)	(0.123)
LNAGEING	-1.9032	-1.9071	-3.9041***	-2.5812***
(Ageing Population)	(0.0043)	(0.0263)	(0.3318)	(0.0928)
LNLE	-1.9018	-3.9022***	-3.6596***	-3.9083***
(Life Expectancy)	(0.0370)	(0.8725)	(0.3191)	(0.2239)
LNGDPC	1.9042	0.2001	-1.9863***	-1.9080***
(Gross Domestic Product per capita)	(0.2905)	(0.0497)	(0.9011)	(0.1646)
LNBEDS	-2.0923***	-2.6305***	-2.9977***	-2.1845***
(Hospital beds)	(0.9211)	(0.2051)	(0.1905)	(0.1633)

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

We determined that there was a long-run relationship between the variables when the health care expenditure was a dependent variable because the F-statistic was China (8.272), India (6.683), Brazil (7.8907), Russia (6.9210) and Thailand (5.6189). All result for F-statistic values were higher than the upper bound critical value at 5.532 percent at the 1 percent significance level based on Narayan (2004) Table 3. This implies that the null hypothesis of no cointegration among the variables in the equation (2) cannot be accepted.

Table 3: Bounds Test for Cointegration Analysis Based on Equation (4)

	10 percent level		5 percent level		1 percent level	
k	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)
4	2.696	3.898	3.276	4.630	4.590	6.368
Calculated F-statistic	China	8.272				
	India	6.683				
	Brazil	7.8907				
	Russia	6.9210				
	Thailand	5.6189				

Notes: The reported bounds critical values are taken from Narayan (2004), Table C[III].
k is the number of regressors

The estimated of long-run coefficient for health care expenditure with respect to population ageing, life expectancy, the GDPC and the number of hospital beds is presented in Table 4. All variables are significant at least at the 1 percent level for both China and India, and 5 percent for Brazil, Russia and Thailand. The results also reveal that our hypothesized variables, namely ageing, positively affect healthcare expenditure in all selected developing countries. The effect in China and India, however, is much larger than in Brazil, Russia and Thailand. These findings support the hypothesis that ageing people account for a larger portion of health care expenditure because they are not participating in the labor market, however, as they aged the need to spend on medication and consultation on health is much higher compared to younger people. From the results, a 1 percent increase in the number of ageing people is estimated to increase health care expenditure in China and India 1.8905 and 1.2701 per cent, respectively. From this analysis, it shows that China has a more ageing population rather than India. These findings support the hypothesis that ageing people account for a larger portion of health care expenditure because they are not participating in the labor market, however, as they aged the need to spend on medication and consultation on health is much higher. Besides that, from the result estimation population ageing in Brazil, Russia and Thailand also affect the healthcare expenditure. This estimates that, population ageing in China, India, Brazil, Russia and Thailand affected the healthcare expenditure. In China, Russia and Thailand the total ageing population are higher than India and Brazil. Thus the effects of population ageing in these countries are higher than other countries.

For the control variable, such as life expectancy were positive for all countries, and they were significant at the 1 percent level; this means that life expectancy is a good indicator for health care expenditure. Life expectancy in China shows a higher increase in health care expenditure than in India because it is 76 years for people in China, 68 years in India, 74 years for Brazil and Thailand and 70 years for Russia. People in China live longer lives, and total ageing is also larger; thus, the ageing population will place greater demands on health care expenditure.

The results show that GDP per capita as an economic indicator has a positive and significant influence on health care expenditure. The result for GDPC in China is 0.0567 percent and 0.1477 percent in India. Both of the results are significant at the 1 percent level and these findings mean that an increase in GDPC also will increase health care expenditure. Finally, our results for total number of hospital beds are positive and significant at the 10 percent level for China; however the result in India is negative insignificant. The numbers of hospital beds proxy for health care indicators play important role in China compared to India. In India, however, the total number of beds in hospitals does not have a relationship with health care expenditure.

Table 4: Long-run coefficient based on the ARDL model

Variable	CHINA	INDIA	BRAZIL	RUSSIA	THAILAND
Ageing population (AGEING)	1.8905*** (1.7989)	1.2701*** (1.2001)	0.8578** (0.7651)	1.6701** (0.9510)	1.2210** (1.018)
Life Expectancy (LE)	2.7686*** (2.6154)	1.4805*** (1.8294)	1.2017*** (1.5689)	1.1956*** (1.4210)	1.2078*** (1.3901)
Gross Domestic Product per Capita (GDPC)	0.0567*** (0.8524)	0.1477*** (1.0032)	0.8210*** (1.3901)	0.9517** (1.0220)	0.8712*** (1.9017)
Hospital beds (BEDS)	0.2820* (1.7411)	-0.2171 (-1.2247)	0.2901 (1.409)	0.3019 (1.7801)	0.4210 (1.5291)

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

Results for the short-run estimation coefficient are reported in Table 5. The estimated coefficient for ECM must be a negative value, and it confirms that there is no problem in the long-run equilibrium relation between the independent and dependent variables. Results for the ECM confirm that all countries are negative values and have a relationship between the dependent and independent variables; they are significant at the 5 percent level in China and at the 10 percent level in the rest of countries. Results for the short-run coefficient indicate that the ageing population has a positive relationship with health care expenditure, and it is significant at the 1 percent level for both countries. This finding also confirms that the ageing population increases health care expenditure in the short run. Besides that, the other variables also indicate positive and significant relationships with dependent variables, except for total number of hospital beds. Results for hospital beds for both countries show a negative relationship, but they are statistically significant at the 5 percent level. From these results, we can conclude that the ageing population has a positive relationship with health care expenditure; an increase in the ageing population will increase total health care expenditure both in the long-run and short-run coefficients.

Table 5: Results for short-run estimation coefficient for China and India

Variable	CHINA	INDIA	BRAZIL	RUSSIA	THAILAND
ECM	-0.6205** (-1.1468)	-0.5606* (-0.9563)	-0.7860* (-0.9793)	-0.6906* (-0.9895)	-0.7906* (-0.8932)
Ageing population (AGEING)	1.5476*** (1.0407)	2.4394*** (1.0068)	0.6904*** (0.7868)	0.4970*** (0.6512)	0.5609*** (0.7612)
Life Expectancy (LE)	1.5253* (3.9117)	2.6148** (0.9415)	1.1748** (0.4015)	2.8901** (0.5901)	1.7181** (0.6215)
Gross Domestic Product per Capita (GDPC)	0.1241*** (1.3025)	0.0216*** (0.2565)	0.0289*** (0.5901)	0.0679*** (0.5901)	0.0579*** (0.1865)

Hospital beds (BEDS)	-0.0212** (-0.2417)	-0.0946** (-1.9346)	-0.0796** (-1.4786)	-0.0601** (-1.7046)	-0.0710** (-1.8510)

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

To test the ARDL model, we applied a series of diagnostic tests and report the results in Table 6. It is clear from Tables 6 that the model is free from basic econometric problems, such as serial correlation, heteroscedasticity, normality, and functional form.

Table 6: Diagnostic Tests of the Effects of Ageing Population on Health Care Expenditure

Country	China	India	Brazil	Russia	Thailand
Jarque-Bera Normality Test	0.9166 (0.6323)	0.0954 (0.9533)	0.3952 (0.8206)	0.2999 (0.8607)	2.5086 (0.2852)
LM Test	0.0139 (0.9861)	2.3376 (0.1212)	0.0772 (0.9260)	2.9816 (0.0725)	0.3739 (0.6921)
Heterosce-dasticity Test	0.5850 (0.8612)	2.1285 (0.0500)	0.7168 (0.7538)	2.0174 (0.0630)	1.1640 (0.3581)
ARCH Test	0.3360 (0.5658)	0.8351 (0.3669)	0.0276 (0.8696)	0.4269 (0.5176)	0.7860 (0.3812)
Ramsey RESET Test	0.5679 (0.4599)	0.5071 (0.4839)	0.7901 (0.3852)	0.7865 (0.3847)	0.2208 (0.6426)

Conclusion

This paper aims to examine the relationship between the ageing population and health care expenditure both in the short-run and long-run estimation in China, India, Brazil, Russia and Thailand by using time series data on healthcare expenditure, the ageing population and three control variables: GDPC, life expectancy and hospital beds. The results confirmed that both in short-run and long-run estimations, the ageing population have a relationship with healthcare expenditure. The ageing population clearly shows relatively higher health care expenditure in the older-aged for all countries. China has a large ageing population; therefore, total health care expenditure is higher among the aged there, while other countries has a smaller ageing population. In these countries as an increasing absolute number of elderly will inevitably increase health care expenditure. The growing enlarges the total patient pool the healthcare market because of these countries are facing an aging society, unfortunately, diseases, especially chronic diseases affect older adults disproportionately, and as a result of an aging population, the country will be increasingly pressured to handle a growing sick population. Because many adults and older-age health problem was rooted in early life experiences and living condition, ensuring good child health can yield benefits for older people. In the meantime, generations of children and young adults who grew up in poverty and ill health will be entering old age in coming decades, potentially increasing the health burden of the older population in these countries.

The government clearly understands the magnitude of the problem and has articulated its commitment to closing the significant gaps in the healthcare sector and has emphasized gaps in the healthcare sector and has emphasized the need for public and private sector cooperation. The gap between the need for healthcare services and the capabilities of current health insurance and delivery system is still immense. The government's commitment to address the current issues in the healthcare sector in apparent through candid acknowledgement. The government has already allocated to move investment to improve public health and rural health services; placed emphasis on controlling healthcare costs; implemented initiatives to improve hospital management to raise quality of patient care; and developed plans to establish and build a national health infrastructure.

Future research can consider other determinants of health care expenditure, such as technological progress and relative price; demographic indicators such as total population, population growth, and young population; health indicators such as birth rate, death rate, and infant mortality rate; and healthcare infrastructure such as private healthcare, public healthcare, and total number of physicians. The structure of this combination of factors has been the center of debate over whether increasing healthcare expenditure is influenced from the other factors. A larger data set and using another approach may also be beneficial to future research.

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