The Effects of Young and Ageing Population on Education Expenditure: The Case of China and India

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Abstract

The motivation of the study is to analyze the impact of young and ageing population on education expenditure in China and India as demographic projection forecast that the percentage of population in India are increasing overtime. The used of long time series data of China and India from 1970 to 2011 helps us to identify the long-run relationship between young and ageing population and education expenditure. The result of the bound test showed that there is a stable long-run relationship between young population and education expenditure, while ageing population is negative relationship with education expenditure. In fact, short-term and long-term result revealed that the young population influences education expenditure in China and India.

Keywords: Young population, ageing population, education expenditure, China, India and ARDL model.

1. Introduction

The influence of population on the economy is seemingly straightforward. It is about having enough resources to meet the needs of the growing number of people. Since the same resource base is shared by all society, everybody is affected by development and many are deprived of their access to the same resources. Education is equally important and strongly related to a broad range of demographic structures. The spread of education throughout a population has been shown to be of central importance for the long-run demographic transitions for high to low level of fertility. Caldwell (1980) in particular, has maintained that high levels of fertility would nowhere persists for long once a society had achieved "mass education" that the large majority of children were sent to school. Education attainment is strongly related to differences between countries in levels of fertility and mortality. A substantial body of research has generally accepted that education is influenced by demographic factors.

A report by the United Nations in 2003, which intensively studied that interrelationship between education and population, found that increased education makes an important contribution to societies' economic growth and to the economic fortunes of individuals and illiteracy is power predictor of poverty. Thus expenditure on education is important to increase economic growth and well-being of society. Higher population growth will demand more government expenditure on education and thus government's role is crucial in giving the best education infrastructure especially for the populous countries such as China and India.

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Expenditure on education may help foster economic growth, enhance productivity, contribute to people's personal and social development and help reduce social inequalities. The proportion of total financial resources devoted to education is one of key choices made by government in each country. Declining birth rate in many countries will result in reduced school age population, which will have an effect on ratios such as the average expenditure per pupil. Indicator on education expenditure cover schools, universities and other public and private institutions involved in delivering or supporting educational services. Expenditure on institutions in not limited to that made on instructional services, but also includes public and private expenditure on ancillary services for students and families, where these services are provided through educational institution. At the tertiary level, spending on research and development can also be significant and is included, to the extent that the research is performed by educational institution.

In general, such cross-national associations may reflect the effects of demographic factors on education on demography, and the effects of demography factors on education. Linkages among population, education and development have been recognized in academic and policy setting. A report by the United Nations in 2003, which intensively studied that interrelationship between education and population and result, found that increased education makes an important contribution to societies' economic growth and to the economic fortunes of individuals and illiteracy is power predictor of poverty. Thus expenditure is important to increase economic growth and well-being of society. Higher population growth will demand more on government expenditure on education and thus government are play role in giving a better education infrastructure especially for the populous countries such as China and India.

Since 1978 China's economy has been transformed step by step from a planned economy to a market economy (Chow, 2002). One aspect of this transformation is the rapid increase in total education spending and in non-government spending. Since reform started, non-government schools have sprung up rapidly at all levels. Non-government or "people oriented" schools consist of two kinds, those established and operated by non-government institutions and public schools turned over or leased to private operations. The development of free market of education accelerated with Deng Xioping's southern expedition in 1992 in which the paramount leader declared a policy of further opening of the Chinese economy to the outside world and urged the Chinese people to adopt market institutions to promote growth. This policy encouraged the establishment of non-government financed educational institutions. Private finding in China includes funds raised or spent by three types of school that are private or non-government school, second is public schools which are leased for private operation, or parts of which are operated and financed independently, or financially independent colleges or schools that are set up by public universities or their affiliated unit and third is tuition and fees charged by public schools.

The implication from the reforms of educational policies and implementation in the 1990s and early 2000s are until 2010, the gross entrance rate of senior high school education will rise approximately 40 percent to over 70 percent until 2010 that will be key period for development. From 2010 and 2020, nine-year compulsory education will reach the world's most advanced level, and the gross entrance rate of senior high school education will rise approximately 85 percent. From 2021 to 2050, China will universalize twelve-year compulsory education with high standards for better quality. The gross entrance rate for higher education will rise 50 percent (Dongpoing, 2005).

Efforts to expand access to education have coincided with an extraordinary growth in population numbers. Following the same trend as the population at large, the school age population has been growing rapidly. Although school systems vary, typically primary schools students are expected to be aged 6-11 years, secondary-school students 12-17 years, and student in tertiary level 18-23 year. The school age population in China and India are projected to increase by 20 percent and 24 percent respectively for 2000 and 2050 Table 1(Monthly Labor Review, May 2002).

Table 1: Projected Change in Size of the School Age Population, 2000 and 2050, for China and India

	School-age population, ages 6-23 (millions)				Percentage of population in school-aged years	
Country	2000	2050	Absolute	Percentage	2000	2050
China	378.9	290.4	88.5	-23	30	20
India	371.4	374.8	3.5	1	37	24

Source: World Population Prospect: The 2000 Revision, Vol.1

China's rapid population growth is likely to impede educational development either by reducing quality to maintain enrolment or by reducing the quantity to maintain educational quality. Nonetheless, China has made significant progress in education. Figure 1 shows the school enrolment rate for primary, secondary and tertiary. Primary school are the higher than secondary and tertiary among the people at China. The former reflects government intervention hastening fertility decline; the latter reflects a fertility transition accompanied by socioeconomic development, such as increase family income, improvement of education, and promotion of social welfare services. Total fertility in rural China has rapidly declined since full-scale implementation of family planning policies began throughout China in 1971 (Population Bulletin, 2004). Total fertility declined will result in a better education. In each age group, there is an inverse relationship between age-specific fertility and educational levels and a higher educational level is associated with lower fertility rate (Varvus, 2000).

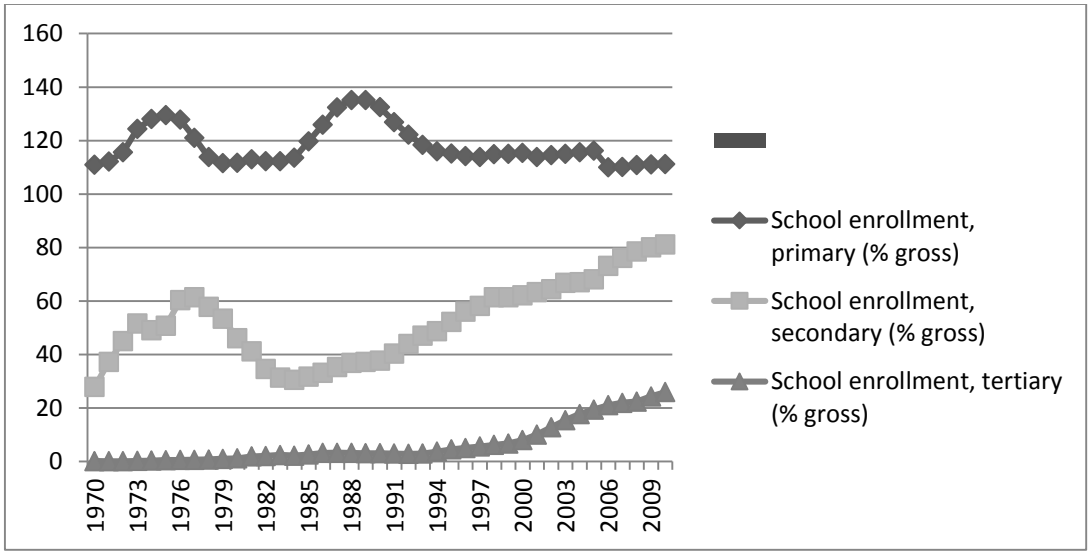

Figure 1: School enrolment, primary, secondary and tertiary (% gross) for China
Source: Source: United Nations, Educational, Scientific & Cultural Organization (UNESCO)

On the other hand, India has the world's largest population in age group between five to 24 years (450 million). It also has around 500 million in the age 25-59 age which constitute the working population and is expected to continuously increase even as the world working population ages diminish. This phenomenon will make India's a supplier of workforce to the entire world. In the wake of this reality, the India's education system should therefore be able to produce a workforce which is globally competitive. Literacy rate in India is one of the key deterrents to socioeconomic progress of the country. The India literacy rate is at 74 percent compared to 12 percent at the end the British rule 1947 and there has been a six fold growth, the level is well below the world average literacy rate of 84 percent and India has the largest illiterate population compared to any other nation in the world (India Population Census, 2011).

According to the National Policy on Education 1968, the government of India had formulated certain principles to promote the development of education in the country. These principles are free and compulsory education,

based on these principles education should be free and compulsory up to the age of 14. Steps should be taken to ensure that child who is enrolled in the school should successfully complete the course. Second, education of teachers; teacher is the most important person to determine the quality of education in the country. He should be honoured in the society. His emoluments and service standard should be increased with due regards to their responsibilities and qualifications. Proper attention should be given for teacher education. Third is education opportunity for all, under this policy every child of the country should get education irrespective of caste, religion, region or whether the case may be. Special emphasis should be given to backward classes, minority children, girls and physically challenged children to avail education facilities.

The size of education infrastructure can be assessed by the private and public spend on education. The Indian private and public spend on education in 2011 was estimated over USD 60 billion across all segments including schooling, higher education, vocational and ancillary or approximately equal to 3 percent of GDP (India Education Outlook, 2012). The 11th five year plan (2007-2012) was termed as "Indian's educational plan" which placed the highest priority on education as a central instrument for achieving rapid and inclusive growth. India has made progress in term of increasing primary education attendance rate and expanding literacy of population. India improved education system is often cited as one of the main contributions to the economic rise of India. Figure 2 show the school enrolment rate for primary, secondary and tertiary showing an increasing rate from 1970 to 2010.

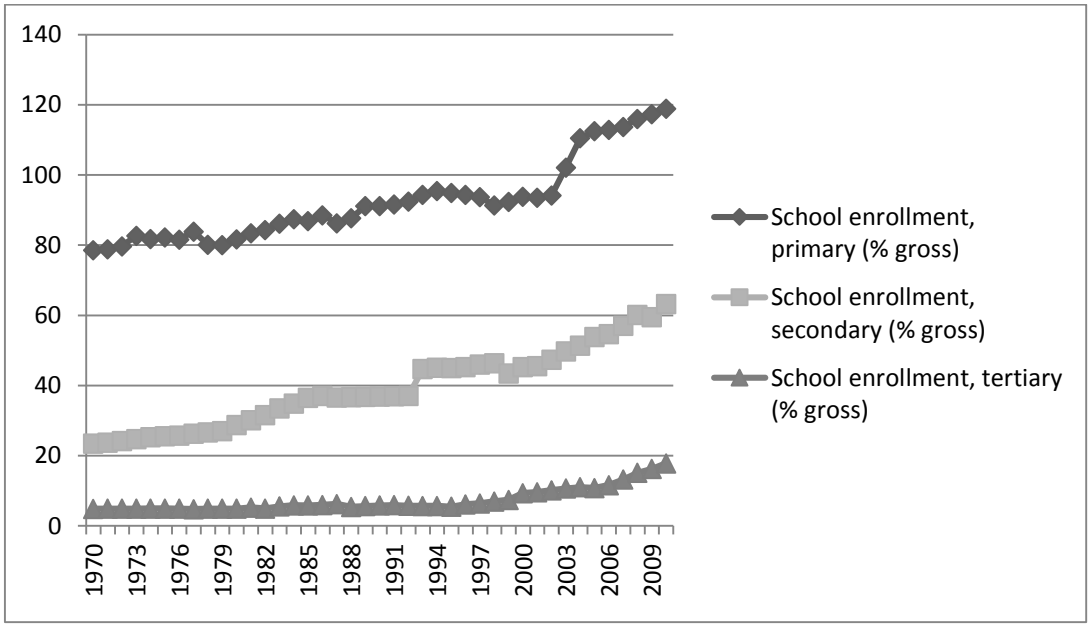

Figure 2: School enrolment for primary, secondary and tertiary (% gross) for India.
Source: United Nations, Educational, Scientific & Cultural Organization (UNESCO)

Total expenditure on education for China and India for 2010 is shows in Figure 3 and Figure 4. Total education expenditure for China and India are 13 percent and 10.5 percent respectively. This expenditure will be distributed for pre-primary, primary, secondary, tertiary and unknown.

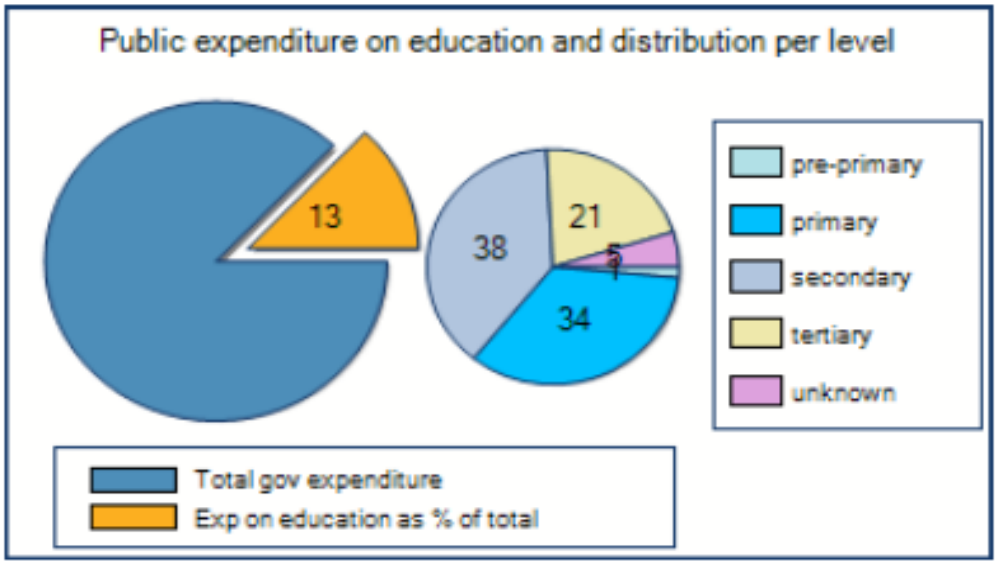

Figure 3: Total government expenditure and distributed expenditure for China for 2010.
Source: United Nations, Educational, Scientific & Cultural Organization (UNESCO)

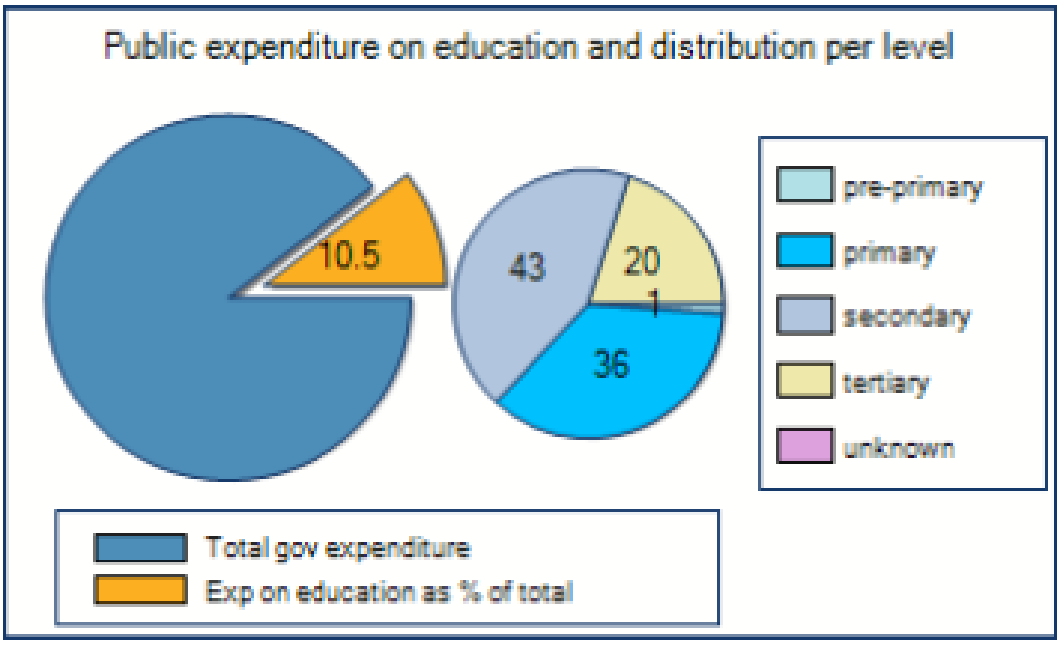

Figure 4: Total government expenditure and distributed expenditure for China for 2010.
Source: United Nations, Educational, Scientific & Cultural Organization (UNESCO)

2. Literature review

Education is the engine of economic growth and social change. It creates motivation for progress and brings revolution in the ideas necessary for the progress of the country. Education not only increase economic returns but also has a significant effect on poverty, income distribution, health, fertility, mortality, population growth and overall quality of human life. There are many educational indicators like literacy rate, gross enrolment ratio, net enrolment ratio, gender disparities, demographic change and others. The role of education on economic development has been recognised for quite time of mainstream economic literature. Education has both intrinsic and instrumental value; it is desirable not only for individual but also for the society as a whole (Sen, 1999).

Education as private good benefits directly those who receive it, which in turn affects the individual's future income stream. At the aggregate level a better educated workforce is thought to increase the stock of human capital in the economy and increase its productivity. From the microeconomic perspective, higher level of educational attainment raises the individual's wage rate in the labour market, and therefore the rate of return on education.

There have also been a number of studies that included a theoretical background in economics that analysed the dynamic of educational policy from the point of view of an international comparison particularly the determinants of educational expenditure (Hanushek and Rivkin 1997; Fernandez and Rogerson 1997; Ram 1995). These studies focused on the impact of socio-economic variables such as gross domestic product (GDP) per capita, enrolment, number of teacher, etc.

Castles (1989) in his seminar contribution to the study of educational spending, consider the impact of tertiary enrolment on education spending. The result shows that positive association between educational spending and student enrolment in the tertiary sector. Educational indicators thus can serve as interesting variables to test for their impact on educational expenditure.

Expenditure on education will be associated with better educational outcomes such as higher enrolment rates and increased school completion. Spending more on teachers, buildings, textbooks and other such materials might provide students with better quality facilities and learning opportunities. Gupta el al. (2002) uses OLS and Two Stage Least Squares (2SLS) to determine the overall level of public spending and intra-sectoral allocation. They use educational attainment measures like enrolment rates in primary and secondary school, persistence through Grade 4, and primary school drop-out rates. Higher spending on primary education may have a positive effect on enrolment, but a higher demand for primary education, reflected in higher enrolment rates, may also provide a push for higher education spending.

Arriaga (1992) studied on impact of population change on education cost. This paper has two principal aims that to analyse and measure how the demographic variables mortality, fertility and immigration affect the cost of education and second to evaluate what possibilities developing countries. This paper relates demographic and education variables of three different population Sweden, United State and Latin America and three educational variables are also considered that is school attendance rates by sex and age, distribution of students of same age by grade and cost of student grade. The result shows that the demographic changes in countries such as Sweden and the United States were favourable for the development of education. For the future, unless an increase of fertility occurs, mortality and fertility changes will not have a significant effect on cost of education in these countries. In current less developed countries the demographic changes during the past were less favourable to educational development. A future reduction of fertility will significantly help them to achieve a higher education level.

Kuehnel (2010) studied how population ageing endogenously changes the composition of government spending. He incorporates heterogeneity and a demographic structure into an infinitely-lived agent endogenous growth model by assuming that household differ in their composition between working young and retired old. The household determine by majority voting the public policy mix between productive expenditure and spending that satisfies the elderly's preferences. Population ageing is predicted to increase public spending that benefits the old and to lower the economy's growth rate. However it does not affect public productive expenditure.

Tasun et al. (2007) by using advanced econometric technique to estimate the impact of elderly population and elderly migration on education spending. Elderly have been increasingly targeted as a group to enhance economic development and the base in communities. A major factor in their rise in importance is the rapid increase in number of retired elderly through ageing of population. While recent literature on elderly migration tends to focus on how elderly migration patterns are influenced by state fiscal variables, the reverse effect from elderly population on fiscal variables is very plausible as shown by Conway and Rork (2006). This paper also

examine the intergenerational conflict in education financing raised by Poterba (1997) and analyse how preferences for education might vary across different elderly age group, which has not been explored before. Thus the results support the presence of intergenerational conflict in education financing. They also find dramatic age heterogeneity in preferences for education spending among elderly migration.

Poterba (1997) also considers the effect of demographic structure on school budgets. He used data from a panel of state within the United State over a 30-year period. He found that a rise in the proportions of elderly residents within a particular state was associated with a decline in education spending. He also tests three demographic variables: the share of the population over age 65; the share of population of school age 5 through 17; and the difference in the racial composition of the elderly and school age population. According to Poterba, the result suggests that the fraction of children and elderly in the population affect per child spending on education. The share of elderly in the population is negatively related to this spending. The analysis of Poterba indicates some interesting points for policy makers. The difference in the size of the school age population does not result proportionate changes in educational spending, thus students in states with a larger school-age population receive lower per-student spending than those in states with smaller numbers.

Poterba (1998) examines the effect of demographic changes and intergenerational linkages on public education. First, he analyse the demographic changes that are to take place over the next three decades in the United States. The demographic structure of the United State is changing because the elderly are growing in greater proportions. He finds evidence through version studies to support the claim the elderly are going to vote for programs that would benefit them more. If government resources are fixed, increases in the elderly population may decrease school spending. Poterba contends there are a many reasons the elderly may continue to support public education. First, the elderly may want to improve skills and productivity of younger people. These higher wages will be taxed to fund programs like Social Security and Medicare. Secondly, he states the elderly may be altruistic and generous.

Ladd and Murray (2001) extend the work of Button, Poterba and other researchers. Unlike Poterba (1997), who used state-level data, Ladd and Murray used country level data because it provides a more disaggregated analysis by shifting observation to localities. Ladd and Murray consider how an elderly share of the population affects a jurisdiction's willingness to fund education. Ladd and Murray mimicked Poterba and found that direct effect of higher levels of elderly people on per student education spending at the country level is not statistically different from zero. However, the elderly do have the ability to affect educational spending dependent upon where they reside within the countries. They also argue that Poterba's estimates of the effect of rising elderly share overstate the negative effects of age on spending to the extent that increases the elderly share are accompanied by greater dispersal of the elderly among local school district.

The recent work of Grob and Wolter (2007), using data of Switzerland from 1990-2002, shows that the education system there has exhibited little elasticity in adjusting to changes in the school-age population, and that the share of the elderly population has a significant negative influence on the willingness to spend on public education. This implies that a society with high proportion of aging population tends to spend less on education in general.

Canete and Ped (2000) studied the influence of population on the basic education development. The influence of population on the economy is seemingly straightforward. It is about having enough resources to meet the needs of the growing number of people. Since the same resources base is shared by all members of the society, everybody is affected by development and many are deprived of their access to the same resources. The population and development policy of the Philippine government has not been consistent. High population growth rate means rapid growth of the school age population that spreads out even more thinly the already very scarce resources for basic education development. This study explores access to resources between urban and non-urban population and its impact on basic education development using evidence from Cebu Province to highlight the straightforward relationship between population and basic education. Thus, it is imperative for

both public and private sector to adequately respond to continue growth of school age population that has an impact on the quality of basic education.

Despite demographic pressure in many developing countries during the period 1960-1980, school enrolment grew at an unprecedented pace, enrolment ratios rose and class sizes generally declined. Schultz (1987) found that, controlling for the per capita income, enrolment ratios were no lower in countries where the proportion school age population on school quality are less clear. The cross- national evidence suggest that school expenditures generally do not increase in response to an increase in the size of the school aged cohort, in other words, spending per school-age child tends to be lower where the demographic burden is greater.

McMahon (1999) in their studied found that a negative and significant relationship between per pupil expenditures and the primary school enrolment rate, and a positive and significant impact of total education expenditure as a proportion of GNP. Their result suggests that in increasing primary education expenditure have a positive and significant impact on the primary gross enrolment rate. However this study does not include income per capita variable as a separate explanatory variable. The other studied by Colcluough and Lewin (1993) study include an income per capita variable, and finds that expenditure as a proportion of GNP is not significant when enter separately.

Studies relating the relationship between education and economic growth have been conducted with various dimensions. Afzal et al. (2010) investigate in the short-run and long-run linkage between school education and economic growth in Pakistan and confirmed the existence of direct relationship. Barro and Sala-i-Martin (1995) found in cross-sectional study that an increase in average male secondary schooling of 0.68 years raises annual GP growth by 0.5 percentage points. Another studies confirm a positive relationship between education expenditure and economic growth have been made by Jogerson and Fraumeni (1992), Aziz, Khan and Aziz (2008), Jung and Thorbecka (2001) and Ogujiuba and Adeniyi (2005). In another studied by Lin (2004) found that higher education played a strong role in Taiwan's economic growth that is 1 percent rise in higher education led to 0.35 percent rise in industrial output and 0.15 percent rise in agricultural output.

Similar studied by Okubal (2005) confirm that a 1 percent increase in the average years of schooling led to 0.38 percent increase in real GDP in the long-run and 0.2 percent increase in the real GDP in short-run. Studied by Dauda (2009) support the view that there is a long-run relationship investment in education and economic growth in Nigeria. Bakare (2006) confirms that 1 percent fall in human capital investment lead to 48.1 percent fall in the rate of growth of GDP in period 1970 to 2000 in the Nigerian economy. Kakar, Khilji and Khan (2011) confirm a positive long-run relationship between education and economic growth in Pakistani economy. Finding of Odit, Dookhan and Feuzel (2010) revealed that human capital led to increase in output of the Mauritian economy and capital formation explained approximately 60 percent of growth rate of GDP. According to Musila and Belassi (2004) a 1 percent increase in average educational expenditure per worker led to about 0.04 percent increase in output in the short-run and 0.6 percent in the long-run.

The literature on Indian economy has had a mixed response. Bosworth, Collins and Virmani (2007) conducted that the contribution to India economy growth has been negligible. In another studied by Chandra (2010) tested the causality between the investment in education and economic growth in India and concluded a bi-directional causality between them. Pradhan (2009) confirmed that there exists a long and short-term relationship between education and economic growth to education but there is absence of reverse causality.

3.0 Methods

In this study, we employed time series data analysis. To examine the order of integration, autoregressive distributed lags (ARDL) or a bounds test was used to examine the relation between exogenous and endogenous variables. In addition, a unit root test was used to test for stationary. The use of the bounds testing technique

was based on the validations. First, Pesaran et al. (2001) and Narayan (2004) supported the use of the ARDL model for the estimation of level relationship because the model suggested that once the order of ARDL has been recognized; the relationship can be estimated by OLS. Second, the bounds tests allowed a mixture of I(1) and I(0) variables as the regressors; that is, the order of integration of the appropriate variables was not necessarily the same. Therefore, the ARDL technique had the advantage of not requiring a specific identification of the order of the underlying data. Third, this technique was suitable for a small or finite sample size (Pesaran et al., 2001).

3.1 Data Description

The data set consists of time series and cross country for two countries China and India over the period 1970-2011. The description for the all variable is discussed as follow:

Education expenditure refers an investment that can foster economic growth, enhance productivity, contribute to personal and social development and reduce social inequality. The proportion of total financial resources devoted to education is one of the key choices made by governments, enterprises, students and their families. The indicator covers expenditure on schools, universities and other public and private institutions delivering or supporting educational services. Expenditure on education is not limited to expenditure in instruction services but includes public and private expenditure on ancillary services for students and their families, where these services are provided through educational institutions. At the tertiary level, spending on research and development can also be significant and is included in this indicator, to the extent that the research is performed by educational institutions. Public expenditure includes both direct expenditure on educational institutions and educational related public subsidies to household administered by educational institutions. Private education expenditure is recorded net of these public subsidies attributed to educational institutions and it also excludes expenditures made outside educational institutions (OECD, 2011). The education expenditure will be measured by the education expenditure as a percentage GDP.

For the demographic variable will be measure by young population and ageing population. According to Tait and Heller (1982), demographic variables are likely to be key determinants of the demands for government services. For the example, an increase in the school-age population tends to increase the pressure on the government to increase educational expenditure. Therefore, these kinds of variables are to have precise and accurate figures for the completeness of the analysis of effect population on education expenditure. Young population (YOUNG) is another important demographic factor that could place pressure on the allocation of education expenditure. This variable is defined as the share of citizens younger than 15 years of age and ageing population (AGEING) is shares of age 65 and over. In the most countries, an increase in the population should imply a corresponding increase in government expenditure on education.

The other variable included is school enrolment rate. School enrolment rate is a factor that tends to have a significant impact on educational expenditure because the higher enrollment, the more likely the government is to increase its budget allocation on education. The average enrollment rate at every stage is used for the analysis of education expenditure in order to see its effect. At each educational stage, a different enrollment rate is applied. Enrolment rates are defined as the gross rate i.e. the number of students enrolled in the given level of education, regardless of age, expressed as a percentage of the population in the relevant official age-group. For example, the primary enrollment rate is used for the analysis of primary educational expenditure, and similar with secondary enrollment and tertiary enrolment.

For the control variables, first is inflation rate. Inflation is defined as a change in price level is bold in many macroeconomic models, as it determines many activities in the economy. These changes are normally calculated in the form of inflation rate. Inflation rate is intended to capture the generally-accepted fact that prices are an

important factor that affects the performance of an economy, and prices are an important role in determining the nominal level of spending. Inflation rates are taken into account as they represent how changes in price level will affects education expenditure. Besides that economic development is considered as a very crucial determinant of the level of public expenditure. In the development process of any developing countries, the government tends to invest immensely in infrastructure as well as education in order to create human capita. In this study, economic growth measured by the Gross Domestic Product per Capita (GDPC). GDPC can be a good reflection of how the economy performs in general or in average in a given period of time.

3.2 Model Specification

To examine the effects of the young and ageing population on education expenditure, ARDL bounds testing as introduced by Pesaran et al. (2001) was used on the following model. The Education Expenditure (EEXP) was predetermined as the dependent variable, while the independent variable was the young population (YOUNG) and ageing population (AGEING) and the control variables were primary school enrolment rate (ENRP), secondary school enrolment rate (ENRS), tertiary school enrolment rate (ENRT), inflation rate (INF) and gross domestic product per capita (GDPC).

The model specification was as follows:

$$LNEEXP_t = \beta_0 + \beta_1 LNYOUNG_t + \beta_2 LNENRP_t + \beta_3 LNENRS_t + \beta_4 LNENRT_t + \beta_3 LNINF_t + \beta_4 LNGDPC_t + \varepsilon_t \quad (1)$$

$$LNEEXP_t = \beta_0 + \beta_1 LNAGEING_t + \beta_2 LNENRP_t + \beta_3 LNENRS_t + \beta_4 LNENRT_t + \beta_3 LNINF_t + \beta_4 LNGDPC_t + \varepsilon_t \quad (2)$$

For multiple regression analysis, the log likelihood function of this model can be written as,

$$LNEEXP_t = \beta_0 + \beta_1 LNYOUNG_{t-1} + \beta_2 LNENRP_{t-1} + \beta_3 LNENRS_{t-1} + \beta_4 LNENRT_{t-1} + \beta_5 LNINF_{t-1} + \beta_6 LNGDPC_{t-1} + \mu_t \quad (3)$$

$$LNEEXP_t = \beta_0 + \beta_1 LNAGEING_{t-1} + \beta_2 LNENRP_{t-1} + \beta_3 LNENRS_{t-1} + \beta_4 LNENRT_{t-1} + \beta_5 LNINF_{t-1} + \beta_6 LNGDPC_{t-1} + \mu_t \quad (4)$$

Using the autoregressive distributed lags (ARDL), the model is transformed into,

$$\Delta LNEEXP_t = \beta_0 + \beta_1 LNYOUNG_{t-1} + \beta_2 LNENRP_{t-1} + \beta_3 LNENRS_{t-1} + \beta_4 LNENRT_{t-1} + \beta_5 LNINF_{t-1} + \beta_6 LNGDPC_{t-1} + \sum_{i=1}^{3} \beta_{7i} \Delta LNYOUNG_{t-1} + \sum_{i=1}^{3} \beta_{8i} \Delta LNENRP_{t-1} + \sum_{i=1}^{3} \beta_{9i} \Delta LNENRS_{t-1} + \sum_{i=1}^{3} \beta_{10i} \Delta LNENRT_{t-1} + \sum_{i=1}^{3} \beta_{11i} \Delta LNINF_{t-1} + \sum_{i=1}^{3} \beta_{12i} \Delta LNGDPC_{t-1} + \mu_t \quad (5)$$

$$\Delta LNEEXP_t = \beta_0 + \beta_1 LNAGEING_{t-1} + \beta_2 LNENRP_{t-1} + \beta_3 LNENRS_{t-1} + \beta_4 LNENRT_{t-1} + \beta_5 LNINF_{t-1} + \beta_6 LNGDPC_{t-1} + \sum_{i=1}^{3} \beta_{7i} \Delta LNAGEING_{t-1} + \sum_{i=1}^{3} \beta_{8i} \Delta LNENRP_{t-1} + \sum_{i=1}^{3} \beta_{9i} \Delta LNENRS_{t-1} + \sum_{i=1}^{3} \beta_{10i} \Delta LNENRT_{t-1} + \sum_{i=1}^{3} \beta_{11i} \Delta LNINF_{t-1} + \sum_{i=1}^{3} \beta_{12i} \Delta LNGDPC_{t-1} + \mu_t \quad (6)$$

Where
$EEXP_t$= Total Education Expenditure
$YOUNG_t$ = Young Population
$AGEING_t$ = Ageing Population
$ENRP_t$= Primary school enrolment
$ENRS_t$= Secondary school enrolment
$ENRT_t$= Tertiary school enrolment
INF_t= Inflation rate
$GDPC_t$= Gross Domestic Product per Capita
Δ=First different operator

There are two model equation of the estimation, Equation (1) is examine the effects of young population on education expenditure and Equation (2) examine the effects of ageing population on education expenditure.
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): $(H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0)$ against the alternative hypothesis$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0)$. Pesaran et al. (2001) report two sets of critical values for a given significant level. One set of critical values assumes that all the variables which are included in the ARDL model are I(0), while the others are calculated on the assumption that the variable are I(1). If the computed test statistic exceeds the upper critical bounds value, then the H_0 hypothesis are rejected. If the F-statsistic falls into the bounds, then the cointegration test becomes inconclusive. If the F-statistic is lower than the lower bounds value, the null hypothesis of no cointegration cannot be rejected.

4.0 Results and Discussions

4.1 Unit root test

A unit root test was done for all variables using the Augmented Dickey Fuller (ADF) and Phillips-Perron tests 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).

Results for the unit root test are reported in Tables 2-5 for China and India. Tables 2 and 3 present the results of the ADF and Philips-Perron tests for China, while Tables 4 and 5 show results of these tests for India. The order of integration was tested at 1, 5, and 10 percent significance levels, and the critical values were obtained from the Mackinnon (1991) Tables. The results were robust regardless of the lag length. 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).

Table 2: ADF unit root tests result for stationary of the variables in China

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LNEEXP (Total Education Expenditure)	-2.4040* (0.0920)	-3.2436* (0.1310)	-6.8476*** (0.1613)	-6.9206*** (0.1628)

LNPOPG (Population Growth)	-0.1491 (0.0177)	-2.3794 (0.0483)	-3.7076*** (0.1491)	-3.6476*** (0.1514)
LNPOPT (Total Population)	-14.0146*** (0.0024)	-1.5593 (0.0151)	-3.9028*** (0.0249)	-3.7143*** (0.0557)
LNYOUNG (Young Population)	-3.3229*** (0.0027)	-11.4502*** (0.0059)	-8.1731*** (0.0107)	-7.9958*** (0.0121)
LNAGEING (Ageing Population)	-0.2929 (0.0002)	-5.8813*** (0.0032)	-2.6013*** (0.0109)	-2.7152*** (0.1256)
LNDR (Dependency Ratio)	0.4459 (0.0005)	-2.0042 (0.0115)	-2.8415*** (0.0147)	-2.7186*** (0.0153)
LNENRP (School Enrolment, Primary)	-3.7461 (0.0493)	-2.5702 (0.0800)	-2.7657*** (0.1220)	-5.1707*** (0.1629)
LNENRS (School Enrolment, Secondary)	-1.0888 (0.0284	-2.4876 (0.0344)	-3.4855*** (0.1164)	-3.5472*** (0.1166)
LNENRT (School Enrolment, Tertiary)	-2.3134* (0.0169)	-4.4930*** (0.1517)	-4.8045*** (0.1582)	-5.1860*** (0.1607)
LNINF (Inflation rate)	-2.5532* (0.1192)	-2.8119** (0.1259)	-6.5846*** (0.1657)	-6.4675*** (0.1684)
LNGDPC (Gross Domestic Product per Capita)	3.2191 (0.0125)	0.3058 (0.0498)	-4.9280*** (0.1613)	-4.0337*** (0.2360)

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

Table 3: Phillips-Perron (PP) unit root test results for stationary of the variables in China

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LNEEXP (Total Education Expenditure)	1.5350 (0.0141)	-0.7109 (0.0741)	-5.3408*** (0.1607)	-5.6082*** (0.1638)
LNPOPG (Population Growth)	-0.7413 (0.0198)	-1.7861 (0.0577)	-3.4254*** (0.1365)	-3.3937*** (0.1381)
LNPOPT (Total Population)	-7.4738*** (0.0024)	-1.2338*** (0.0151)	-2.9084*** (0.0249)	-3.3670*** (0.0558)
LNYOUNG (Young Population)	1.0235 (0.0082)	-1.6603 (0.0383)	-2.0219*** (0.0480)	-1.6980*** (0.0533)
LNAGEING (Ageing Population)	-1.0883 (0.0044)	-2.2272 (0.0363)	-1.7341*** (0.0418)	-1.5812*** (0.0438)
LNDR (Dependency ratio)	-0.5306 (0.0077)	-2.2090 (0.0464)	-1.9621** (0.0442)	-1.8096*** (0.0465)

LNENRP (School Enrolment, Primary)	-0.5134 (0.0142)	-2.3205 (0.0864)	-4.7414*** (0.1537)	-4.6785*** (0.1537)
LNENRS (School Enrolment, Secondary)	-0.2465 (0.0331)	-2.1941 (0.0942)	-5.1743*** (0.1601)	-5.1149*** (0.1629)
LNENRT (School Enrolment, Tertiary)	-2.2577 (0.0155)	-2.0571 (0.0607)	-4.8045*** (0.1582)	-5.1909*** (0.1607)
LNINF (Inflation rate)	-2.5620* (0.1239)	-2.8625* (0.1333)	-7.5981*** (0.1725)	-10.7737*** (0.1747)
LNGDPC (Gross Domestic Product per Capita)	4.0506 (0.0125)	0.4466 (0.0498)	-4.9892*** (0.1613)	-6.0413*** (0.1648)

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

Table 4: ADF unit root tests result for stationary of the variables in India

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LNEEXP (Total Education Expenditure)	-0.2863 (0.0174)	-1.8294** (0.0907)	-5.8176*** (0.1635)	-5.7347*** (0.1658)
LNPOPG (Population Growth)	-0.7977 (0.0011)	-2.5957 (0.0038)	-2.8258*** (0.0116)	-2.9217*** (0.0193)
LNPOPT (Total Population)	-2.7188*** (0.0882)	-2.8350*** (0.0003)	-3.0167*** (0.0009)	-3.4999*** (0.0045)
LNYOUNG (Young Population)	-0.8956 (0.0020)	-5.5194*** (0.0024)	-5.1059*** (0.0064)	-4.6286*** (0.0143)
LNAGEING (Ageing Population)	-0.1869 (0.0003)	-6.4807*** (0.0040)	-2.4687** (0.0127)	-5.6203*** (0.0138)
LNDR (Dependency Ratio)	-0.1037 (0.0004)	-6.1164*** (0.0009)	-4.2586*** (0.0034)	-1.9467*** (0.0083)
LNENRP (School Enrolment, Primary)	-0.1557*** (0.0330)	-2.4778*** (0.0982)	-5.2206*** (0.1601)	-5.1707*** (0.1628)
LNENRS (School Enrolment, Secondary)	-0.2394 (0.0143)	-2.4559 (0.0848)	-3.4547*** (0.1988)	-3.4052*** (0.2016)
LNENRT (School Enrolment, Tertiary)	2.3811 (0.0248)	0.2057 (0.0546)	-5.4525*** (0.1579)	-6.7636*** (0.1532)
LNINF (Inflation rate)	-4.2695*** (0.1752)	-4.6535*** (0.1748)	-6.1952*** (0.2537)	-5.8173*** (0.2685)

LNGDPC (Gross Domestic Product per Capita)	0.8526 (0.0205)	-1.3908 (0.1714)	-5.7575*** (0.1618)	-5.8294*** (0.1642)

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

Table 5: Phillips-Perron (PP) unit root test results for stationary of the variables in India

Variable	Level		First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LNEEXP (Total Education Expenditure)	-0.2812 (0.0174)	-1.8294** (0.0907)	-5.7926*** (0.1635)	-5.7037*** (0.1658)
LNPOPG (Population Growth)	2.1416 (0.0074)	-5.2844*** (0.0095)	-3.0476*** (0.0173)	3.1957*** (0.0276)
LNPOPT (Total Population)	-3.0728*** (0.0007)	-3.2580*** (0.0048)	4.4493*** (0.0078)	-5.1131*** (0.0147)
LNYOUNG (Young Population)	8.8241 (0.0020)	-1.4665** (0.0090)	-0.1490*** (0.0154)	-1.7922*** (0.0395)
LNAGEING (Ageing Population)	2.7568 (0.0031)	0.1964 (0.0194)	-1.0274*** (0.0306)	-1.4811*** (0.0422)
LNDR (Dependency ratio)	7.3848*** (0.0025)	1.0269*** (0.1000)	-0.2405 (0.0157)	-2.1669 (0.0356)
LNENRP (School Enrolment, Primary)	-0.2465 (0.0330)	-2.1941 (0.0941)	-5.1743*** (0.1601)	-5.1147*** (0.1628)
LNENRS (School Enrolment, Secondary)	-0.5133 (0.0141)	-2.3204 (0.0863)	-4.7413*** (0.1536)	-4.6784*** (0.1557)
LNENRT (School Enrolment, Tertiary)	2.4847 (0.0248)	0.2635 (0.0546)	-5.6755*** (0.1579)	-6.7634*** (0.1532)
LNINF (Inflation rate)	-4.4327*** (0.1480)	-4.5116*** (0.1502)	-8.6212*** (0.1713)	-8.4674*** (0.1759)
LNGDPC (Gross Domestic Product per Capita)	0.6790 (0.0205)	-0.8174 (0.0737)	-5.8253*** (0.1618)	-5.8860*** (0.1642)

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

4.2 Cointegration test

The next step is to investigate whether education expenditure, young population, ageing population, primary school enrolment rate, secondary school enrolment rate, tertiary school enrolment rate, inflation rate and GDPC common long-run relationship. To achieve this, we tested the presence of the long-run relationship in equation (5) and (6). 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. We determined that there was a long-run

relationship between the young population variables when education expenditure was a dependent variable because the F-statistic was 9.1223 for China and 8.0636 for India while the result of F-statistic for ageing population is 5.2961 for China and 3.6903 for India. Both 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) (see Table 6). This implies that the null hypothesis of no cointegration among the variables in equation (4) cannot be accepted. The diagnostic test result of equation (5) and (6) is displayed in Table 7.

Table 6: 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)
6	2.696	3.898	3.276	4.630	4.590	6.368

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

4.3 The Long-run and short-run estimation coefficients

The estimated of long-run coefficient for education expenditure with respect to young population, ageing population, primary school enrolment rate, secondary school enrolment rate, tertiary school enrolment rate, inflation rate and the GDPC is presented in Table 7. To test the ARDL model, we applied a series of diagnostic tests and the result report in Table 8. It is clear that from the Table 8 that the model is clear from basic econometric problems for example serial correlation, heteroscedasticity, normality and functional form.

Table 7: Result for long-run relationship between population and education expenditure for China and India

	China		India	
VARIABLE	Model with YOUNG	Model with AGEING	Model with YOUNG	Model with AGEING
WALD TEST F-STATISTIC	9.1223***	5.2961***	8.0636***	3.6903***
Population (POP)	1.1051*** (3.9759)	-2.6597** (-0.9791)	4.5251** (1.6937)	-0.9372 (-0.2890)
School Enrolment, primary (ENRP)	0.5119** (2.2886)	-0.2005 (-0.4012)	2.3443** (3.1307)	-2.3968*** (-3.2238)
School Enrolment, secondary (ENRS)	1.2174* (1.8865)	0.1542 (0.8907)	1.2251*** (3.3321)	1.2576*** (2.8257)
School Enrolment, tertiary (ENRT)	0.2207*** (3.0204)	0.1781 (0.9693)	0.0889 (0.1957)	-0.1955 (-0.9160)
Inflation rate (INF)	-0.0146* (-1.6494)	-0.0297 (-0.4265)	-0.1201** (-2.2227)	-0.1120** (-1.8247)

Gross Domestic Product per Capita (GDPC)	1.0151*** (10.9367)	1.0394*** (6.7340)	1.6358*** (4.6216)	1.5472*** (3.8897)

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

Table 8: Diagnostic Test of the Effects of Population on Education Expenditure

Country	China		India	
Test	MODEL WITH YOUNG F-Statistic (p-value)	MODEL WITH AGEING F-Statistic (p-value)	MODEL WITH YOUNG F-Statistic (p-value)	MODEL WITH AGEING F-Statistic (p-value)
Jarque-Bera Normality Test	3.0745 (0.2149)	1.5988 (0.4495)	1.0919 (0.5792)	1.5160 (0.4686)
LM Test	7.6943 (0.0171)	2.3716 (0.0001)	23.5789 (0.0146)	0.8732 (0.5025)
Heteroscedasticity Test	0.3818 (0.9754)	0.7673 (0.7208)	1.0484 (0.5376)	3.2424 (0.0953)
ARCH Test	1.4797 (0.2320)	0.4541 (0.5048)	1.2342 (0.2754)	4.2587 (0.0478)
Ramsey RESET Test	0.0308 (0.8649)	0.6042 (0.4593)	2.8268 (0.1680)	0.0302 (0.8703)

The young population is positive effect the education expenditure both in short-run and long-run estimation both in China and India. The positive impact on education expenditure is the young population, as we know that China have the highest population and is significant with the result that total population is positively and significant influence the education expenditure. Studied from the Arriaga (1992) found that the impact of population change on education cost and demographic variables mortality, fertility and immigration affect the cost of education.[4] While young and ageing population also significant effects the education expenditure both in short-run and long run estimation but in the long-run estimation but ageing population is negatively while in the short-run the coefficient is positively with education expenditure. From Poterba (1997)[5] found the rise in the proportion of elderly person was associated with a decline in education spending.

For the school enrolment there are various sign of estimation depends on the variables of population. For the model with population growth, primary school enrolment rate is negatively correlated with the education expenditure both in long-run and short-run estimation, while secondary and tertiary school enrolment rate is positively correlated with education expenditure. For the model with total population, all the school enrolment rate is positively sign with education expenditure, similar result for the young population that is positively correlated with the education expenditure both in short-run and long-run estimation. In ageing model, the

[4] Arriaga (1992) studied on impact of population change on education cost at Sweden, United States and Latin America and the aims of this paper is to analyses and measure how the demographic variables mortality, fertility and immigration affect the cost of education.

[5] Poterba (1997) using three demographic variables; the share of the population over the age 65; the share of population of school age 5 through 17; and the difference in the racial composition of the elderly and school age population.

primary school enrolment is negative sign, however secondary and tertiary is positive sign with education expenditure whereas in model with dependency ratio primary and tertiary education is negatively correlated with education expenditure in long-run while in short-run only primary education is negatively correlated with education expenditure. For the control variable, gross domestic product per capita is positive influence education expenditure both in long-run and short-run coefficient while inflation rate is negatively correlated with the education expenditure.

Results for the short-run estimation coefficient are reported in Table 9. 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 both China and India are negative values and have a relationship between the dependent and independent variables; they are significant at the 5 percent level for China and at the 10 percent level for India both for young population and ageing population. Results for the short-run coefficient indicate that the young population has a positive relationship with education expenditure, and it is significant at the 1 percent level for China and 10 percent for India. This finding also confirms that the young population increases education expenditure in the short run. However, ageing population is negatively correlated with the education expenditure both in China and India and insignificant with education expenditure. Besides that, the other variables also indicate positive and significant relationships with dependent variables, except for primary school enrolment rate and inflation rate. Results for primary school enrolment rate and inflation rate for both countries show a negative relationship, but they are statistically significant expect ageing population in China. From these results, we can conclude that the young population has a positive relationship with education expenditure; an increase in the young population will increase total education expenditure both in the long-run and short-run coefficients.

Table 9: Result for short-run relationship between population and education expenditure for China and India

	China		India	
VARIABLE	Model with YOUNG	Model with AGEING	Model with YOUNG	Model with AGEING
ECM	-1.5412** (-0.1544)	-1.2512* (-0.5139)	-5.0113** (-0.1485)	-2.7513* (-01191)
Population (POP)	1.6987*** (2.5302)	0.0885 (0.0205)	0.9073* (1.0081)	0.1016 (1.3447)
School Enrolment, primary (ENRP)	0.0001* (1.0223)	-1.0284 (-1.5160)	0.3410* (1.3598)	-0.9212* (-1.0092)
School Enrolment, secondary (ENRS)	0.1569** (2.5894)	0.0025 (0.4868)	2.5466*** (3.3037)	2.6606*** (3.0960)
School Enrolment, tertiary (ENRT)	0.0257 (0.1845)	0.0235 (0.6717)	-0.0653 (-0.2036)	-0.1297 (0.3859)
Inflation rate (INF)	-0.0067** (-1.3970)	-0.0084 (-2.0387)	-0.0210 (-0.5597)	-0.0062 (-0.1936)
Gross Domestic Product per Capita (GDPC)	0.4573** (3.0573)	0.0002 (0.8220)	0.8801*** (2.0804)	0.1190*** (2.6829)

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

5.0 Conclusion and Recommendations

This paper aims to examine the relationship between the young and ageing population and education expenditure both in the short-run and long-run coefficient in China and India, by using time series data on education expenditure, young population, ageing population and the control variables such as school enrolment rate for the primary, secondary and tertiary, inflation rate and GDPC. The result confirms that both in short-run and long-run estimations, the young population have a relationship with education expenditure. The young population clearly shows relatively higher education expenditure in the younger aged for China and India. In the long-run India has a higher coefficient of young population and education expenditure than China, because India has a younger people than in China, therefore total education expenditure is higher among the aged there, while China has a smaller younger population. In China and India as an increasing absolute number of younger will inevitably increase education expenditure. Thus it will conclude that a more young population will increase the education expenditure while an ageing population will decrease the expenditure on education. The result seem to send a signal that policymakers hardly take into account the population factors, particularly the demand from the educational sectors, as the important factors to determine the level of expenditure. In other words, the government may have to overlook these factors when making decision on educational expenditure. This result is similar by previous studied Arriaga (1992) found that demographic is positive influence education cost and studied by Canete and Ped (2000) that found high population growth will increase the school age of education and thus increase education expenditure. On the other hand ageing population and dependency ratio are negative influence education expenditure both in China and India. That is the allocation of expenditure on education is not affected by the size of the ageing population and dependency ratio and this similar result by Kuehnel (2010); Tasun et al. (2007); Button (1992); Kemnitz (1999); Evans et al. (2001) and Grob and Wolter (2007) that found ageing is negatively influence education expenditure and this will support by Poterba (1998) that elderly are going to vote for programs that would benefit them more.

Secondly as for school enrolment rate has had primary, secondary and tertiary school enrollment rate has positive and negative effect on education expenditure. The empirical result indicates that primary and secondary education is significant and positively coefficient, this implying that the education expenditure is significant determined by the primary and secondary school enrolment rate. The previous studied by Castles (1989); Gupta et al (2002) found that positive impact of school enrolment rate to the education expenditure.

Thirdly, as for inflation rate and gross domestic product per capita, the coefficient of INF is significant but it has a negative sign. This indicates that the inflation is negatively related to the education expenditure. On the other hand, it could be the case when price levels increase, the government expenditures on education decrease. This estimation also has crucial implication for theories. That is, it lends support to the Keynesian Counter-Cyclical theory to the extent that inflation has a negative impact on government expenditure, particularly in this case of educational expenditure in China and India. Precisely, the government raises its expenditure to boost the economy in the time of low inflation. On the other hand, it could be the case that government increases education expenditure in less proportion compare to an increase in inflation. While as for GDPC, the coefficient is significant and positive with education expenditure. It means that increase in the GDP will increase the expenditure on education. The result seem to send a signal that policy makers hardly take into account the GDPC factors, particularly for the education expenditure as an important factor to determine the level of expenditures. In other words, the government may have overlooked these factors when making decision on education expenditure and the result of positive influence of GDP on education expenditure is confirmed by the previous studies by Afzal et al. (2010); Lin (2004); Okunbal (2005); Dauda (2009) and Kakar, Khilji and Khan (2011) that found positive effects of GDP on education expenditure.

From the above comparison, it can also be noted that a number of predictors successful to be incorporated in to the policy determination of educational expenditure in China and India both over time. This clearly leaves some puzzles to be resolved and explained in the future especially the percentage of increasing total young and ageing population in China and India. This proportion of young and ageing should be addressed by scholars in the field of studies as well as the policymakers in the field of education. On the other words, the combination control variable such as school enrolment rate, inflation rate and GDP per capita also help ensure the significant effect of population on education expenditure.

Future research can consider other determinants of education expenditure, demographic indicators such as total population, population growth, and working aged population; and education infrastructure such as private education, public education, and total number of teachers. The structure of this combination of factors has been the center of debate over whether increasing education 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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