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Nguyen Thi Thu Ha

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FACULTY OF BUSINESS AND ECONOMICS

Nguyen Thi Thu Ha

The impact of population ageing, economic growth on private savings in Vietnam

DOCTORAL DISSERTATION

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CHAPTER 1 INTRODUCTION

The chapter presents the significance and motivation of the study, and then research purposes and objects. According to these objectives, main research questions that the proposed study seeks to address and hypotheses are developed. Finally, the structure of research with six chapters is outlined.

1.1. Significance of the study

In recent decades, population ageing is recognized as a significant issue of most countries in the world. It has happened in almost developed countries and now spreads to less developed ones. Vietnam has entered the so-called "ageing phase" of the population since 2017 and now is facing a remarkable increase in the proportion of the elderly population, which is estimated to rise from 8.7 percent in 2010 to 11.6 percent in 2020 and to 24.8 percent in 2049 (General Statistics Office of Vietnam (GSO, 2011).

The population ageing is known as a demographic transition resulting from a rapid decline in fertility rate, an increase in the elderly dependency ratio and a higher life expectancy (United Nations Population Fund (UNFPA), 2011). With regard to Vietnam, this country is entering the ageing process at the high speed that is shown by a sharp decline in the fertility rate, some increase in the old age dependency ratio, which is expected to accelerate quickly over the next years along with an increase in life expectancy. This population ageing situation in Vietnam in the coming decades will be a huge economic burden for the working age adults in the households, thereby affecting their savings and the savings in the economy. Furthermore, if the country cannot control this ageing situation, it will negatively impact the economic growth that will be able to affect private savings as well as the aggregate saving in the economy.

According to the former Life Cycle Hypothesis of Modigliani and Brumberg (1954), the individuals smooth consumption over their lifetime. Specifically, people tend to save more when they are young and their incomes are high, and dissave when they are old and after retirement. This means that the individuals' savings is the highest during the work period, but after retirement their income reduces, while the retirees still need to consume to maintain the normal living standards during their retirement period, thus leading to a decrease in their savings.

From the microscopic to the macroscopic view, Modigliani and Brumberg (1979) and Modigliani (1986) developed the original Life Cycle Hypothesis to create the macroeconomic consumption and savings functions. They revealed that if the proportion of the working age population in a country increases, private savings will increase. By contrast, if the ratio of dependents (the children aged less than 15 years old and the adults aged 60 and over to the working age population aged from 15 to 60) rises, the savings will decrease. In other words, private savings increases with a higher rate of the working age population due to their high income during the work period, but declines with a higher rate of the minor and the elderly population (hereafter referred to as the youth dependency ratio and the elderly dependency ratio) because the children do not have income and their consumption relies entirely on the income of the working age adults in the households, while the retirees receive a lower income after retirement that may not be enough to maintain their living standards. Besides, as a consequence of population ageing, there are a large number of the elderly dependents that suggests the possibility of more expenditure in relation to their low income after retirement, thereby causing a reduction in private savings (Wilson, 2000).

Increasing life expectancy also have an effect on private savings, the Life Cycle Hypothesis of Modigliani and Brumberg (1954) indicated that with an increase in longevity, the working age adults tend to save more during the work period of their lives due to the longer retirement period in the future, meaning that private savings would rise at first. Later on, when the dependent population includes the children and the elderly population, which was known as spenders, was significantly higher than the working age population (the active population in the economy), private savings would be reduced. In this case, private savings would be lower in case of having a higher rate of the elderly in the population (or would be higher in the opposite case).

From that, the implication of the Life Cycle Hypothesis is that changes in the population age structure can exert a potentially large influence on private savings, especially in the context of population ageing as represented by a declining fertility rate, the higher young age and old age dependency ratios and a longer life expectancy.

On the other hand, the Life Cycle Hypothesis of Modigliani (1986) considered the relationship between the age structure of the population (refers to the dependency burden), economic growth, and private savings in the economy and further confirmed the significant

negative impact of the elderly dependency ratio on private savings rate. Specifically, in the Life Cycle Hypothesis, private savings directly related to the levels of income and consumption by the individuals. Modigliani (1986), indeed, supposed that people choose their consumption (and hence their savings) relying on the current (and expected) levels of their income. If the economy grows, the income will grow, implying that the young people will be richer and save more than the elderly. Indeed, the savings of the young population will be much higher than the dissaving of the elderly population, leading to the higher private savings. In other words, there exists a positive association between economic growth and private savings in the economy. Besides, based on the Life Cycle Hypothesis, Apergis and Christou (2012) also indicated that the higher rate of the elderly population as a result of population ageing will increase the burden of government spending on social insurance plans and pension funds for the old age persons.

Furthermore, for the past few decades, private savings is often being mentioned as a key component in the economy system of a country from both social and economic aspects and has become a major concern for recent studies relating to its association with population ageing and economic growth. In regards to the linkage between population ageing and private savings, there were a large number of studies investigating this relationship. In particular, recent empirical researches employed the modern time series methods, including the cointegration test and Granger causality test in analyzing this correlation within the Life Cycle Hypothesis framework and confirmed that there is a substantial impact of the population ageing, referring to the youth dependency ratio and the elderly dependency ratio, on private savings.

In terms of the economic growth and private savings, there are a number of theoretical and empirical researches based on the Life Cycle model examining the relationship between economic growth and private savings, but the results sometimes are contradictory. Indeed, the direction of causality between two variables has continued to generate much debate among researchers. Most of the empirical studies used cross-country data for the estimation this relationship; however, the limitation of the cross-country regression analysis is that it relies on the assumptions of homogeneity about the nature and quality of the data, and thus the validity of the result is suspect. There is therefore a need to undertake econometric analysis on private saving behavior using the time series data of individual

country and employing the well-developed techniques for handling non-stationary time series data within an integrated theoretical framework.

1.2. Statement of problem

Vietnam is a developing country situated in South East Asia. Because of cultural peculiarities, the Vietnamese people seem to save more for their family life and their longer future lives after retirement as the population structure is ageing. Besides, Vietnam has experienced dramatic demographic changes with a decrease in the ratio of young dependents, an increase in the pre-retirement working population, and meanwhile, Vietnam also experienced a remarkable economic growth that earned her the moniker of a new economic dragon in Southeast Asia (Collins and Zhu, 2005). The achievement was made possible through the comprehensive economic reform known as *Doi Moi* (renovation program) since 1986 aimed at transforming the country "from a centrally planned economy to a market-oriented economy". However, whether the coincident development of demography, economy and private savings are interrelated is a moot question?

The author acknowledged the advantage of the cointegration techniques for handling non-stationary time series data that were thus adopted in studying the relationship between population ageing, economic growth and private savings. More importantly, there is no robust consensus on the associations of population ageing and economic growth with private savings reported in previous researches, and to date there is no empirical study conducted on this relationship in Vietnam. Thus, there is clear merit in conducting empirical research in this area by employing the cointegration techniques. The approach is suitable for analyzing time series data from Vietnam and for investigating the short run and long run impacts of population ageing and economic growth on private savings within the Life Cycle Hypothesis framework as well as answer the question: "whether the Life Cycle Hypothesis can be applied in Vietnam", where this hypothesis may be less likely to apply due to its cultural peculiarities, for example, the young Vietnamese people have to care their elderly parents and the financial transfers from the young people to their ageing parents are more common than that in Western countries.

1.3. Research aims and objectives

The main purposes of the research are to determine whether the short run and the long run associations of population ageing (refers to the ratio of the youth dependents and the ratio of the old age dependents to the working age population, life expectancy and social

insurance funds rate) and economic growth (is represented by GDP growth rate, GDP per capita and inflation rate) with private savings exist in Vietnam or otherwise. And if affirmative, which is the direction of causality between these variables. In addition, the research will test this topic within the Life Cycle Hypothesis framework and shed light on whether the Life Cycle Hypothesis applies in Vietnam where this hypothesis may be less likely to apply due to its cultural peculiarities. Finally, some policy implications are suggested to spur private savings in a country in general and in Vietnam in particular.

Concretely, the objectives of the research are as follows:

- To review the population ageing, the economic growth, pension schemes and private savings in Vietnam during the period 1985 - 2016.
- To identify the associations of the young age dependency ratio and of the old age dependency ratio with private savings rate in Vietnam.
- To determine the relationship between life expectancy and private savings rate in Vietnam.
- To examine the relationship between social insurance funds rate and private savings rate in Vietnam.
- To investigate the direction of causality between private savings rate and the young age dependency ratio, the old age dependency ratio, life expectancy and social insurance funds rate.
- To determine the relationship between GDP growth rate and private savings in Vietnam.
- To determine the relationship between GDP per capita and private savings in Vietnam.
- To examine the relationship between inflation rate and private savings in Vietnam.
- To investigate the direction of causality between private savings and GDP growth rate, GDP per capita and inflation rate.
- To identify whether these findings confirm or reject the Life Cycle Hypothesis in the cultural peculiarities of Vietnam.
- To suggest policy implications for policy makers to spur private savings in Vietnam.

1.4. Research questions and hypotheses

According to the objectives, main research questions that the proposed study will seek to address are:

- How are the population ageing, the economic growth, pension schemes, and private savings in Vietnam in the period 1985 - 2016?
- Is there the long run relationship between the young age dependency ratio, the old age dependency ratio, life expectancy, social insurance funds rate, and private savings rate in Vietnam?
- To what extent, the young age dependency ratio, the old age dependency ratio, the longevity, and social insurance funds rate affect private savings rate in Vietnam?
- Is the direction of the causality running from the young age dependency ratio, the old age dependency ratio, life expectancy, and social insurance funds rate to private savings rate in Vietnam?
- Is there the long run relationship between GDP growth rate, GDP per capita, inflation rate and private savings in Vietnam?
- To what extent, GDP growth rate, GDP per capita, and inflation rate impact private savings in Vietnam?
- Is the direction of the causality running from GDP growth rate, GDP per capita, and inflation rate to private savings in Vietnam?
- Whether these findings confirm or reject the Life Cycle Hypothesis in the cultural peculiarities of Vietnam?
- What are the priority policies that need to be executed to spur private savings in Vietnam?

Following these research questions, a number of hypotheses in the two regression models of the relationship between population ageing (refers to the youth dependency ratio, the elderly dependency ratio, life expectancy and social insurance funds rate) and private savings and between economic growth (refers to GDP growth rate, GDP per capita and inflation rate) and private savings will be developed as follows:

- **Hypothesis 1:** There is a significant impact of the youth dependency ratio, the elderly dependency ratio, life expectancy, social insurance funds rate on private savings rate in Vietnam.
- **Hypothesis 2:** The direction of causality runs from the young age dependency ratio, the elderly dependency ratio, life expectancy and social insurance funds rate to private savings rate in Vietnam.
- **Hypothesis 3:** There is a significant impact of GDP growth rate, GDP per capita, and inflation rate on private savings in Vietnam.

- **Hypothesis 4:** The direction of causality runs from GDP growth rate, GDP per capita and inflation rate to private savings in Vietnam.
- **Hypothesis 5:** These findings confirm the Life Cycle Hypothesis in the case of Vietnam.

1.5. The structure of research

The thesis is organized and divided into six main chapters.

Chapter 1 is the introduction and motivation of this research. Specifically, the significance of the study, the statement of the problem, the research purposes and objects, and research questions and hypothesis are developed in this chapter.

Chapter 2 provides an overview of the population ageing, the economic growth, pension schemes, and private savings in Vietnam in the period 1985 - 2016.

Chapter 3 reviews the Life Cycle Hypothesis of savings, relevant theories and empirical studies regarding to the impact of population ageing, which is represented by the children dependency ratio, the elderly dependency ratio, life expectancy and social insurance funds rate on private savings rate and the effect of economic growth (which is represented by GDP growth rate, GDP per capita and inflation rate) on private savings.

The research methodologies are employed to test the hypotheses, data collection (the sources and the type of the data), the model specification, and the time series techniques (including Unit root tests for stationarity, Vector Autoregressive (VAR) model, the cointegration tests consisting of two-step Engle and Granger residual-based test and Johansen test based on VARs, Vector Error Correction Model (VECM), Granger Causality and Block Exogeneity Wald tests, impulse response function and variance decomposition, and diagnostic tests for Ordinary Least Square (OLS) model) will be described in Chapter 4.

Chapter 5 presents and analyzes the obtained empirical results within the Life Cycle Hypothesis framework as well as discusses these findings as compared to the results of previous researches.

Chapter 6 includes a brief summary of the study and conclusions, and then policy implications and its recommendations for the Vietnam government and policy makers that can be used to spur private savings in the population ageing context in Vietnam. Indeed, identifying the limitations of the study and suggesting areas for further study is another important contribution of this chapter.

CHAPTER 2 LITERATURE REVIEW

The chapter starts with the definitions of population ageing and private savings, and how to calculate private savings through the national accounts identifies. After that, the Life Cycle Hypothesis regarding the relationship between population ageing, economic growth and private savings, its applications and the issues of this theory are presented and discussed. Finally, related literatures and empirical studies focusing on the influences of demographic and macroeconomic variables representing for the population ageing variable (the youth dependency ratio, the old age dependency ratio, life expectancy and social insurance funds rate or pension funds rate) and for the economic growth variable (GDP growth rate, GDP per capita and inflation rate) on private savings will be outlined in more detail.

2.1. The definition of population ageing

Elderly usually refers to the age of 60 or 65 and over. In 1956, the Population Division of United Nations has adopted 65 years old as age boundary for the classification between people in the workforce and the retirees (or the elderly). In 1982, World Assembly on Ageing used 60 years old as the age starting line of the elderly population. Vietnam National Committee on Ageing defined that the elderly refers to people those aged 60 years old and over. The research considers the population ageing in Vietnam, thus will use 60 years of age and over (60+) to refer to the elderly population. Indeed, the population aged less than 15 years old is called the children. The working age population is the population in the 15-59 years age group that is calculated by deducting the elderly and the children population from the total population.

The United Nations Population Division (2017) also stated that ageing is defined as ageing of the population due mainly to an increase in the proportion of the elderly in the population. Similarly, Population Handbook affirmed that population ageing is known as the so-called ageing of population resulted from the increasing proportion of the elderly population or the diminishing proportion of children population of such a gradual process. Fu (2013) acknowledged that a country's population is ageing or in the ageing situation once the share of the elderly population increases and the share of the child population decreases, which is caused by an increase in life expectancy and a decrease in fertility rate and/or mortality rate respectively.

From that, the population ageing is considered as demographic structure changes and it describes the issues of population age structure. In general, the population ageing of a

country refers to changes in the population age structure, which is as a result of a decreasing proportion of the children and an increasing proportion of the elderly in the population. Also, the country enters an ageing society when its population age structure is old and experienced either of characteristics, more specifically, the population over 60 years old reach 10 percent or the population over 65 years old reach 7 percent (the United Nations Population Division and World Assembly on Ageing).

2.2. The definition of private savings

Savings can be divided into two types, including domestic savings (which consists of government, corporate and household savings) and private savings (which refers to the savings of households and corporates) or personal savings (which includes household and individual savings) (Aron and Muellbauer, 2000).

Private savings, in this thesis, is calculated through the national accounts identities, in which the national income equals to the output in an open economy and can be expressed as follows:

$$Y = C + I + G + (EX - IM) = C + I + G + NX$$

Where: Y is national income or Gross Domestic Products (GDP)

C is consumption

I is investment

G is government spending

NX is net exports (Export (EX) minus Import (IM))

Based on this national accounts equation, we can calculate the national savings (S) which is defined as the value that is not consumed by the government as follows:

$$Y - C - G = S = I + NX$$

Besides, the country's national savings (S) is the sum of private savings (S_p) and public (or government) savings (S_G).

$$S = I + NX = S_p + S_G$$

Public (or government) savings (S_G), which is government revenue, is computed by taxes minus government expenditures and then is called the budget surplus or the budget deficit depending on the compared value between government revenues and expenditures.

In one transformation, we get the private savings identify:

Private savings (S_P) = I + NX - S_G

= Investment + Net exports - Public savings

Or private savings (S_P) = (Y - C - G - NX) + NX - (Government revenues - expenditures)

= (GDP - C - G) - (Government revenues - expenditures)

= GDP - C - Government revenues

For the research's purpose, private savings rate in this thesis is then calculated as a percentage of GDP.

2.3. The Life Cycle Hypothesis and related literatures

2.3.1. The Life Cycle Hypothesis

The Life Cycle Hypothesis, which was introduced by Modigliani and Brumberg (1954), was the first and most important theoretical framework used to analyze the savings behaviour with the demographic transition. The main idea of the first theory was simple that the individuals usually considered their long term resources, not just their current income when deciding how much to consume in any given period (Pistaferri, 2006). Also, the Life Cycle Hypothesis and the permanent income hypothesis were considered as an unified framework. However, the difference between these two hypotheses was that while the Life Cycle Hypothesis assumed a finite planning horizon, the permanent income hypothesis assumed an uncertain future income and a standard "utility function" that specified the customer's attitudes toward the level and riskiness of their expenditures.

Specifically, the Life Cycle Hypothesis assumed that the consumption depends on not only the current income, but also a lifetime total resources. According to Modigliani and Brumberg (1954), the individuals would deal with the estimated lifetime income and create an optimal configuration in different stages of the age to gain maximized intertemporal effects. In order to maintain the standard of living after retirement, the individuals must maintain their savings during the work period. They spent one part of their earnings on self-consumption and childrearing, and saved the other part for their consumption after retirement. In the individual's life cycle, the work period corresponded to positive savings, while the children and the elderly corresponded to negative savings. An individual's savings accumulation increased in the work period and would achieve a maximum level

near retirement time. After that, the personal property would decrease gradually. The life cycle of the individual's wealth accumulation demonstrated an appearance of pyramid.

Relying on these above ideas, Modigliani and Brumberg (1979) developed the original Life Cycle Hypothesis to create the macroscopic consumption and savings functions. These consumption and savings functions based on four basic assumptions. First, there was no bequest between generations. Second, the individual's consumption rate was determined by their age and their preferences in line with utility maximization, not by their total resources. Third, the interest rate was zero. Fourth, people would consume consistently during the rest of their life. Following the former Life Cycle Hypothesis of Modigliani and Brumberg (1954) that individuals needed to consume during the life cycle, while their savings was only positive in the working period. Therefore, from the microscopic to the macroscopic view, if the ratio of the country's working age population increased, the savings would increase. By contrast, if the ratio of dependents or the ratio of the children and the elderly to the working age population rose, the savings would decrease (Modigliani and Brumberg, 1979).

Modigliani (1986) continues revised and improved the Life Cycle Hypothesis and summarized this hypothesis as six parts. First, the individual's consumption habits were not the determinants of the national savings because in fact, the countries, where people have different consumption habits, also experienced the same national savings rate. Second, the growth rate of income per capita and the changes in age structure of the population affected on the national savings rate of a country. Third, if the growth rate of income and population were zero, the national savings rate in the long run would be zero. Fourth, the wealth-income ratio was a decling function of the growth rate of income. If the growth rate of income was zero, the wealh-income ratio would reach the maximum level. Fifth, although there was no bequest, the country's wealth could be accumulated significantly. Sixth, with a given growth rate of income, the wealth-income ratio and the saving rate depend mainly on the total working years before retirement. More importanly, the Life Cycle Hypothesis of Modigliani (1986) has been used to examine the relationship between the age structure of the population (refers to the dependency burden), economic growth and private savings. As above mentioned, this hypothesis emphasized on the choice of how to maintain stabilized living standards when facing with changes in a life cycle. The individuals smooth consumption over their lifetime. In the individual's perspective,

the average propensity of consume, which was calculated by dividing consumption by income, was greater in both the young and the elderly. More clearly, when people were young, they were likely to borrow against the future income, but when they were old or retired, they tended to use their savings. On the other hand, the working age population had a greater tendency to save for their retirement, but in the meanwhile, the working age population had a lower propensity to consume, which was typically enhanced by a higher income (Sjafii et al., 2015).

The Life Cycle Hypothesis of Modigliani (1986) also stated that the income differs systematically over an individual's life, thus the level of personal savings moves in accordance with the income of life (Mankiw, 2011). In other words, people tend to save more when they are young and their incomes are high, and dissave when they are old and after retirement. This means that private savings is the highest during the work period, but after retirement the income decreases, people draw from their previous savings to maintain the normal living standards during their retirement. More old age dependents resulting from the population ageing suggest the possibility of more expenditure relatives to income, thus lead to a decrease in private savings. This hypothesis can also be expanded include the children's dependency burden on private savings, because the children do not have income, thus the working adults in the households need to support their young dependents' lives by sacrificing their savings, thus resulting in a reduction in private savings (Wilson, 2000).

From that, it can be concluded that the Life Cycle Hypothesis of Modigliani implies that private savings can be influenced by changes in the population age structure or the size of age groups in the population. Private savings rises with a higher percentage of the working age population because their income is high, thus they can save relatively more, but reduces with a higher percentage of the minor and elderly population (hereafter referred to as the youth dependency ratio and the elderly dependency ratio) due to their low income or even no income (Yasin, 2007).

2.3.2. The savings rate (SR) in the Modigliani's simplified model

Assumed that the individuals start working at age D, work for W years, retire for R years, and die at L years old, that the income and consumption are independent of age, and that no productivity growth and no bequests or other intergenerational transfers exist in the model and the interest rate is zero. The savings rate (SR) in the Modigliani's simplified model (1970) is presented as follows:

$$\text{SR} = \frac{(D+R)}{L} - \frac{W}{L} * DEP - \frac{W}{L} * AGE$$

Where: *DEP* is the proportion of young dependents (the minors aged less than 15 years old) to the working age population (people aged 15 - 60 years old).

AGE is the proportion of the elderly (those older than 60 years old) to the working age population.

The equation shows that the savings rate is a declining function of both DEP and AGE, and the coefficients of these two variables are the negative of the proportion of working life to life-span. This result is explained that because children do not have income but require consumption and the elderly have not enough income to cover expenses, leading to a failure in savings; hence, a higher ratio of the children and the elderly population, people will reduce the level of savings. Furthermore, the higher rate of dependent population will increase the burden of government spending on funds for retirement (Apergis and Christou, 2012). In general, in the life cycle model, the age structure of population can be considered as a fundamental factor in determining the savings rate and there is a negative impact of population ageing, which is represented by the youth and elderly dependency ratios on savings rate in the economy.

On the one hand, the Life Cycle Hypothesis of Modigliani (1970) indicated that people chose their consumption (and hence also savings) relying on the current (and expected) levels of income. On the other hand, the Modigliani's Life Cycle Hypothesis affirmed a positive association between savings and income growth. Modigliani (1970) supposed that if there were no income growth and no population growth across generations, the savings of young people would balance the dissaving of the elderly, thus the aggregate saving rate was zero. However, if the income grew, the young people or the working age people would be richer than the elderly. Therefore, the young would save more than the dissaving of the elderly, resulting in a higher savings (both private savings and the aggregate savings). In other words, there was a positive relationship between income growth and private savings. Carroll et al. (2000) favored the Modigliani's Life Cycle Hypothesis and stated that if the individual's consumption bases on their habits and changes slowly in response to the change in their income, an increase in individual's income will lead to a higher savings rate. Similarly, the buffer stock model of savings of Deaton (1991) and Carroll (1997) were in favor of the Modigliani's Life Cycle Hypothesis and also provided a similar (or positive)

correlation between economic growth and private savings. They supported the viewpoint that private savings is an important force for the economic stability and growth. However, Carroll and Weil (1994) disagreed with these authors that, *ceteris paribus*, an exogenous increase in the aggregate economic growth will make forward looking people feel wealthier, and thus consume and expenditure more and save less. This finding confirmed a negative influence of economic growth on private savings.

The Life Cycle Hypothesis has been work well and is central to economic analysis. Although there have been changes in methods that the theory used, this hypothesis continues to provide the framework in which researchers think about intertemporal issues at both the individual level and the economy level. Over the last decade, researches, which both in theoretical and empirical aspects, have tried to modify and challenge these issues, but we are still far from the sort of integration.

One issue of the Life Cycle Hypothesis needed to be considered that the relationship between the population age structure and the savings is a current topic of debate. More specifically, the cross-country regressions frequently show that the savings rate is lower when the number of dependent children and the elderly is high, and savings is the highest in the middle - age (after the childrearing stage, but prior to retirement) when earnings is high, which is in accordance with the life cycle theory. However, the microeconomic evidence on the age-profiles of savings is not consistent with these impacts of cross-country regressions. Indeed, the cross-country analysis seems to be weak to econometric techniques, with results quite sensitive to reasonable changes in statistical specification (Deaton, 2005).

Another issue of the Life Cycle Hypothesis has originated from uncertainty. Modigliani (1970) argued that uncertainty will generate a demand for precautionary savings, which is known as the accumulated assets of savers in the life cycle and can serve for two purposes: one is for retirement and another is for a buffer against unexpected urgent situations. Consequently, uncertainty will change the picture of consumption and savings much.

Besides, according to Carroll (1997), people, in fact, who are sufficiently prudent with uncertain future earnings will never borrow, even if they are possible to borrow. Indeed, if such people are expected their earnings to growth over time, they will maintain their consumption in relation to their current income. In this case, the individual's consumption is effectively controlled by their current income. The consumption behavior of Carroll is

directly contrary to that of Modigliani in the viewpoint that the individuals' consumption can be detached from their income.

Perhaps the most fundamental challenge to the life cycle model has been related to its basis underlying assumptions that people make consistent, rational and intertemporal plans, and people act as if they are maximizing a utility function defined over the life-time periods. As a result, the assumptions of economists regarding the people's behavior along with the customer's choice have long been challenged by psychologists and others. Furthermore, many anomalies and paradoxes have been identified in the way that people deal with the uncertainty, which is inevitable when people make choices between the recent consumption and the future consumption. For instance, the economists pay more attention to the utility maximization. Therefore, they make provision for retirement above and beyond the schemes of the state, so that the life cycle theory is caught up the plausibility, even if the details are uncertain or even wrong. Following these viewpoints of economists, some people also make preparation for their retirement, thus the Life Cycle Hypothesis might meet some problems associated with its wrong details (Deaton, 2005).

Another challenge to the life cycle model relates to the individual interests. Instead of maximizing the utility, people now assume to act optimally in their own interests, in which instead of having choices, they ought to do or cannot do so to achieve their goals. However, in fact, it is impossible for them to plan their consumption, savings and retirement according to the principles of the Modigliani's Life Cycle Hypothesis because the life is complicated and the individual's choice under uncertainty is particularly, and even when people know what is the best for them, they do not always do it. Hence, the behavioral economics has appeared and provided a successful empirical description concerning to the way that people actually act to make people better off, but the Life Cycle Hypothesis still exists as the baseline theory (Deaton, 2005).

2.3.3 The relationship between population ageing and private savings rate

2.3.3.1. Influence of the dependency ratios on savings rate

As above mentioned, an important implication of the Life Cycle Hypothesis is the linkage between the dependency ratio and private savings rate. Based on the original Life Cycle Hypothesis of Modigliani (1970), Fry and Mason (1982) and Mason (1987, 1988) provided the variable rate-of-growth effect in the life cycle savings model related to the relationship between the dependency burden and the savings rate. The variable rate-of-

growth effect model was divided into two effects: growth effect and dependency effect. Growth effect implied that the population growth led to a higher growth of income, and then resulted in a higher savings rate. By contrast, dependency effect, which was expressed by an increase in the number of dependents, operated in the opposite direction. An increase in the youth and old age dependents influenced on the timing of life cycle savings because the household consumption shifted from non-childrearing to childrearing stage and from the working age period to the retirement period. In the childrearing stage, the household consumption increased, but after the children grew up, the savings would rise as the income grew. An increase in the youth dependency ratio offered a higher rate of economic growth due to a higher contribution of working age population in the economy resulting from the shift from dependent children to mature young people, thus leading to a higher individual's income and then a higher private savings rate. To explain this finding in more detail, the growth-tilt effect model, which was considered as a powerful theory, was used to confirm a positive association of changes in population age structure (which was represented by the burden of child dependents in the population) and the level of income growth with private savings rate (Fry and Mason (1982), Mason (1987, 1988)). Nonetheless, regarding the effect of old age dependency ratio on private savings rate, Fry and Mason (1982) found a negative impact because the income of elderly was often less than their expenses for their living standards, thus leading to a lower savings rate. In general, the youth dependency ratio has a positive effect on private savings rate, while the old age dependency ratio was negatively related to private savings rate. However, the main limitation of variable rate-of-growth effect model was that this model was a static model, thus it was difficult in analyzing the impact of dynamic changes of dependency burden on private savings. Therefore, Lindh (1999) developed the Life Cycle Hypothesis of Modigliani (1970) as well as followed the theories of Fry and Mason (1982) and Mason (1987, 1988) by introducing the dual mechanisms of population age structure on private savings, in which the indirect effect mechanism have appeared more frequent than the direct effect mechanism. Additionally, the indirect effect mechanism of population age structure on savings, which was not immediately apparent and had some time lag, specified that changes in the age structure of population took action and explained substantial parts of the growth variation, thus generated a positive influence on savings in the next period.

As for empirical studies investigating the impact of dependency ratio on private savings, there were a large number of studies, but most studies affirmed that there was a negative

impact of dependency ratio on private savings rate. However, when separating into the youth dependency ratio and the old age dependency ratio, other studies found the opposite results relating to its influences on private savings rate.

Leff (1969) based on the Life Cycle Hypothesis of Modigliani (1970), applied statistical techniques to analyze a cross sectional data of 74 countries and found a statistically significant, but negative correlation between the youth dependency ratio, the old age dependency ratio and the aggregate savings rate (including private savings and public savings). Leff (1969) explained that the children and the elderly consumed more and contributed less to their household income. He also expected that the higher rates of the dependent youth and of the dependent elderly population in a country would put pressure on a society's potential for savings.

In contrast to the results of Leff (1969), Adams (1971) and Ram (1982) analyzed the cross sectional data of 74 countries (including 47 developing countries, 20 Western developed countries and 7 underdeveloped countries) in 1970 and 121 countries in the period 1970 - 1977 respectively, and found that both the youth dependency ratio and the elderly dependency ratios have insignificant influences on the aggregate savings rate. Furthermore, they disagreed with Leff (1969) in terms of his prediction regarding the possible negative relationship between a high proportion of dependents and private savings. According to Adams (1971), the higher dependency ratio may provide the motivation for working harder and raise the savings level of working age people in order to support for the future consumption of dependents. Thus, instead of imposing a constraint on a potential for savings, the higher dependency ratio will provide an opportunity of increasing private savings in the country. There seems to be a positive impact of the dependency ratio on the level of savings. However, the greatest weakness of Leff's study as compared to Adam and Ram's studies was that in fact, the underdeveloped countries tend to have high birth rates or high child dependency ratios and low savings rates, while the developed countries tend to have the opposite situation. Leff (1969) used the mixed data of developed and developing countries together in his analysis, thus his statistical result is not reliable enough in explaining economic phenomenon.

More recently, Kelley and Schmidt (1996) modified the Leff's model and utilized the Mason (1987, 1988) variable-growth life cycle framework to investigate the influence of dependency rate on savings by using a 88 countries' panel data set (including 23 developed

countries and 65 less developed countries) in the six periods of growth (1960-1965 … 1985-1990) and found that the coefficients of correlation were small in the 1960s, and not statistically significant in the 1970s, but negative in the 1980s that supported the Life Cycle Hypothesis. These findings of Kelley and Schmidt (1996) were contrary to the Leff (1960) model, more specific, while the association between the dependency ratio and the aggregate savings rate in the Leff's model was weak, this relationship in Kelley and Schmidt's study was found consistently over time, especially in the stages of development in the Mason variable-growth life cycle framework, there was a significant impact of dependency ratio on savings rate and demographic factors accounted for a majority of change in savings rate across countries. Nonetheless, Kelley and Schmidt's study only provided the quantitative results of a complex topic regarding the elasticity of savings with respect to the dependency ratios, but did not give an interpretation.

Higgins and Williamson (1997) used pooled cross-sectional and time series data from Asian countries and indicated that a remarkable increase in savings rate in Asian countries since 1960s was caused by the impressive decrease in the young age dependency burden. Indeed, the differences in the level of foreign capital dependence between South and East Asian countries could mainly be explained by the size of the young dependent population. The higher young age dependency depressed savings, resulting in the foreign capital inflows into Asian countries. In fact, whenever the dependency burden of youth population decreased significantly, Asian countries would remarkably reduce its dependences on foreign capital. Also, Higgins and Williamson (1997) estimated that the higher elderly dependency depresses investment more than savings, thus, will increase the capacity of Asian countries to export the capital to other countries in the next decades. However, the limitations of study were that it uses steady-stead behavior to examine the age structure dynamics, more specific, it evaluates the magnitude of changes in the dependency ratio of an Asian country through comparing to the dependency rates of other countries at comparable stages of development and this study only focuses on the impact of the youth dependency rate on savings, but ignores the econometric analysis of the impact of the elderly dependency rate on savings.

Another study proposed by Horioka and Watanabe (1997) used the microeconomic data from the Survey on Financial Asset Choice of Households of the Japanese Government in 1994 to examine the saving motives for Japanese households and estimated the

contribution of net saving for each of these motives to the overall household savings in Japan. Specifically, Horioka and Watanabe (1997) found twelve motives for the household savings in Japan, which then were classified into two groups: the precautionary motive and the bequest motive. Among the precautionary motive group, illness, peace of mind and retirement were dominant positions contributing to the net household savings in Japan, while the bequest motive had a little impact on household savings. In addition, the saving motives of Japanese households differed greatly according to the age and the savings level of households at each stage in the life. They also confirmed that net savings for the retirement and the precautionary motive were key factors determining the saving motive and the saving behavior of Japanese households.

Horioka and Watanabe (1997) mentioned that the possible reason of a high net savings for retirement was due to a response of the elderly regarding their savings to uncertainty, thus savings for retirement far exceeded dissaving. They explained that the accumulation of the elderly was moderated by uncertainty about their healthcare expenditures in the future or the fear on their lower living standards after retirement, while the population ageing means a higher rate of the elderly population put a rising pressure on pay-as-you-go system, often causing a lower benefit of the elderly from public pension schemes. Thus, people tend to save more for their future retirement, leading to a higher savings. Indeed, another possible reason of a high net savings for the precautionary motive came from the weakness of capital and insurance market and the deficiencies in social insurance schemes consisting of the unemployment insurance, health insurance, and welfare schemes. In fact, people would save more for the precautionary motive, if they predicted that they would not be able to borrow the money in emergency cases, or if they understood that it was difficult for them to against some risks that might happen in their lives, especially unpredictable risks such as the earthquake and natural disasters. By giving a consideration on the importance of savings for retirement and the precautionary motive, Horioka and Watanabe (1997) affirmed that these explanatory factors affecting the retirement and the precautionary motives could well be responsible for the high savings rate of Japanese households. Along with the rapid population ageing in Japan, a high rate of the elderly population brought high levels of the individual savings as well as household savings due to their retirement and precautionary motives.

To the best of our knowledge, the study of Horioka and Watanabe (1997) was the first attempt that used micro data in analyzing a large number of household saving motives. However, the findings must be interpreted carefully because this study relied partly on the planned data rather than on the actual data and the results would change if, for instance, it took households longer to achieve their wealth objectives for each motive than initially planned. Indeed, the analysis did not shed light on why net savings for retirement and precautionary motives were so high in Japan.

Also, Loayza, Schmidt-Hebbel and Serven (2000) used a large cross country time series macroeconomic data set on savings and its demographic and macroeconomic factors to explore and investigate the determinants of public savings and private savings across and within countries over time. In addition, the method of instrumental variables was applied to correct for endogeneity and heterogeneity, then a variety of robustness was employed to check changes in the estimation, the data sample, and the model specification. The results of this study were summarized as follows. Firstly, the growth rate of real per capita income was the most important factor contributing to an increase in private savings rate. The level of influence of income growth rate on private savings rate in developing countries was larger than that in developed countries. Indeed, the policies boosting the economic development were considered as effective and indirect tools helped increase savings rate. Specifically, the fiscal policy was an effective means to raise a country's national savings. The effective fiscal policy helped increase gross national disposable income (GNDI) by 4% that would increase the national savings rate by 2.8% of GNDI per year. Secondly, when holding other factors constant, the higher inflation rate, which was known as a summary measure of macroeconomic volatility, led to an increase in private savings rate due to the precautionary motive for savings and vice versa. Thirdly, the shares of child dependents and the elderly in the population had significant negative impacts on private savings rate, and the negative influence of old age dependency ratio on private savings rate was more than twice than that of young age dependency ratio on private savings rate, which is consistent with the Life Cycle Hypothesis of Modigliani (1970). Besides, in contrast to the findings of Higgins and Williamson (1997) regarding the impact of financial liberalization, Loayza, Schmidt-Hebbel and Serven (2000) stated that the financial liberalization has a largely negative impact on private savings rate due to the enhanced credit availability and the financial deepening, thereby leading to a reduction in private savings rate as well as in real interest rate. The successes of this study were that it used the

largest panel data set and solved the issues of simultaneity and country heterogeneity that was ignored in previous studies before estimating the empirical equations. Moreover, this study estimated a variety of private savings rate and national savings rate regression models for a worldwide sample of countries as well as for each of industrial and developing country samples. Indeed, instead of employing a narrow model of savings, the research applied a number of reduced-form linear regressions that helped provide inferences on the impacts of policy and non-policy variables on private savings rate, rather than simply describing their relationships.

Based on the evidence of the highest and a remarkable increase in private savings rate of the four fastest growing economies in Southeast Asia: Indonesia, Malaysia, Singapore and Thailand, Faruquee and Husain's research (1998) aimed to identify factors contributing strongly to a positive performance of private savings and the economic determinants of the long run pattern of private savings in these four countries over the period 1970 - 1992. Specifically, after verifying the private savings trend and its underlying economic determinants, and then testing for unit roots and the cointegration of data, Faruquee and Husain (1998) employed an error correction model to test and estimate the short run dynamic and long run effects of these stationary and cointegrated variables on private savings rate. The empirical analysis was conducted for each country and then used a panel time series data of the four countries to identify the common development of factors accounting for the high performance of private savings. The empirical results indicated that the shifts in the age structure of population was the key factor contributing a sustained increase in private savings rate in all four economies over the past twenty years. In addition, the demographic transition resulted in an increase in the relative size of working age population in the economy that helped increase private savings rate in all four Southeast Asia countries. This result also implied that a higher proportion of working age population led to an increase in private savings rate, while a higher proportion of youth and old age dependency ratios caused a decline in private savings rate in the economy. Moreover, the long run influence of demographic shifts on private savings rate was similar in three countries: Malaysia, Thailand and Singapore, but was significantly stronger in Indonesia. Besides, other factors, for instance, the long run implications of prevention funds and compulsory saving schemes were less clear among countries. The appearance of compulsory pension funds only brought a little impact on private savings rate in Malaysia, while Singapore observed the strongest effect of the compulsory pension funds on its

private saving rate in the long run. The differences in the level of influence of this pension funds on private savings rate among the four countries were caused by different ways that each country chose to implement these pension schemes. Finally, the marginally significant long run effect of financial deepening on private savings rate was only observed in Singapore, which was the country achieving the highest level of financial development in this period, but was not observed in three remaining countries. Unlike other earlier studies relating to private savings behavior in Asian countries, this study was more reliable because it paid attention on testing for the stationary of the time series in each of the countries before applying the cointegration techniques that then provided a solid foundation for empirical inferences.

On the other hand, Kraay (2000) employed a variety of statistical analysis using a provincial panel data in China during the period 1978 - 1995 to investigate the influences of economic growth, financial deepening, and dependency ratio on household savings rate and tried to explain why China's national savings rate was unusually high as compare to their income level in this period. In particular, this study contributed to forming the standard intertemporal model of consumption and savings for China to examine and estimate the impacts of future income growth, future income uncertainty, and dependency ratio on household savings rate as well as explore the role of subsistence consumption in explaining interprovincial disparities in China's household savings rate. More specifically, China's high economic growth rate, financial deepening, and the low elderly dependency ratio were the determinants contributing positively to the unusually high rate of China's savings as compared to its income level in this period. Interestingly, the statistical findings indicated that the high dependency ratio entered with a positive sign, although the estimated coefficients of the relationship between the child dependency ratio, the old age dependency ratio, and savings rate in either rural or urban households were small and not significantly different from zero. These findings were in contrast to previous studies, which confirmed the negative associations of the youth dependency ratio and of the old age dependency ratio with savings rate. Furthermore, Kraay (2000) insisted that the long term income growth has a significant negative effect on private savings rate because people tend to increase their consumption along with their higher expected future income. However, the future income uncertainty did not affect the current savings rate due to the existence of precautionary savings in the individuals. Indeed, the share of food consumption in total expenditure (which was considered as the key factor determining subsistence consumption)

was significantly negatively correlated with private savings rate as well as household savings rate. Overall, the elderly dependency ratio contributed positively to an unusually high rate of the China's savings, but there were small and insignificant associations of the child dependency ratio and of the old age dependency ratio with the household savings rate in both the rural and the urban in China in the period 1978 - 1995. This study also provided insights into factors underlying the rural-urban and interprovincial differences in China's household savings rate, but the results could not explain the reasons of high rate of China's savings rate. However, the limitation of the study lies on the used data, in other words, the study will provide better results regarding to the magnitude of the effects of variables on household savings rate, if Kraay (2000) use household level data instead of using the aggregate data. Besides, the study based on the long time series averages of saving to alleviate the time-varying of this measurement error, thus it cannot clarify the frequency determinants of savings.

Horioka and Wan (2007) used the provincial panel data from China's household survey for the period 1995 - 2004 and a life cycle model to determine factors driving up the growth rate of Chinese household savings. Unlike Kraay (2000), who obtained the results for urban and rural households, Horioka and Wan (2007) obtained the results for each sample of urban households, rural households, all households and a pooled sample of both urban and rural households. Horioka and Wan (2007) found that the key determinants of China's high household savings rate were the lagged savings rate, the growth rate of income, and in some cases, the inflation rate, and the real interest rate. The result of testing the impact of the old age dependency ratio on household savings rate was not statistically significant, but the young age dependency ratio had negative and significant influence on household savings rate with the correct sign in the pooled sample of both urban and rural households. Also, this study showed mixed results concerning the Life Cycle Hypothesis (with the statistically significant and positive coefficient of income growth supporting the Life Cycle Hypothesis and the insignificant coefficient of the old age dependency ratio being unfavorable to the Life Cycle Hypothesis). The finding of a positive connection between income growth rate and household savings rate implied that the savings rate of Chinese households would remain high along with the high growth rate of income. However, if the growth rate of income tapered off, there would be a gradual decline in Chinese household saving rate. In other words, the savings rate of Chinese households remained high and increased in the short and medium run, resulting in a current savings account surplus in

China. However, in the long run, household savings rate was expected to taper off in case of the growth rate tapers off, and thus China might well suffer current account deficit rather than surplus.

Besides, Banerjee et al. (2010) used a sample of household savings in nineteen cities from nine provinces in China, which was collected from the Urban Household Survey (UHS), to investigate the extent to which China's high household savings rate could be explained by the Life Cycle Hypothesis. In this study, Banerjee and his colleagues assumed that parents are credit constrained and depend on their children who will support for their old age, in which sons support for their parents' old age life more than daughters did. The study results affirmed that the exogenous reduction in fertility rate due to family planning policy causes a significant rise in household savings rate and an increase in savings rate is observed in the households where parents have the first child is a daughter. Moreover, the lower savings rate of parents whose the first child was a son as compared to those the first child was a daughter, after China implemented family planning policy or "one child policy", was due to the fact that parents expected their sons would provide more support for their old age lives than daughters did. These results not only provided strong evidence in explaining the high savings rate of Chinese households in recent decades, but also were in line with the Life Cycle Hypothesis in terms of the negative relationship between the lower fertility rate (leading to a reduction in youth dependency ratio) and a higher household savings rate. However, the limitation of this study was that although this study mentioned that the savings behavior of parents and the youth dependency ratio are two of the most important factors determining the high savings rate of Chinese households, it ignored other related factors affecting the savings behavior. Furthermore, this study relied on the simple life cycle model, which applied the empirical estimations without additional assumptions, to implement the adjustments for the model, thus these adjustments could not fit to the data perfectly.

Apergis and Christou (2012) used time series cross sectional data of sixteen African countries in the period 1960 - 2005 and employed panel unit roots, cointegration and causality tests to analyze the short run and long run relationships between dependency ratio, gross domestic savings rate (as share of GDP) and real per capita income (GDP per capita) as well as test whether the dependency ratio positively or negatively correlated with the long run domestic savings rate in the context of African countries. The empirical

results provided the evidence of the cointegrating (long run) relationship between dependency ratio, domestic savings rate, and GDP per capita. Indeed, for the panel causality analysis, while the income (GDP per capita) had a statistically significant and positive effect on domestic savings rate, there was a statistically significant and negative impact of dependency ratio on domestic savings rate and the causality run from dependency ratio to savings rate. This implied that a higher income and a lower rate of dependent population lead to a higher savings rate in the long run in African countries, which is consistent with the life cycle predictions for developing countries. Furthermore, the statistically significant and negative impact of dependency ratio on savings rate in African countries also confirmed that the size of dependent population was one of the most important factors determining the long run savings behavior in African developing countries, while the size of working age population make a positive contribution to a higher savings rate in these countries. Indeed, the estimated positive coefficient of income variable (GDP per capita) indicated that the economic growth is a powerful factor determining savings rate over the long run. However, Apergis and Christou (2012) revealed that the Life Cycle Hypothesis is less applicable in African countries due to its cultural peculiarities, for instance, the uncertainty of income and the greater prevalence of intergenerational transfer within the family in these countries. Also, Apergis and Christou (2012) doubted the possibility of increasing savings rate of African countries because these developing countries were at an earlier stage in the demographic transition resulting from a lower fertility rate and a lower mortality rate, while its youth and elderly dependency ratios remained high as compared to other Asian countries. In fact, in order to increase the savings rate and boost the economic growth, the decline in fertility rate was considered as the best way to reduce the youth dependency ratio and then achieve a higher savings rate. Nevertheless, it was difficult for African developing countries to change their attitudes toward births reduction, especially in rural areas, thus increasing the savings rate through a decrease in the dependency ratio did not appear in African countries. Another limitation of this study was that this study investigated the relationship between dependency ratio and domestic savings rate by using a trivariate model of GDP per capita, dependency ratio and domestic savings rate, but there might be a number of factors that differed remarkably across countries affecting the results. Therefore, a multivariate framework was suggested for reexamining this study in order to have a better understanding of the relationship.

In terms of consumer perspectives, Erlandsen and Nymoen (2008) stated that the burden of dependents (the children and the elderly) have a negative impact on private savings because these persons are known as dissavers and do not contribute to their family income, in meanwhile, the dependents depend entirely on the income of working age members in the family for their consumption. Hence, the more the dependency burden is, the less the private savings is. Likewise, Kinugasa and Mason (2004) provided robust evidence of a negative linkage between dependency burden and private savings that over three-quarter growth in private savings rate relied on the enhancement in old age survival than a declining burden of young age dependents. Moreover, Agrawal and Sahoo (2009) proved that the youth dependency ratio and the elderly dependency ratio are important factors in determining private savings rate and have significant negative effects on private savings rate. The negative associations of the young age dependency ratio and of the old age dependency ratio with private savings rate was observed in almost developing countries because these countries was facing with big issues, for instance, the poor development, a decrease in fertility rate, a high proportion of old age dependents in the population, which make people less motivated to save. Especially in the process of population ageing when there was a higher number of the elderly consumers who still consumed for their normal lives, while their income declined remarkably after retirement, thus the level of private savings would decrease (Thanoon and Baharumshah, 2005; Agrawal et al., 2009).

On the contrary, when conducting researches in developed countries, Heller and Symansky (1998) and Lee et al. (2000) found an opposite result with a positive correlation between the elderly dependents and private savings. They explained that due to a longevity extension and a significant ageing of the population in the near future, people tend to save more during their work period for a better life after retirement, thus the involvement of elderly dependents in the decline in private savings is insignificant. Besides, Attanasio and Banks (1998) revealed that the effect of dependency burden of retirees on private savings rate differs across countries. Specifically, in case of having a higher ratio of retirees in the population, the United States observed a decline in private savings rate, while the United Kingdom observed that the private savings rate remained rising.

In less developed countries, Jorgensen (2011) found a similar result with a positive, but insignificant association between the elderly dependency ratio and private savings rate in both the short run and the long run. This positive relationship was due to the fact that the

savings of the elderly remained quite high in their old age in these countries. The finding was contrary to the negative relationship between the dependency ratio and private savings rate in developed countries, but was true for developing countries.

From previous studies, it is clear that there was a significant relationship between population ageing (was explained by the youth dependency ratio and the old age dependency ratio) and private savings rate. However, there were still a limited number of studies that used modern time series methods in analyzing the correlation between population ageing and private savings, especially in developing countries. Hence, the next part will present some studies applying cointegration techniques - well developed techniques for handling non-stationary time series data to examine the impacts of dependency ratios on private savings rate within the Life Cycle Hypothesis framework.

In case of China, Modigliani and Cao (2004) applied the regression analysis to China's time series data for the period 1953 - 2000 to determine the determinants of household savings. Their findings showed that there was a significant linkage between dependency ratio and household savings rate in China and the higher household savings rate in China resulted from the faster economic growth and demographic transition. More specifically, Modigliani and Cao (2004) mentioned that a high value and a dramatic increase in China's household savings rate in recent decades is due mainly to two things: a declining birth rate as a result of the family planning policy, thus leading to a lower child dependency ratio and the savings of the working age population was more than the dissaving of the elderly population. Obviously, the findings of Modigliani and Cao (2004) in China regarding the negative associations of the young age and old age dependency ratios with household savings rate is in favor of the Life Cycle Hypothesis.

Another research was conducted by Zhu (2011) using the cointegration and Granger causality analyses to test the correlation between dependency ratios and private savings rate and the association between the current account and the relative productivity differences in China in the period 1978 - 2007. In his research, Zhu (2011) divided the total dependency ratio into the young age dependency ratio and the old age dependency ratio to examine the different effects of the youth dependency ratio and of the elderly dependency ratio on private savings rate. Indeed, Zhu (2011) used the current account in case of the demographic transition to explain Chinese consumption behavior and its influence on the economic growth in the short run and the long run. The main findings were summarized as

follows. Firstly, there was a negative correlation between the total dependency ratio and private savings rate in China. More specifically, a 1% decrease in China's total dependency ratio brought an increase in private savings rate by 0.39% of GDP, which was consistent with the Life Cycle Hypothesis of Modigliani (1970). Similar to the findings of Modigliani and Cao (2004) for China, Zhu (2011) indicated that the high private savings rate in China in recent years was caused by a decline in the total dependency ratio resulting from the implementation of one-child policy in China in the late 1970s. However, when separating the model into the impact of child dependency ratio on private savings rate and the impact of elderly dependency ratio on private savings rate, Zhu (2011) observed two opposite results. The youth dependency ratio was negatively associated with private savings rate, while the old age dependency ratio was positively related to private savings rate. Indeed, the impact level of the elderly dependency ratio on private savings rate was larger than that of the child dependency ratio on private savings rate. More specifically, a 1% decrease in the child dependency ratio led to an increase in private savings rate by 0.37% of GDP. By contrast, the old age dependency ratio increased by 1%, private savings rate increased by 3.94% of GDP in China. Besides, the China's high savings rate in recent years was the price that China would have to pay for its future demographic structure. This means that as a result of a changing demographic structure, there was a higher ratio of the child and elderly dependents as compared to the working age population that would lead to a slower economic growth in the future. Furthermore, Zhu (2011) stated that the current account balance referred to savings transfer over time and space, in which the demographic structure determined the transfer of savings over time, while the relative productivity difference determined the transfer of savings across the space. Indeed, the relative productivity identified the "spillover" of the current account surplus, but the demographic structure, which represented by dependency ratios, determined the "return" of the current account deficit. From an intertemporal perspective, China would need current savings for the future consumption and due to a higher dependency rate, private savings rate would decrease, which in turn caused less capital accumulation and then a lower growth rate of China's productivity. In this sensitive, if China focused too much on an increase in an individual's consumption and its current account surplus to promote the short term economic growth, but did not concentrate on the demographic transition in the future, this phenomenon would cause a serious problem affecting the long term economic growth and social insurance system.

In the case of Japan, Horioka (1997) applied the cointegration analysis to the time series data during the period 1955 - 1993 to examine the effect of dependency ratio on Japan's household savings rate. The study found a significant relationship between the total dependency ratio and household savings rate in Japan. Indeed, the ratios of youth dependents and of elderly dependents to the working age population have a significant negative impact on household savings rate in Japan. These findings provided strong evidence confirming the possible application of the Life Cycle Hypothesis in the context of Japan. In other words, the Life Cycle Hypothesis was true for and could apply in Japan, a country where this hypothesis was less likely to apply because of its cultural peculiarities, for instance, the prevalence of intergenerational transfer. Besides, similar to the viewpoints of Modigliani and Cao (2004) and Zhu (2011) when mentioning Japan's high savings rate in recent decades, Horioka (1997) also argued that the high household savings rate in Japan was explained by a higher ratio of working age population as compared to a proportion of the child and elderly dependent population. However, in the future as the older population grew, Japan's household savings rate would decrease.

Unlike the time series study of Horioka (1997), the study of Horioka and Watanabe (1997) used the microeconomic data from the Survey on Financial Asset Choice of Households of the Japanese Government in 1994 and focused on the saving motives for Japanese households. Horioka and Watanabe (1997) found the opposite result regarding to the association between the elderly dependent population and the savings of the aged and the savings of Japanese households. Specifically, the high elderly dependency rate resulting from population ageing contributed to a high net savings of the aged and of Japanese households due to their retirement and precautionary savings motives. This implies that there was a positive relationship between the old age dependency rate and private savings rate as well as household savings rate in 1994 in Japan.

Also, in contrast to the study of Horioka (1997), Koga (2006) analyzed demographic dynamics in Japan and explored the causes of a sharp decline in Japan's household savings rate. Instead of using only the youth and old age dependency ratios, Koga's study focused on both the child and aged dependency ratios and other age groups in investigating the impact of demographic factors and income on household savings rate in Japan. Koga (2006) applied the cointegration analysis to time series data in Japan in the period 1981 - 2003 to examine the linkage between demographic variables, income, and household

savings rate. The results revealed that there exists a force that can bring any deviations return to the long run equilibrium where household savings rate, demographic factors, and income are cointegrated. Moreover, the elderly dependency ratio was a main factor causing a sharp decline in household savings rate in Japan in the 1990s. Also, Koga (2005) predicted that the effects of age groups on the Japan's economy will describe as a hump-shaped curve, which is also consistent with the Life Cycle Hypothesis. However, one limitation of Koga' study (2005) was originated from the assumption of framework that the effect of the life cycle curve remained constant, thus the shape of this curve was determined by the labor supply decision of spenders. In case of a growing elderly population in Japan, and the elderly was considered as spenders, the life cycle curve might be affected by their labor supply decisions. Therefore, giving consideration to the labor supply decision of the elderly or spenders was important and necessary for future researches in analyzing the consumption and savings behaviors of individuals.

Similar to the study of Horioka (1997) in Japan, Thornton (2001) also applied cointegration techniques to time series data on private savings rate and the age structure of the population to test a simple life cycle model of savings for the United States in the 1956 - 1995 period and found the similar results relating to the association between dependency ratio and private savings rate. The empirical analyses presented significant and negative impacts of the youth dependency ratio and of the old age dependency ratio on private savings rate in the United States during the period 1956 - 1995, which provides strong evidence in support of the Life Cycle Hypothesis of savings in the United States. Furthermore, this study also predicted that as the elderly population grows, the United States will experience a decline in private savings rate.

Table 2.1: The summarized results of previous researches on the association between dependency ratios and private savings rate

Studies	The degree of the association		Significance of dependency ratio	
	Youth	Elderly	Youth	Elderly
Fry and Masson (1982) Mason (1987,1988)	positive	negative		
Leff (1969)	negative	negative	significant	significant

Adam (1971); Ram (1982)			insignificant	insignificant
Kelley and Schmidt (1996)	The coefficients of relationship was small in 1960s, not statistically significant in 1970s and negative in 1980s			
Higgins and William (1997) Banerjee et al. (2010)	negative			
Horioka and Watanabe (1997) Koga (2006)		negative		
Faruquee and Husain (1998) Loayza, Schmidt-Hebbel and Serven (2000) Erlandsen and Nymoen (2008) Kinugasa and Mason (2004) Agrawal and Sahoo (2009) Thanoon and Baharumshah (2005) Agrawal et al. (2009) Apergis and Christou (2012)	negative	negative		
Modigliani and Cao (2004)	negative		significant	
Zhu (2011)	negative	positive		
Jorgensen (2011)	negative	positive	insignificant	insignificant
Horioka (1997) Thornton (2001)	negative	negative	significant	significant
Lindh (1999)	positive	positive		
Kraay (2000)	positive	positive	small and insignificant	
Horioka and Wan (2007)			significant	insignificant
Heller and Symansky (1998) Lee et al. (2000)		positive		

Beside the youth and old age dependency ratios, there are other external factors of population ageing affecting private savings rate that should be included in the discussion.

For the research's purposes, the study focuses on two other variables: life expectancy and social insurance funds rate (relating to pension funds rate) to explore its impacts on private savings rate. By reviewing the previous studies related to this matter, the author found contradictory results regarding these associations.

2.3.3.2. Influence of life expectancy on private savings

Regarding the life expectancy variable, there was no empirical consensus in what involved the consequences of the increase in life expectancy in the economy. Thus, this research aims to investigate the impact of ageing, which is as a result of the increase of life expectancy, on private savings. In this case, life expectancy is an explanatory variable.

The Life Cycle Hypothesis of Modigliani and Brumberg (1954) supposed that with the increase in longevity, the working age people tend to save more during their work period due to the longer retirement period in the future, meaning that private savings will rise first. Later on, when the old age population, which was known as spenders, was significantly higher than the working age population (the active population in the economy), private savings will be reduced. In other words, private savings will be lower in case of having a higher rate of elderly in the population (or will be higher in the opposite case). On the other hand, the standard life cycle theory supported the negative relationship between life expectancy and private savings. For this standard life cycle theory, people looked forward to the future and desired to save more for their future expenditures. Accordingly, the aged were living in the second period of the life cycle or the retirement period, hence their savings rate should be low. This also implied that the increase in longevity did not necessarily mean an increase in private savings rate. Likewise, Bloom et al. (2007) based on the standard life cycle theory and confirmed that an increase in longevity reduces the individual's savings rate in older ages.

Some recent studies of Li, Zhang and Zhang (2007), Li, Li and Chan (2012), Prettner (2012) and de Freitas and Martins (2014) supported a positive relationship between an increase in individual's life expectancy and private savings. More specifically, Li, Zhang and Zhang (2007) used an overlapping generations model and found that an increase in longevity is positively correlated with savings at private, household and aggregate levels. This positive connection was explained that when people are expected to live longer, they tend to save more for their longer lives after retirement. Similarly, Li, Li and Chan (2012) confirmed a positive impact of a longer life expectancy on private savings rate in China in

the period 1985 - 2005. Also, Prettner (2012) and de Freitas and Martins (2014) insisted that a longer life expectancy implies that people have a longer time span for savings, resulting in an increase in private savings. On the other hand, Doshi (1994) used a cross country data within the life cycle framework to analyze and then found mixed results regarding to the association of life expectancy with private savings rate in 129 countries. For less developed countries, the study observed a positive relationship between life expectancy and private savings rate, whereas, for high income developed countries, there was a negative correlation between two variables. Doshi (1994) explained that for less developed countries, people tend to save more for their longer lives after retirement, while for developed countries, due to the high income, people do not need to save more for their future expenditures, leading to a decline in private savings rate in these developed countries.

2.3.3.3. Influence of social insurance system on private savings

This part makes a further discussion about the underlying factors, for instance, the social insurance system or pension schemes that was not taken into account in the previous theoretical model and empirical analysis. Therefore, the influence of pension system on private savings will present with two purposes that it is a reflection and supplementary analysis to previous models and it gives an in-depth explanation to the empirical analysis.

In fact, the personal income comprises of two components, including the consumption and the savings. Without the pension system, people tend to save more to cope with their consumption after retirement and all unexpected situations in the future. However, with pension system, it is possible for individuals to adjust their savings behavior accordingly.

Feldstein (1974) was the first scholar considering the impact of pensions on private savings in life cycle savings theory. According to this life cycle savings theory, the social security, more specific, the pension system had two effects on private savings, including the asset substitution effect and the retirement effect. The asset substitution effect referred that due to having the pension insurance in the society, the employees could receive pension benefits from the public pension plan, which makes them reduce their savings associated with the retirement during their working lives. By contrast, the retirement effect referred that the pension insurance benefits mechanisms might encourage workers to retire early, and for the advantage of early retirement, they would raise savings to gain the financial security after retirement. Overall, the impact of pension insurance on private savings relies on the ratio between the asset substitution effect and the retirement effect. If pensions were

considered as a substitute of income, people would not need to save to be wealthy for and during their retirement period, meaning that in this case, pensions would decrease private savings. On the contrary, if pensions were seen as an incentive to early retirement, which implied an increase in private savings during the retirement period would be longer.

On the other hand, Feldstein (1974) mentioned that the social security system or pension system might also diminish the effect of ageing. If the individuals could receive more from the national transfer, they would reduce their savings for the purposes of pensions, unemployment, and healthcare accordingly. From the entire ageing process, due to the relatively low savings rate in the young period resulting from the social security system, the fluctuation of savings rate were much smaller than that in the case of without the social security system. Hence, the population ageing theory would be weakened.

From the world's perspective, the degree of ageing in developing countries was generally lower than that in developed countries. Also, the development of social security system in developing countries was weaker than that in developed ones. Thus, the role of social security system would be reflected more in the developing countries. For developing countries, improving the social security system would be more beneficial to boost the consumption, hence decreasing the private savings.

Later on, in contradiction to previous studies, recent empirical researches on the association between social insurance system and private savings showed mixed results. Börsch-Supan et al. (2006) explored that the pensions diminishes private savings in three large continental European countries with large pay-as-you-go pensions systems: France, Germany and Italy. Similarly, Edwards (1996) used a panel data of 36 Latin American countries in the period 1970 - 1992 to analyze and confirmed a negative influence of social security system on private savings. Nevertheless, Bailliu and Reisen (1998) found a positive effect of pension funds on private savings in ten countries (including six OECD countries - Canada, Germany, Finland, Norway, the Netherlands, and the United Kingdom and four non-OECD countries - Malaysia, Singapore, Korea and Chile). Also, this empirical study produced statistically significant evidence to confirm that the development of pension funds contributes significantly to the higher aggregate savings. In OECD countries, the fast ageing process required the higher savings of employees for their retirement, which was also largely driven by the employees' long term savings goals. Similarly, in the emerging economies with the slow ageing process, it required the higher

savings for the sustainable finance investment and economic growth. Thus, these countries have promoted the development of pension funds to increase the private savings as well as the aggregate savings in the economy.

2.3.4. The relationship between economic growth and private savings

As above mentioned, the Life Cycle Hypothesis is the principal theoretical underpinning that has guided the individuals' savings behavior study over a long time. In the next part, beside the demographic factors, the macroeconomic factors representing for economic growth will be analyzed through its influences on private savings within the Life Cycle Hypothesis framework.

2.3.4.1. Influence of economic growth on private savings

The Life Cycle Hypothesis of Modigliani (1970) predicted that the higher economic growth led to an increase in the income per capita growth that then would cause a rise in the aggregate saving because of the higher lifetime resources and the higher savings of the young population as compared to the dissavings of the older population. However, there was a debate among researchers relating to its structural interpretation. Some authors gave evidence that savings drives the economic growth through the saving-investment link, while others agreed that savings is driven by economic growth.

With regards to the relationship between economic growth and private savings, the habit persistence theory of Carroll (2002) found a positive association and the direction of the causality running from economic growth to savings. Similarly, Saltz (1999) used the Granger causality test and explored the same causality from the economic growth to private savings for ten of seventeen Latin American and East Asian developing countries in the period 1960 - 1991. For these ten countries, a faster growth rate of GDP occurred before and resulted in a higher growth rate of private savings and not vice versa, which was in favor of the habit persistence theory of Carroll. Additionally, Saltz (1999) found the bidirectional causality for two of ten countries. Nevertheless, there were only four in seventeen countries, including these two cases of bidirectional causality, for which the growth rate of savings was positively correlated with and led to the growth rate of GDP. Apart from that, Saltz (1999) recommended that policy makers should focus on boosting the economic growth, rather than just boosting private savings because the empirical evidence revealed that polices, which could enhance the GDP growth rate, would lead to a faster growth rate of savings. The distinct point of Saltz's analysis as compared to other

studies was that instead of using the rate of private savings to GDP as the measure of savings because of its limitation in representing an accurate picture of savings trend, Saltz (1999) used the log of private savings to test whether the growth rate of GDP causes the growth rate of savings or vice versa.

Jappelli and Pagano (1996) confirmed that economic growth was one of the key determinants of private savings and provided evidence in favor of a positive causality from the economic growth to private savings, meaning that the economic growth occurred before the growth of private savings in Italy. More importantly, Jappelli and Pagano (1996) insisted that the private savings rate in Italy was high, but began to fall in the late 1990s that could be explained by the economic fluctuations in this period and changes in the population age structure. Specifically, all demographic groups include the children aged less than 18, the elderly aged 60 and above, head of households, permanent income earners, and self-employed persons were responsible for a reduction in the Italian savings rate in the late 1990s, in which the young age group was more responsible for a reduction in the savings rate than the remaining groups.

Gavin, Hausmann and Talvi (1997) supported the viewpoint of Jappelli and Pagano (1996) and argued that "a higher economic growth rate preceded higher private savings rather than the reverse". Indeed, the economic growth was the most powerful determinant of private savings over the long run and the savings rate was positively correlated with the economic growth. From this view, the low rate of private savings in Latin American was the consequence, more than the cause, of a low and volatile economic growth, while the high private savings rate, which was resulted from a high and less volatile economic growth, was observed in the rapidly growing economies in the East Asia. Regarding the impact of polices on savings, Gavin, Hausmann and Talvi (1997) indicated that the inflation stabilization and structural reform policies aimed at increasing the efficiency as well as boosting the growth of the economy, which temporarily decreased the savings rate for many years and then would increase the savings rate again, but these policies might lead to a dependence of the economy on potentially volatile capital flows.

Similarly, Sinha and Sinha (1998) found the direction of causality running from the GDP growth to the growth of savings (which was explicitly separated into public savings and private savings). In other words, the economic growth of Mexico preceded and led to its savings growth during the period 1950 - 2001, while the reverse causality in the short run

did not exist in Mexico. In the analysis, all variables including real GDP, public savings, and private savings were expressed in logarithmic forms so that the first differences give us the growth rate. Moreover, when testing the long run relationship among variables, it is worth noting that there was a positive linkage between GDP growth rate and private savings rate in Mexico.

Mahambare and Balasubramanyam (2000) have attempted to test the influence of economic liberalization on savings in the India context - a developing country in the period 1960/61 - 1996/97. The statistical results revealed that the appearance of economic liberalization in India depresses the aggregate saving level in the short run, but in the long run, the economic liberalization helps increase the savings through its impact on economic growth. This finding also affirmed the existence of long run positive linkage between the economic growth and savings in India, but there was a negative short run association between the economic growth and savings and the causality running from the economic growth to savings for India during the period 1960/61 - 1996/97.

Likewise, Sahoo, Nataraj and Kamaiah (2001) used annual time series data over the period 1950/51 to 1998/99 and employed the error correction model to test the causal association between private savings and economic growth in India. The results revealed that there was one-way causality from the GDP growth to private savings in the short run. Indeed, the economic growth has a strong positive impact on private savings in India in the long run, which was similar to the findings of Mahambare and Balasubramanyam (2000) in the Indian context, but was contrary to the Ricardian equivalence theory where “savings serve as the engine of economic growth”. More specifically, Mahambare and Balasubramanyam (2000) found that in the short run, economic growth which is expressed by economic liberalization depresses savings, but in the long run economic liberalization contributes to economic growth that then boosts private savings.

Besides, Agrawal (2000) focused on the determinants of private savings, the level of savings of the five South Asian countries (including Bangladesh, Nepal, Pakistan, Sri Lanka and India) and compared with the private savings of the five East Asian countries (including Malaysia, Indonesia, Thailand, Korea and Singapore). Agrawal (2000) stated that the private savings rates of the five South Asian countries, which were measured as a percentage of GDP, ranged between the low and medium level, while the private savings rates of the five East Asian countries were so high over 30 percent since 1980.

Additionally, the lower rates of private savings of the five South Asian countries as compared to the private saving rates of the five East Asian countries since 1980 was mainly due to the differences in the dependency ratio among the five South Asian countries and the five East Asian countries. More specifically, the decline in dependency ratio of the five East Asian countries was more rapid than that of the South Asian countries. Another important concentration of this study was on examining the correlation and the direction of causality between economic growth and private savings through Granger causality analysis. Agrawal (2000) found a positive connection between the growth rate of GDP and the private savings rate in the five East Asian countries, but the direction of causality was different among countries. For India and Sri Lanka, a higher growth rate caused a higher private savings rate, while a higher private savings rate led to a higher growth rate of GDP in Bangladesh and Pakistan. For Nepal, there was non-causality between growth rate and private savings rate in either direction. By contrast, for South Asian countries, Agrawal (2000) did not find any evidence for the existence of causality between the growth rate and private savings rate, but private savings rate was determined by the growth rate of GDP.

Apart from that, Baharumshah et al. (2003) studied factors affecting the savings behavior in the fast growing Asian economies, including Singapore, South Korea, Malaysia, Thailand, and the Philippines, based on time series data during the period 1960 - 1997. The empirical result showed a positive influence of economic growth on private savings in these five Asian countries, which also explained why the fast growth Asian economies are able to maintain the high private saving rates in the past decades. Furthermore, this study also revealed that after the Asian financial crisis in 1997, the Asian countries will experience the lower economic growth rate, thus leading to a reduction in private savings rate. The inverse causality from private savings to economic growth was not observed in four countries, except Singapore.

In the other way, Waithima (2009) applied the two-step method to set up the private savings model for Kenya. The analyzed results of this savings model indicated that there is a positive association between the GDP growth rate and private savings rate in Kenya, more specific, in the long run a 1% increase in the growth rate of GDP will bring an increase in private savings rate by 0.5%, which is consistent with the Life Cycle Hypothesis. Another noteworthy result was that there is a positive effect of population growth rate on private savings rate, thus a small population size seems to be as a

mobilization tool for private savings. In addition, there was a unidirectional causality from GDP per capita to private savings. The individual's consumption seemed to have a significant negative impact on private savings in the short run, but in the long run, this effect was not observed.

The same results regarding the association and the direction of causality were found by Nurudeen (2010) that there was a long run equilibrium relationship between economic growth and private savings and the causality run from economic growth to private savings in Nigeria in the period 1970 - 2007. This finding also implied that economic growth preceded and led to private savings. In case of Nigeria, Nurudeen (2010) rejected the Solow's hypothesis that savings preceded the economic growth, but followed the Keynesian theory that the economic growth resulted in a higher savings. Moreover, Nurudeen (2010) proposed that the Nigerian government and policy makers should concentrate on priority policies to boost the economic growth so as to raise its private savings.

On the other hand, the neoclassical growth model showed the opposite causal channel: savings to growth, that was, a higher savings caused a higher economic growth because a higher savings contributed to a higher capital accumulation for the faster economic growth.

Sandilands and Chandra (2003) tested the Endogenenous Demand - Driven theory of growth for India in the period 1950 - 1996 and concluded that the Indian savings contributed to a higher capital accumulation in India and this high capital accumulation was the result rather than the cause of economic growth. In other words, in India, private savings resulted in the capital accumulation, but the capital accumulation did not cause economic growth in the long run. More specifically, there was a long run positive relationship between private savings, capital accumulation and economic growth in India, but the causality only runs from private savings to capital accumulation and from economic growth to capital accumulation, and not vice versa.

Furthermore, another study, which was conducted by Krieckhaus (2002) in 32 developing countries in the world, confirmed the vital role of savings for the economic growth. Krieckhaus (2002) stated that a higher level of savings caused a higher level of investment and thus contributed to a higher rate of economic growth in these countries. This finding also means that savings has a remarkable influence on the economic growth in these developing countries. Specifically, in his empirical research, public savings constituted

over a third of total savings in the East Asian countries, which contributed strongly to the fast growth of these economies in recent decades. In addition, public savings in Brazil increased remarkably to 10% of GDP since 1964, which caused a dramatic increase in investment and then led to the fast growth of the economy. However, in the 1980s, public savings of Brazil has fallen significantly and negatively affected its economic growth.

Another research carried out by Anderson (1999) also concluded that the causal chain linking economic growth and private savings differed among three developed countries: Sweden, the United Kingdom and the United States. Specifically, the study found a significant relationship between economic growth and private savings in the long run for only two developed countries Sweden and the United Kingdom, but in the short run, Anderson (1999) did not find a clear direction of causation between variables among countries. Specifically, there were bidirectional causality between economic growth and private savings for the United States, a unidirectional causality running from private savings to economic growth for the United Kingdom and an insignificant causality for Sweden.

Focusing on time series evidence for an individual country, Sajid and Sarfraz (2008) used the quarterly data over the period from the first quarter of 1973 (1973Q1) to the four quarter of 2003 (2003Q4) and then applied the cointegration and the vector error correction techniques to explore the relationship between the savings and the output (Gross Domestic Product (GDP) and Gross National Product (GNP)) in Pakistan. In the long run, there was a significant association between the savings and the output. For the Granger causality test, there were three unidirectional causalities running from savings to the output, more specific, the unidirectional causality run from national savings to GDP, from public savings to GDP and from private savings to GDP in the Pakistan context, which favored the viewpoint of capital fundamentalists that savings preceded the output. On the other hand, in the short run, there were three unidirectional causalities running from the output to savings, which favored the Keynesian's viewpoint that savings depends upon the output level. More specifically, the unidirectional causality runs from GNP to national savings, from GNP to private savings, and from GDP to public savings.

Also, Ramesh (2011) applied time series analysis of an individual country to his study. The Ramesh's study also examined the relationship and the direction of causality between savings, investment, and economic growth in India at both the aggregate level and the sectorial level over the period 1950/51 to 2007/08 by employing the cointegration and

Granger causality analyses. At the aggregate level, there was a long run equilibrium relationship between savings, investment, and economic growth in India. Indeed, the Granger causality test showed that a higher aggregate savings and the investment in the collective economic sector caused a higher economic growth in India, but the inverse causality was not observed. Besides, Ramesh (2011) stated that the Indian economy was not catch up with the technology frontier, thus instead of relying on the innovations, the growth of the Indian economy was driven by domestic savings. On the other hand, the empirical results indicated that, at the sectorial level, the causality running from savings and investment to economic growth existed in the private sector, while in the household sector, there was a mutual relationship between savings, investment, and economic growth. In the household sector, savings and investment led to the economic growth, in meanwhile, savings and investment was also driven by the economic growth in India.

Similar to Ramesh's study (2011), Aswini and Mohit (2012) also applied the cointegration and the Granger causality tests in analyzing the time series data from 1950/51 to 2010/11 to investigate the causal relationship between savings, investment, and economic growth in India. This study found a similar result with Ramesh's study that the direction of causality only runs from savings and investment to economic growth in India during the 1950/51 - 2010/11 period. In addition, the empirical analysis confirmed that a higher domestic savings would certainly boost the economic growth. Moreover, due to its low technological progress, India was not catch up new technologies from foreign investors, thus the economic growth of India depended mainly on or was driven by domestic savings and/or domestic investment.

On the other hand, Anoruo and Ahmadi (2001) used the cross sectional and time series data of economic growth and private savings and then utilized the cointegration test and the Vector Error Correction Model (VECM) to examine the relationship and the direction of causality between economic growth and the growth rate of private savings for seven African countries (Congo, Cote d'Ivoire, Ghana, Kenya, Nigeria, South Africa and Zambia) over the period 1960 - 1997. The cointegration test revealed that there was a positive long run linkage between economic growth and the growth rate of private savings. Unlike the findings of previous studies, Anoruo and Ahmadi (2001) found mixed results in the short run correlation between economic growth and the growth rate of private savings. More specifically, Granger causality tests indicated that the direction of causation between

economic growth and the growth rate of savings differs across African countries. The bidirectional causality between the economic growth and the growth rate of private savings was observed in Cote d'Ivoire and South Africa. For four countries Ghana, Kenya, Nigeria and Zambia, the growth rate of private savings led to the economic growth, while for Congo, the causality run from the economic growth to the growth rate of private savings.

Table 2.2: The summarized results of previous researches on the relationship between economic growth and private savings

Studies	The direction of causality in the short run	The long run relationship
Jappelli and Pagano (1996) Gavin, Hausmann and Talvi (1997) Sinha and Sinha (1998) Saltz (1999) Kraay (2000) Sahoo, Nataraj and Kamaiah (2001) Carroll (2002) Baharumshah et al. (2003) Nurudeen (2010)	Running from economic growth to private savings	Positive
Mahambare and Balasubramanyam (2000)	Negative, from economic growth to private savings	Positive
Krieckhaus (2002) Sandilands and Chandra (2003) Ramesh (2011) Aswini and Mohit (2012)	Running from savings to economic growth	Positive
Agrawal (2000)	Mixed results of the direction in the East Asian countries (from GDP growth rate to private savings for India and Sri Lanka, and vice versa for Bangladesh and Pakistan. Non-causality for	Positive

	Nepal) and non-causality in the five South Asian countries (Malaysia, Indonesia, Thailand, Korea and Singapore)	
Anoruo and Ahmadi (2001)	Mixed results among African countries. The bidirectional causality for Cote d'Ivoire and South Africa. From private savings to economic growth for Ghana, Kenya, Nigeria and Zambia. From economic growth to private savings for Congo.	Positive
Anderson (1999)	The bidirectional causality for the United States, a unidirectional causality running from private savings to economic growth for the UK and an insignificant causality for Sweden.	Positive
Sajid and Sarfraz (2008)	The unidirectional causality, but no clear direction between savings and the output (the causality running from private savings to GDP and from GNP to private savings)	Positive
Waithima (2009)	Non-causality	Positive

2.3.4.2. Influence of income per capita on private savings

The principal assumption of the Life Cycle Hypothesis of Modigliani (1970) was that an individual looked for a maximized present value of lifetime utility subject to the budget constraint, which was obtained by using the current net worth plus the present value of expected income of the individual over the remaining working life. Therefore, the individual's consumption in each period would rely on his or her expectation about lifetime income. Besides, the individual's income fluctuated over the lifetime, thus the savings

behavior of an individual was different in different stages in his or her life cycle. This implied that an individual would smooth consumption over his or her lifetime, being a net saver in his or her young age period due to the high income in this period and a net borrower in his or her old age period. However, this theory also stated that if the income growth rate was zero in case of without bequest motive, the savings of an individual would zero or was independent of its income per capita. Thus, the growth rate of income per capita was positively associated with private savings. In other words, private savings was higher in fast growing countries with the higher growth rate of income per capita. To sum up, if the Life Cycle Hypothesis existed in the context of a country, there would be a positive coefficient of the correlation of the per capita income growth rate with private savings.

By contrast, the Permanent Income Hypothesis of Friedman (1957) mentioned an opposite argument with the Life Cycle Hypothesis of Modigliani (1970) that the growth rate of income per capita caused a decline in private savings. More specifically, the assumption of Permanent Income Hypothesis was that an individual's consumption at a given time depends on his or her current income and expected income in the future, which is also called the permanent income. Hence, the change in an individual's income would lead to a change in private savings. People tended to save more when they expected that their incomes would increase in the future, whereas, they tended to save less when they expected their incomes would decrease. Moreover, if people believed a future economic growth prospect, they would expect higher future income than current income, thus they would save less. In other words, the more confidence of customers as a result of the economic growth prospect in the future was, the lower private savings was. In short, if the Permanent Income Hypothesis exists in a country, we will expect a negative coefficient of the impact of the growth rate of income per capita on private savings.

On the one hand, the empirical studies indicated that the level of per capita income was a positive associated with private savings and the degree of this influence in developing countries was greater than that in high income countries. Loayza, Schmidt-Hebbel and Serven (2000) estimated that a double increase in the real level of income per capita in developing countries will lead to a 10% increase in private savings. They also suggested that the development-enhancing policies are considered as an effective tool of the government for increasing private savings in the economy. On the other hand, Loayza, Schmidt-Hebbel and Serven's study (2000) focused on the relationship between income

inequality and savings and its impacts on household savings and corporate and public savings. The findings indicated that there was a positive impact of income inequality on household savings, but a negative impact on corporate and public savings. Consequently, these results led to an ambiguous influence on the aggregate savings.

World Bank (1993) also showed a positive linkage, but mixed results regarding the causation between income growth and savings across the East Asian countries. More specifically, for six fast growing countries in the East Asia which have among the highest savings rates in the world (including Indonesia, Thailand, Taiwan, Japan, Korea, and China), the report indicated that the income growth has a positive connection with the high savings rate and the income growth is a good predictor of a higher savings rate, but it was not true for the reverse direction. In other words, for these six fast growing East Asian countries, the savings rate was determined by the income growth. Nevertheless, for two other East Asian countries Malaysia and Hong Kong, a positive relationship between income growth and savings rate was also observed, but the direction of causality between income growth and savings rate run in either way.

On the other hand, the empirical study of Carroll and Weil (1994), which applied the Granger causality tests on the five-year average in the pooled time series cross sectional data of 64 countries, posited a statistically significant and negative effect of the income growth and private savings and the direction of causality running from the income growth to private savings, not vice versa. Carroll and Weil (1994) used the standard growth model in explaining a negative relationship, in which consumers with the standard utility, and in a fast growing economy, they reduced their savings because of knowing that they would be richer in the future than now. However, the limitations of this study were that the study does not test the unit roots of the time series data before applying the Granger causality tests and the results are presented by the average data, which could not show different patterns of the causality for different countries as well as answer clearly the direction of causality for each country. After that, Jappelli and Pagano (1996) found a similar result relating to the negative relationship between income growth and private savings in Italy. They confirmed that the higher growth rate of the economy in the future will lead to a higher increase in the permanent income of an individual as compared to an increase in his or her current income, resulting in a higher consumption and thus depressing private savings. Furthermore, Kraay (2000) used the panel data of rural and urban households in

China to examine the determinants of the household savings and also found a significant negative effect of future income growth on savings rate in case of rural households.

2.3.4.3. Influence of the inflation rate on private savings

Inflation might affect an individual's savings behavior in indirectly ways and its impact on private savings was ambiguous theoretically and practically (Deaton and Paxson, 1993). There exist two opposite results regarding savings behavior in case of inflation driven uncertainty relating to the future income growth that people, who are risk-averse, tend to save more as a precaution to overcome the future financial difficulties, whereas, due to increasing inflation, people increase their consumption before the price of products increase further, hence lesser savings.

On the one hand, when considering the linkage between the inflation and private savings, Heer and Süssmuth (2006) indicated that the inflation rate is significantly negatively correlated with private savings. This negative correlation was because the inflation is considered as the opportunity cost of holding money, implying that an increase in the inflation rate leads to increasing the opportunity costs of holding money as well as raising the benefits of spending and consumption, thereby declining private savings (Miller and Benjamin, 2008). Furthermore, Athukorala and Sen (2004) affirmed that the inflation brings the uncertainty in the future income and the reactions of an individual to a change in inflation will influence on his or her savings. More specifically, if a higher inflation rate occurs in the economy, people will react to an increase in the uncertainty by transferring financial assets to real tangible assets due to a decline in the utility of holding money. This reaction of an individual will reduce the present savings and cause greater consumption due to his or her consuming for durables products, hence decreasing private savings.

On the other hand, Chopra (1988) stated that the higher inflation rate or an increase in uncertainty will encourage the individuals to save more as a precaution to overcome the future financial difficulties. This means that an increase in inflation rate is positively associated with a higher private savings. Moreover, Deaton (1977) posited that increasing inflation leads to a higher private savings whenever people, who are seen as customers, misinterpret an increase in the nominal price for an increase in the real price and then is not decide to spend. Likewise, Loayza, Schmidt-Hebbel and Serven (2000) confirmed a positive influence of the inflation rate on both private and national savings in 69 countries consisting of 20 industrial and 49 developing countries in the period 1970 - 1995. Masson,

Bayoumi and Samiei (1998) found the similar positive relationship between the inflation rate and private savings in case of 21 industrial countries, but a negative linkage in 40 developing countries. Similarly, Gavin, Hausmann and Talvi (1997) affirmed a significant positive impact of inflation on private savings when considering lagged impacts in the context of six East Asian countries (six rapidly growing economies or the Asian "miracle" economies Hong Kong, Indonesia, Korea, Malaysia, Singapore and Thailand) and twenty Latin American countries in the period 1970 - 1994. By contrast, Bandiera et al. (2000) found a mixed result in terms of the association between the inflation rate and private savings rate for eight developing countries Chile, Ghana, Indonesia, Korea, Malaysia, Mexico, Turkey and Zimbabwe, more specific, one significant positive correlation in Mexico, three significant negative relationships in Ghana, Indonesia and Malaysia, and four insignificant correlations for the four remaining countries over the period 1970 - 1994. Also, Edwards's study (1996) showed that there was no significant effect of the inflation rate on private savings rate in 36 Latin American countries for the period 1970 - 1992.

Interestingly, Carroll (1992) explored different savings behaviors between the young population and the older population in case of occurring inflation or uncertainty. On the one hand, young customers, who expected their incomes to increase in the future, but did not know by how much, decided to increase their consumption in relation to their income when the inflation or uncertainty occurred, resulting in a decline in their savings. On the other hand, the older population would face with a lot of uncertainty in their lives, for instance, the living costs and healthcare expenses for a longer life after retirement, thus they tended to save more as a precaution against possible adverse changes in their income, leading to an increase in their savings.

2.4. Summary

From above literatures, it could be concluded that there was robust consensus of researches concentrating on the impact of population ageing (was explained by the youth dependency ratio and the old age dependency ratio) on private savings rate. Obviously, the total dependency ratio has a negative impact on private savings rate. However, when separating the total dependency ratio into the young age dependency ratio and the old age dependency ratio, the author observed mixed results. Some authors agreed with the positive connection, while others found the negative linkage between the dependency ratio and private savings rate. In regards to the association of the other variables of population ageing, including life

expectancy, which is considered as the consequence of population ageing and social insurance funds rate with private savings rate, there was no robust consensus among researchers and these linkages were not clear.

Similarly, there was a debate among researchers considering the relationship between economic growth (representing by the macroeconomic variables: GDP growth rate, income (or GDP per capita) and inflation rate) and private savings. In addition, the empirical researches on the causality between economic growth and private savings remained very sparse due to the scarcity of sufficiently long time series data for most developing countries. In fact, most studies found a positive linkage between economic growth (GDP growth rate) and private savings, but the causal channel or the direction of the causality was unclear. Some researches confirmed that the economic growth causes private savings, whereas other studies proved that private savings leads to the growth. On the other hand, the long run associations of the other explanatory variables: income (or GDP per capita) and inflation rate with private savings were also unclear, and was positive or negative depending on each country situation and which theory affecting. Likewise, the direction of causality between these variables and private savings was also unclear. Besides, the main limitation of related previous studies was that most studies did not test the presence of unit roots of the time series data before applying the cointegration and Granger causality analyses, thus it was impossible to avoid the problems of spurious regressions that negatively affected the reliability of the research results (Banerjee et al., 1993).

CHAPTER 3 POPULATION AGEING, ECONOMIC GROWTH AND PRIVATE SAVINGS IN VIETNAM IN THE PERIOD 1985 - 2016

The chapter highlighted a brief review of population ageing in Vietnam and the main reasons resulting in the rapid ageing of Vietnam's population. Specifically, the decline in fertility rate, the increase in life expectancy, the pace of population ageing, the dependency ratio and potential support ratio are presented to bring a specific picture relating to population ageing in Vietnam. After that, the economic growth of Vietnam, more specific, GDP growth rate of Vietnam will be discussed in each period of the economic development. As a consequence of population ageing, the development of Vietnamese pension schemes is also a concern of the Vietnam government because it might affect private savings in Vietnam as well as put a pressure on the government budget and the economic growth of Vietnam. Finally, a brief view of the total dependency ratio, the young dependency ratio and the old age dependency ratio, GDP growth rate and private savings rate will be outlined to analyze its trends during the period 1985 - 2016.

3.1. A brief review of population ageing in Vietnam

For some decades, many countries have begun to recognize the issues of population ageing. This is particularly evident in developing countries. The United Nations (2010b) reported that the proportion of elderly people in the population has been rising globally, more specific, the percentage of older people aged 60 and over was 11.0% of the world's population in 2010 and is expected to rise gradually to 13.5% in 2020 and 21.8% in 2050.

According to population projections for Vietnam 2009 - 2049 by General Statistics Office (2011), Vietnam is now facing an increasing share of the elderly population (60+), which is estimated to rise from 8.7% in 2010 to 11.6% in 2020 and 24.8% in 2049 that is higher than the world population figure. Moreover, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) also stated that the population starts ageing when the proportion of the elderly aged 60 and over in the total population reaches more than 10 percent. In Vietnam, the ratio of old age population aged 60 and over in the total population reaches 10% in 2017, which means that Vietnam enters the so-called "ageing phase" of the population from 2017 onward (General Statistics Office of Vietnam (GSO), 2011). Besides, the increasing rate of the elderly in Vietnam will potentially be higher than that in developed countries. Western countries took a hundred years to transit from an "ageing" to an "aged" population structure. Specifically, Thailand and Japan are

considered as the fastest ageing countries in Asia took 22 years and 26 years respectively to complete the demographic transition (Thanakwang and Soonthorndhada, 2007), while Vietnam only spend 20 years to finish this transition process. In addition, as projected by United Nations (2010b) regarding population prospects in the Southeast Asian countries, there will be a significant difference in the ageing trajectory between countries over the next four decades. Singapore will be the ageing country with the highest proportion of the elderly in 2050, followed by Thailand and Vietnam.

Table 3.1: Demographic projections, the world 2000 - 2050 and Vietnam 2009 - 2049

Unit: a thousand people and percentage

Year	Global population					
	Total	**0-14**	**15-59**	**60+**	**15-64**	**65+**
2010e	6,895,889	26.8	62.2	11.0	65.9	7.6
2020p	7,656,528	24.9	61.5	13.5	65.7	9.4
2030p	8,321,380	22.9	60.5	16.6	65.4	11.7
2040p	8,874,041	21.4	59.4	19.2	64.3	14.3
2050p	9,306,128	20.5	57.7	21.8	63.3	16.2
Year	**Vietnam's Population**					
	Total	**0-14**	**15-59**	**60+**	**15-64**	**65+**
2010e	86,722	24.0	67.3	8.7	69.6	6.4
2020p	96,179	23.0	65.4	11.6	69.8	7.2
2030p	103,117	20.3	63.2	16.5	68.5	11.2
2040p	107,004	17.9	61.4	20.7	67.2	14.9
2049p	108,707	17.6	57.6	24.8	64.4	18.0

Remarks: e for estimates; p for predictions; the predictions are based on the assumption of medium variant.

Source: United Nations (2010b) and General Statistics Office of Vietnam (GSO) (2011).

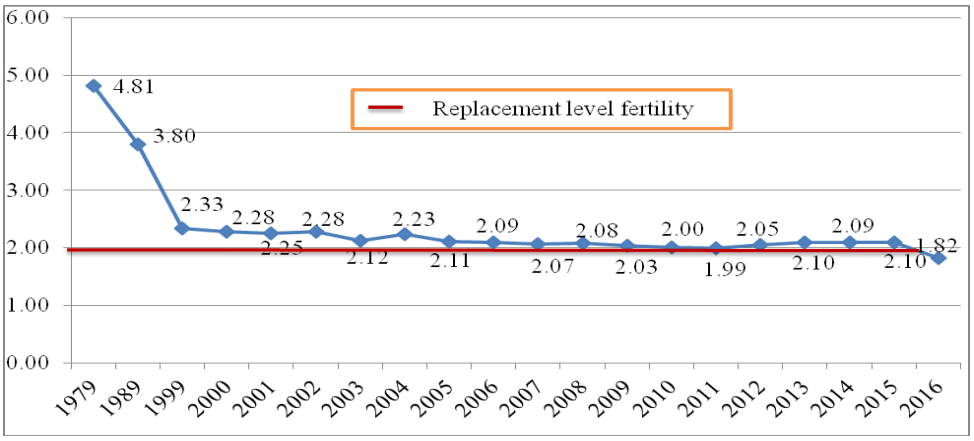
The rapid ageing of Vietnam's population is caused by two major important factors: the decline in fertility rate and the increase in life expectancy of Vietnamese (General Statistics Office of Vietnam (GSO), 2011).

3.1.1. Decreasing fertility rate

In the second half of the twentieth century, some Asian countries have experienced a demographic transition from high to low level of fertility. While the fertility rate in developed countries has reduced to below the replacement rate, the fertility rate in developing countries is higher than that in developed ones, and it has fallen more rapidly (United Nations, 2010b). Along with this demographic trend in Asia and the implementation of family planning policies in Vietnam since 1960, Vietnam has been facing a dramatic decrease in the fertility rate. Specifically, in the late 1970s, the total fertility rate (TFR) in Vietnam was very high nearly 5 births per woman, but after that the TFR has declined quickly as shown in Figure 3.1:

Figure 3.1: The total fertility rate (TFR) in Vietnam during the period 1979 - 2016

Unit: births per woman



Source: General Statistics Office (1979, 1989, 1999, 2009, 2016)

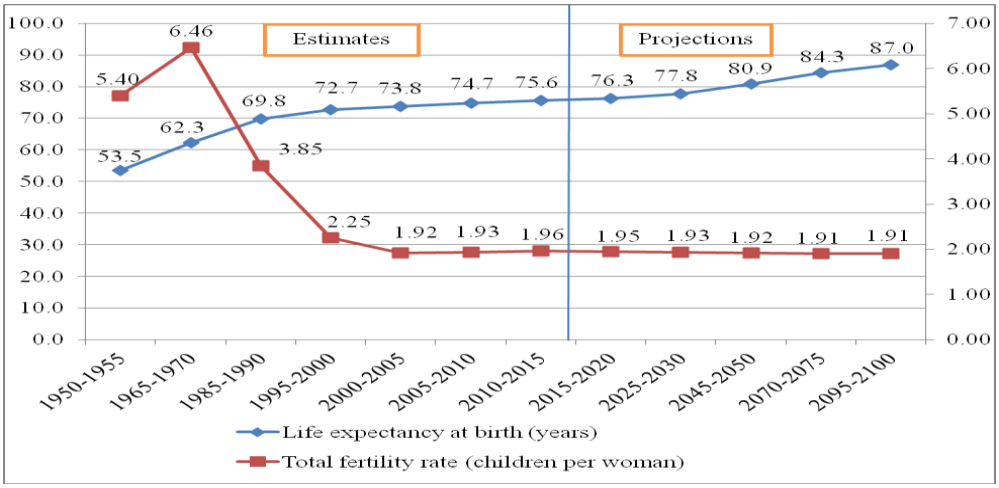
As seen in Figure 3.1, the total fertility rate (TFR) in Vietnam has drastic decreased from 4.81 to 1.82 births per woman between 1979 and 2016. More specifically, in the period 1979 - 1999, the total fertility rate (TFR) in Vietnam declined by a half from 4.81 to 2.33 births per woman that was a result of Vietnam's family planning policies. From 2000 to 2016, even though the total fertility rate (TFR) of Vietnam has fluctuated over the years but in general, it has still clearly exhibited a downward trend. In 2006, Vietnam officially announced that the country reached its replacement level with the total fertility rate (TFR) of approximately 2.1 children per woman. From 2006 to 2015, the total fertility rate (TFR) of Vietnam remained hovering above the replacement rate at around over 2 children per woman. However, the fertility rate in Vietnam in 2016 was below the replacement level at only 1.82 children per woman.

As compared to the Southeast Asian countries, the total fertility rate (TFR) of Vietnam was lower than the average fertility rate of these countries (2.3 births per woman). Indeed, the fertility rate of Vietnam was only higher than that of Singapore and Thailand with 1.2 and 1.6 births per woman, but was much lower than that of remaining countries in Southeast Asia (Kandiah, 2003). These results also confirmed the successful implementation of Vietnam's family planning policies in recent decades, which not only contributed to a positive demographic transition with a declining fertility rate in the context of a remarkable socio-economic development of Vietnam, but also supported for maintaining the fertility at the replacement level that was the requisite for a stable fertility in the future.

3.1.2. Increasing longevity

The population estimates for Vietnam by United Nations (2015b) show that the average life expectancy at birth in Vietnam was very low at 53.5 years in 1950-1955 and rose gradually to 69.8 years in 1985-1990 and to 75.6 in 2010-2015. Assuming the medium variance, the Vietnamese's life expectancy is predicted to 80.9 years by 2045-2050 and very high at 87 years in 2095-2100 (Figure 3.2). This increasing longevity trend of Vietnam is similar as compared to other Southeast Asian countries, including Thailand, Malaysia and Indonesia, which have a higher level of per capita income.

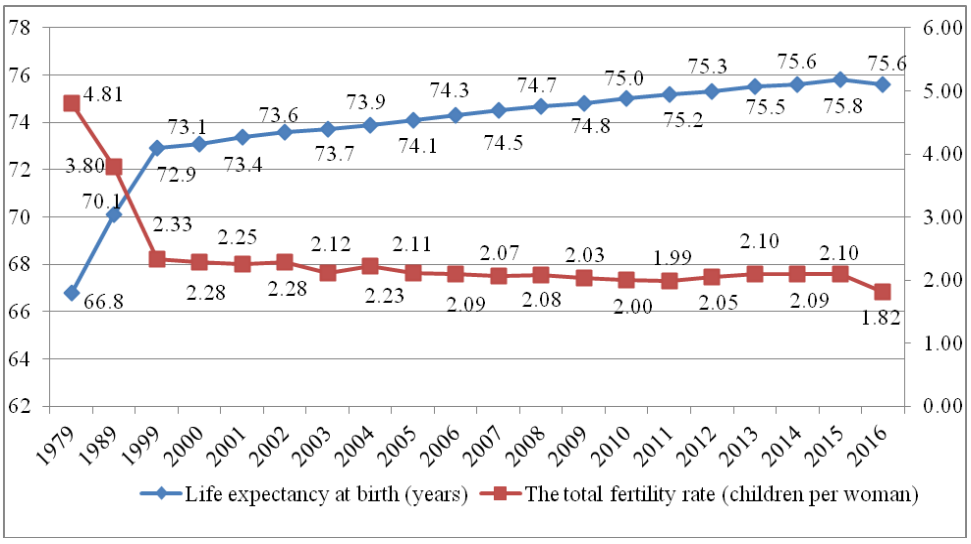
Figure 3.2: Decreasing fertility and increasing longevity in Vietnam, 1950-2050



Source: United Nations (2015b).

Similar to the results of United Nations (2015b), the annual population survey by General Statistics Office of Vietnam (GSO) also confirmed a significant increase in the Vietnamese people's average life span in the research period 1985 - 2016 (Figure 3.3).

Figure 3.3: TFR and life expectancy at birth in Vietnam in the period 1979 - 2016



Source: General Statistics Office of Vietnam (GSO) (1979, 1989, 1999, 2009, 2016)

As shown in the Figure 3.3 regarding to the life expectancy at birth in Vietnam, the average life expectancy at birth of a Vietnamese person consistently increased over the years, from 66.8 years in 1979 to 73.1 years in 1999 and 75.6 years in 2016. In addition, according to the World Economic Forum (WEF) Global Competitiveness Report (2015), Vietnam ranks 56 out of 138 countries in the world in terms of the average life expectancy in 2016 and this average life-span of Vietnamese people is the second highest in Southeast Asia, only after Singapore. Given the current average life expectancy and the continuing upward trend in the coming years, Vietnamese people's average life expectancy is expected much higher than the overall average life expectance of people in developing countries, which stands at around 68 years old.

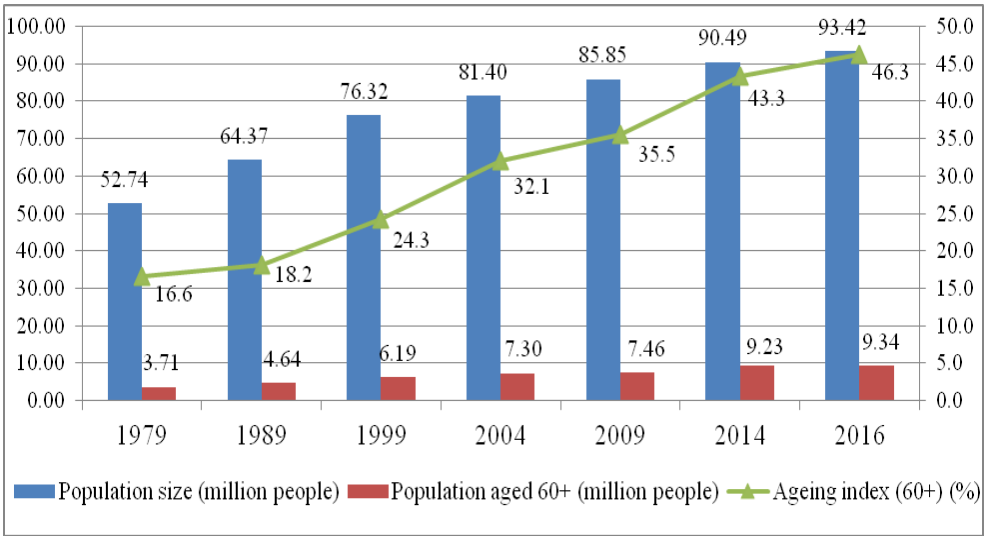
The increasing longevity in Vietnam is surely evidence of achievements in some respects. Firstly, medical advances allow people to live longer. In the past, people faced with serious illness and diseases leading to a high risk of death, while in recent decades, it is easy for people to access healthcare services that can lower the risk of death. Secondly, the economic growth with a higher income leads to a better quality of life and an increase in the life expectancy. Thirdly, people are actively concentrating on their well-being, so they spend much money on sport activities and the supplementary food market. This helps them stronger to live longer (United Nations, 2015b).

Beside two important factors using to measure the ageing of population, including a sharp decrease in the total fertility rate (TFR) and a significant increase in the average life

expectancy of Vietnamese people, another important criteria is also used more popular in comparison with other countries in terms of the degree of population ageing, consisting of the pace of population ageing (is measured by the ageing index) and the old age dependency ratio. The ageing index is referred as the elder-child ratio as measured by the number of elderly people per 100 youths under age 15. The old age dependency ratio is the proportion of the elderly, who reach the retirement age, to the working age population (United Nations Population Fund (UNFPA), 2011). Retirement age norms may be different in each country, most countries generally accepted the ageing baseline is 65 years old, but in Vietnam because the official working ages according to regulations are from 15 to 59 years old, thus the ageing index and the dependency ratio in Vietnam are measured using the age of 15 - 59 for working age and the age of 60 and over for retirement age. In Vietnam, both the ageing index and the old age dependency ratio are high, currently ahead of Asia and will continue to grow rapidly in the coming decades.

3.1.3. The pace of population ageing

Figure 3.4: Population size and the ageing index in Vietnam, 1999 - 2016



Source: General Statistics Office of Vietnam (GSO) (1979, 1989, 1999, 2009, 2016).

Figure 3.4 shows that the population size and population aged 60 and over dramatic increased in Vietnam over the past three decades. The population size of Vietnam increased from 52.74 in 1979 to 81.40 in 2009 and 93.42 million people in 2016. In this period, the elderly population aged 60 and over also increased two and a half times from 3.71 to 9.34 million, which was equivalent to the increasing proportion of the elderly in the population from 7.07% in 1979 to 10% in 2016. More importantly, the ageing index (60+)

of Vietnam was almost doubled from 16.6 in 1979 to 35.5 in 2009 and nearly triple to 46.3 in 2016, which resulted from the decreasing fertility rate and the increasing longevity. The ageing index in Vietnam also implies that there is a person aged 60 and over for every six children aged 0 - 14 in 1979, and for nearly every three children in thirty years later, and for over every two children in 2016.

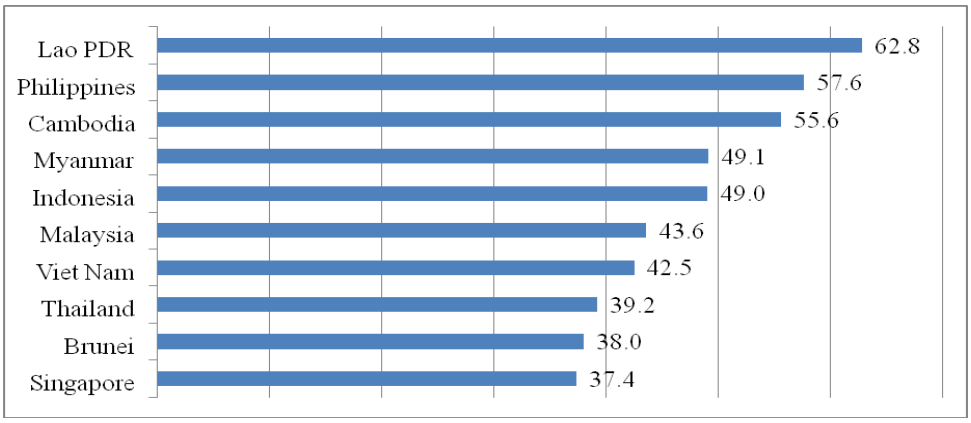
Furthermore, population projections of General Statistics Office (2011) for Vietnam in the period 2009 - 2049 indicates that the ageing index (60+) of Vietnam is expected to continue to increase gradually to 50 in 2019, 65 in 2024 and 85 in 2029. In particular, the Vietnam's ageing index will exceed 100 in 2032, meaning that at this time, the elderly population will outnumber the child population.

3.1.4. The dependency ratio and potential support ratio

The dependency ratio is the proportion of the dependents (people aged under 15 and 60 years and over, which is known as the economically inactive cohorts) to the working age population (people aged from 15 to 60 years and is known as the economically active cohort), reflecting the number of people that each working age individual have to support. A high dependency ratio means that there are less working age adults can support the youth and the elderly (Tom and Murat, 2017).

On the other hand, the United Nations Population Division divides the dependency ratio into two types, including the child dependency ratio and the elderly dependency ratio, to measure the burden of non-working people (dependents) on the working age population. The child dependency ratio is measured as the ratio of the minors less than 15 years old to the working age population (people aged from 15 to 60), which also indicates the number of children those need to be supported for every 100 working age people. The old age dependency ratio is the ratio of the elderly aged 60 and over to the working age population, showing the number of the elderly those need to be supported for every 100 working age people. Accordingly, the higher the dependency ratio is, the greater the burden for the working age population that may impede the economic growth of a country. By contrast, a low rate of dependents to the working age population may enhance savings and investment, thus promote the economic growth.

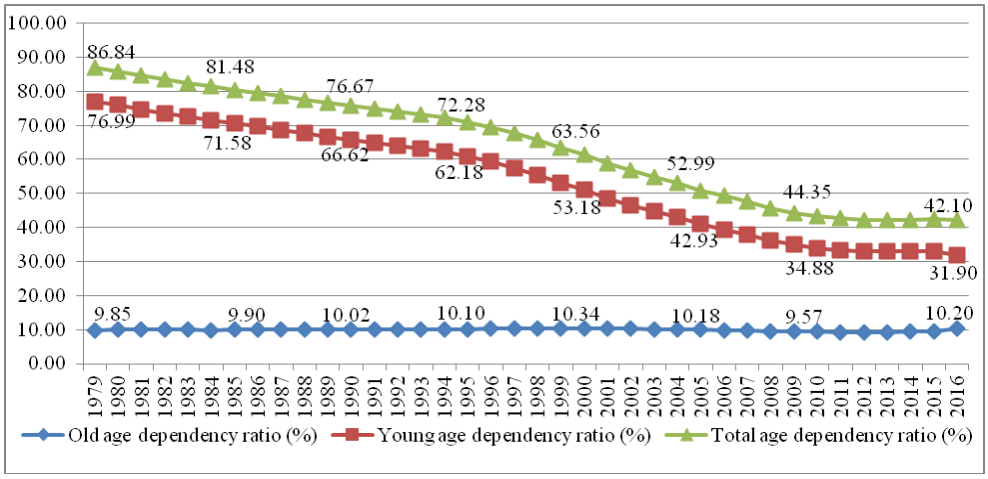
Figure 3.5: The total dependency ratio in ASEAN countries in 2015



Source: United Nations (2015b).

In Vietnam, the total dependency ratio is high and will continue to increase in the coming decades. In comparison to other Asian countries, although the total dependency ratio of Vietnam in 2015 ranks fourth out of ten Asian countries, which is only lower than the total dependency ratios of Thailand, Brunei and Singapore, it also brings a positive impact on the Vietnam's economic growth. Vietnam is one of seven Asian countries, except for Laos, the Philippines and Cambodia, is currently in the period of "population bonus" or "golden population structure", in which the total dependency ratio in the population reaches nearly 50, meaning that for every two working age persons there is one dependent (United Nations, 2015b).

Figure 3.6: The dependency ratios in Vietnam in the period 1979 - 2016



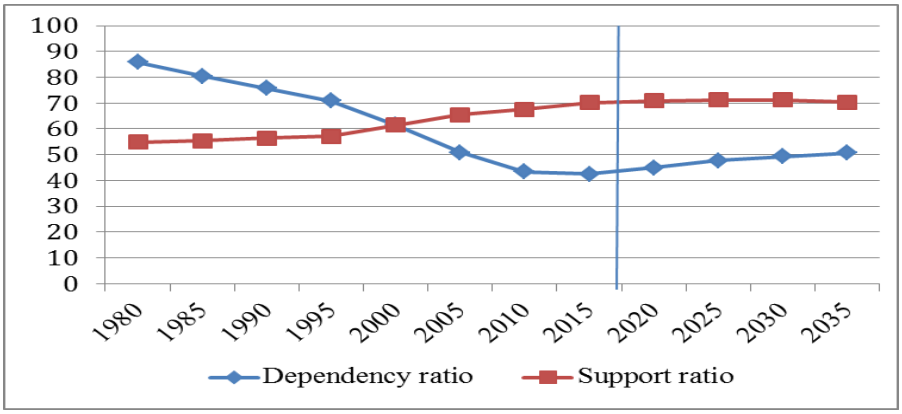
Source: General Statistics Office of Vietnam (GSO) (1979, 1989, 1999, 2009, 2016).

Figure 3.6 presents that the child dependency ratio decreases significantly, but the aged dependency ratio increase regularly in Vietnam during the period 1979 - 2016. The

proportion of youth dependents to the working age population in Vietnam dropped from 76.99% in 1979 to 53.18% in 1999 and 31.9% in 2016, about a 2.5-fold decrease in this period. The decreasing ratio of child dependents was due to a remarkable decline in the fertility rate after Vietnam implemented the family planning policy since 1960. By contrast, the elderly dependency ratio increased slightly from 9.85% in 1979 to 10.34% in 1999 and 10.2% in 2016. The old age dependency ratio in Vietnam was relatively constant around 10% and has not fluctuated much that perhaps because the growth speed of the elderly population was similar to the growth speed of the working age population. Furthermore, resulting from a rapid decrease in the child dependency ratio, the total dependency ratio in Vietnam was dramatically reduced by a half over the past three decades. Specifically, every non-working age person corresponded to about one working age person (86.84 dependents per working age person) in 1979, but after that, corresponded to more than two working age persons in 2009 and 2016 (with 44.35 and 41.1 dependents per working age person respectively).

With regards to the potential support ratio, this ratio is an indicator measuring how many effective employees, who aged 15 to 64 years old and are supporting the whole economy, in the total population. A higher support ratio, on one hand, shows a decline in the dependency level, on the other hand, implies a higher labor supply that helps increase savings and investment, and thus promotes the economic growth. On the contrary, a rising dependency ratio implies an increasing consumption, thereby reducing savings and investment in the economy as well as hindering the economic growth.

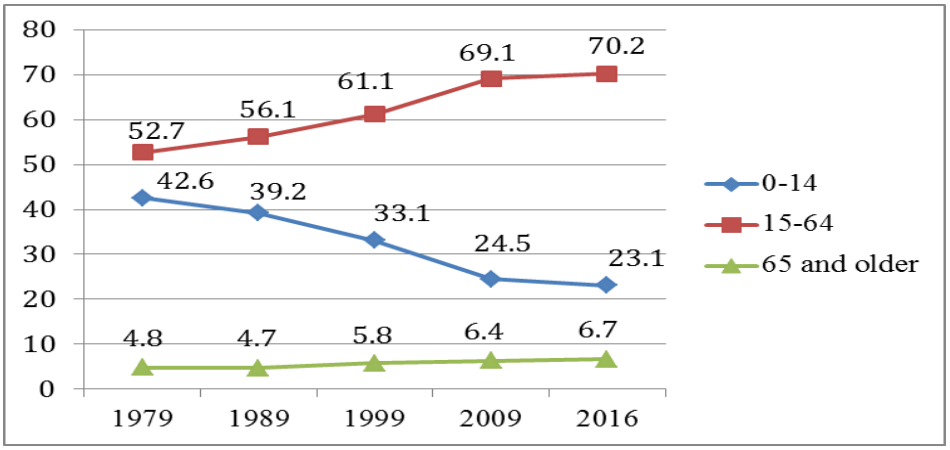
Figure 3.7: Projected indicators of the dependency ratio and the support ratio in Vietnam during the period 1980 - 2035



Source: Population Division of the United Nations and World Population Prospects: *The 2017 Revision. http://esa.un.org/unpp/wpp*

Figure 3.7 shows that the support ratio increased from 54.9% in 1980 to 61.5% in 2000 and 70.2% in 2018, which was also the golden period for Vietnam to take advantage of a growing labor supply contributing to the fast economic growth. After 2018, the support rate is estimated to decrease slightly. By contrast, the dependency ratio declined significantly from 85.8% in 1980 to 42.5% in 2015 and is estimated to increase to 44.9% in 2020 and 50.8% in 2035 that is a consequence of changes in population age structure, more specific, a lower rate of 0 - 14 age group and a higher rate of 65 and older age group in the population (Figure 3.8).

Figure 3.8: Changes in population age structure in Vietnam in the period 1979 - 2016



Source: General Statistics Office of Vietnam (GSO) (1979, 1989, 1999, 2009, 2016).

Figure 3.8 demonstrates that the proportion of the population aged 0-14 declined remarkably from 42.6% in 1979 to 33.1% in 1999 and only 23.1% in 2016. By contrast, at the same time, the proportion of working age population increased greatly from 52.7% in 1979 to 61.1% in 1999 and 70.2% in 2016. Similarly, the proportion of the elderly aged 65 and over rose constantly from 4.8 to 6.7 between 1979 and 2016. Of particular note, for nearly 40 years, Vietnam experienced a remarkable change in population age structure in the period 1999 - 2009. Within ten years, the number of children aged 0-14 dropped by almost 4 million, from 25.3 million in 1999 to 21.0 million in 2009, corresponding to a 8.6% decrease from 33.1% in 1999 to 24.5% in 2009. Along with a sharp decrease in the proportion of the minors, there was a great increase in the proportion of working age population from 61.1% to 69.1% between 1999 and 2009.

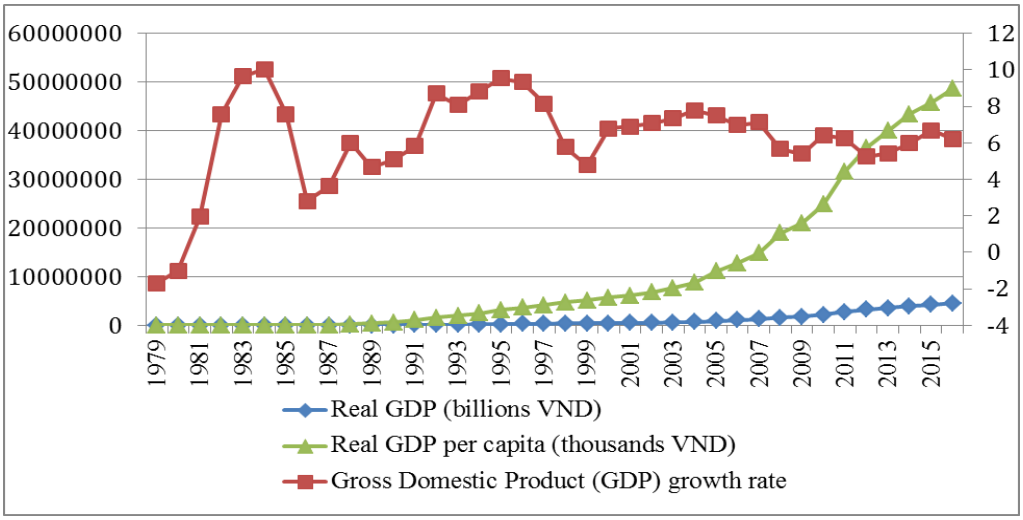
In summary, over the past three decades, although the total dependency ratio of Vietnam declined rapidly due to a sharp decrease in fertility rate, the elderly dependency ratio also increased slightly and is expected to continue to rise remarkably in the next decades

(General Statistics Office of Vietnam (GSO), 2011). Indeed, the increasing longevity with a lower per capita income in Vietnam as compared to other Southeast Asian countries, a higher rate of the elderly population along with a rapid increase in the ageing index, which refers to population ageing situation, will be a huge economic burden for the working age adults and next generations in the coming decades.

On the other hand, the increase in the number and the proportion of the elderly population will undoubtedly increase the demand on healthcare services and require building social insurance system for a better quality of the life of the elderly. Thus, developing a social security system as well as pension schemes for the elderly in the context of longer life expectancy is a serious concern for the Vietnamese government.

3.2. Overview of Vietnam's economic growth

Figure 3.9: Real GDP (billions VND), real GDP per capita (thousands VND) and GDP growth rate of Vietnam in the period 1979 - 2016



Source: Author's calculation from the data of General Statistics Office of Vietnam (GSO).

3.2.1. Vietnam's economy between 1976 and 1985 after the country's reunification

After two decades of war, the economic isolation combined with the inherent issues of a central planned subsidized economy, the Vietnam's economy was performed poorly between 1976 and 1980 (Beresford, 1989a). Moreover, the Vietnam's economy was a subsistence agrarian economy depending mainly on the agricultural production, but the agriculture, in 1977 and 1978, suffered severe natural disasters. In addition, the successive wars divided Vietnam into two regions, the South and the North, and had significantly affected the Vietnam economy. The Vietnam's economic growth increased in first years,

but then gradual declined in the period 1977 - 1980. Specifically, gross social product of Vietnam grew by only 1.4% per year and its growth rates fell significantly from 4.4% in 1977 and 4.1% in 1978 to minus 1.7% in 1979 and minus 1% in 1980. In the meanwhile, the annual growth rate of population was high and increased an average of 2.3% during this period, resulting in a decline in per capita gross social product (Fforde and de Vylder, 1996). Indeed, domestic savings were very low and decreased over the period due to rising food expenditure in the total expenditure from 71.6% in 1976 to 83% in 1980 and the failure to achieve the economic targets, especially for the agricultural export targets in Vietnam. The share of agricultural exports and the processed agricultural products' exports in total exports were only 60% and 62% respectively in comparison to its targets (Beresford and Phong, 2000). Besides, the foreign investment into Vietnam was limited and largely financed by China and Soviet countries (van Donge, White and Nghia, 1999).

In the five-year plan 1981 - 1985, it is worth noting that a wide range of experiments were applied to modify and adjust the management mechanism aimed at lessening the extent of bureaucratic central planning. Specifically, the first renovation step of this five-year plan aimed at decentralizations, in which the Communist Party of Vietnam issued the Directive No.100 on conducting and expanding the production contract system to individuals and labor groups in the agriculture, which helped maintain cooperatives and promote the agricultural production. As a result, the rice-equivalent food production rose gradually from 15.0 in 1981 to 18.2 million tons in 1985 (General Statistics Office of Vietnam (GSO), 2004). The second renovation step was related to the state-owned enterprises (SOEs), more specific; the government permitted SOEs to import and export under license as well as self-financing and self-accounting their business. Nevertheless, the renovate effort of the state-owned enterprises (SOEs) in this period achieved very little success. The state-owned enterprises (SOEs) could not take initiative in controlling their inputs and outputs as well as could not optimally combine its inputs with outputs due to certain faults in the price system. Moreover, the "indulgence" and the support of the government in providing the credit, subsidy programs, and compensation programs led to a weak financial management of the state-owned enterprises (SOEs) (van Donge, White and Nghia, 1999). The third renovation step involved the development of free market and the increased commercialization of economic activities through an official recognition of the private economic sector, in which farmers were permitted to sell their products in the free market, and traders and handicraftsmen were permitted to do their business as the legal

businessmen. The fourth renovation step emphasized on abolishing state subsidies. Nonetheless, under this renovation step, the price of certain materials increased as high as its real value along with a simultaneous increase of salary and money supply, causing the high inflation rate in the economy. Indeed, although the imports of Vietnam from the capitalist countries decreased, the imports from the socialist countries increased steadily, resulting in a high trade deficit and a large fiscal imbalance in the economy (Economist Intelligence Unit (EIU), 1991). In 1985, new bank-notes were issued and the exchange rate was 10 old Vietnam dongs for 1 new Vietnam dong aimed at improving the fiscal and monetary balance. Unfortunately, this change also led to a serious lack of cash in the economy. In this case, the Vietnam government was obliged to issue money to solve the cash shortage problem in the economy and maintain the operation of SOEs. These actions of the Vietnam government helped improve the fiscal balance of Vietnam, but negatively affected the inflation rate, more specific, this made the inflation rate of Vietnam continue to remain high in this period (van Donge, White and Nghia, 1999). However, thanks to "new economic thinking" in the process of implementing the five-year plan 1981 - 1985, the total value of agricultural production and industrial production in Vietnam increased by 5.3% and 9.5%, respectively between 1981 and 1985. Exports increased by 15.8% and the national productive income rose by 6.4% in this period. As a result, the Vietnam economy grew significantly with the annual growth rate of gross social product averaged of 7.3%. The growth rate of gross social product rapid increased from 1.9% in 1981 to 7.6% in 1985 (General Statistics Office of Vietnam (GSO), 2004).

Concerning the Vietnam economy in the long period from 1976 to 1985, it can be concluded that the Vietnam economy recorded a low growth rate and even no growth during this period. The gross social products increased by 50.5%, corresponding with the average annual growth rate of only 4.6% between 1976 and 1985. Agriculture was a vital economic sector of the economy, but its growth rate was only 3.8% per annual. Indeed, with a high priority to the industry sector, the Vietnam government allocated about 80% of total state investment for the industry during this period, but its share in the national economy was small with unstable growth rate (World Bank, 1990). On the other hand, in 1985, the population of Vietnam was large nearly 59.9 million, more specific, rising by 25.7% as compared to the population in 1976 and the average annual growth rate of population was high at 2.3%. The reports of the Vietnam government indicated that in order to ensure the stable income of Vietnamese people, the economy was required to

achieve a growth rate of 7% per year. However, in practice, the Vietnam's economic growth failed to meet its target and its domestic production was not enough to adapt to the Vietnam people's minimum consumption. Thus, the Vietnam economy have to import almost goods for production and individual's consumption, leading to an increasing dependency on external resources and a foreign debt burden. Furthermore, the Vietnam government's revenues failed to cover its expenditures, causing the government budget deficit and the modest domestic savings. Additionally, due to a simultaneous reform of price and salary and the change in money supply, a hyperinflation kept increasing uncontrollably that affected all areas of socio-economic life (Fforde and de Vylder, 1996). Besides, in the early 1980s, the Vietnam economy faced many serious issues resulting from the weakness inside the economy and adverse changes in the international conditions. More specifically, the economy still operated in the old model and the management mechanism was characterized by the bureaucratic subsidized centrally-planned mechanism with a massive and unplanned development of state economic sector. Not only that, the Vietnam government gave a high priority to and spent a large resource on the heavy industry and large-scale production, but also ignored the laws of the market along with lost the financial aid from the former socialist countries. Consequently, the existing issues in the 1976 - 1985 economic reforms forced the Vietnam government to launch *Doi moi* (renovation) policy programs to overcome its hardships and move further towards a market economy (Minh and Long, 2008).

3.2.2. The period 1985 - 1988: Doi moi (renovation) policy and initial adjustments towards a market economy

In the period 1986 - 1988, the main achievement of Vietnam economy was that it can eliminate the old management mechanism and then develop an initially economic thinking of new management mechanism. Furthermore, the efforts to strengthen the key economic role of private and individual sectors in the economy along with an increasing extent of market relationships instead of the dominance of the economic decision making of the state sector contributed to the growth of Vietnam economy, especially in 1987 and 1988. Specially, the first law on foreign investment was issued in 1987, which encouraged the foreign investors to supply goods into the domestic market in order to meet the consumption demand. Indeed, the government provided the legal framework for an expansion of private small and medium enterprises (SMEs) in 1988, which helped enhance

the competitiveness of SMEs in the market and increase its production possibilities. Besides, the Vietnam government devaluated the domestic currency against the US dollar to improve the competitiveness of Vietnamese products in the international and regional markets and promote exports (Fforde and de Vlyder, 1996).

More importantly, the *Doi moi* (renovation) policy programs, which were launched by the Vietnam government since 1986, helped boost the growth rate of Vietnam economy from 2.8% in 1986 to 3.6% in 1987 and 6% in 1988, and end a prolonged economic crisis due to an interrupted import-export market between Vietnam and East European countries. Meanwhile, the positive GDP growth rate also contributed to the engagement of the Vietnam government in further economic reforms.

3.2.3. The period 1989 - 1996: Early transformation to the market mechanism

The economic reforms, which were taken in the period 1989 - 1996, placed emphasis on liberalization and stabilization through several policies relating to the price control, the unification of the exchange rate system, the imposition of positive real interest rates, the issuance of the Ordinance on Economic Contracts and the elimination of subsidies to state-owned enterprises (SOEs).

In 1989, the radical changes in the Vietnam economy marked the turning point towards a market economy. Indeed, the economic growth rate of Vietnam decreased slightly from 6% in 1988 to 4.7% in 1989, which was caused by the restructuring of the state-owned enterprises (SOEs) along with a smaller scale of the state sector in the economy. This insignificant reduction, on the other hand, was as a result of a rapid growth of non-state sector resulting from liberalization policies in the economy, in which the growth rate of non-state sector and the share of non-state sector to the total industrial growth were 9.8% and 69% respectively as compared to 1.8% and 41% of state sector in 1989 (Minh and Long, 2008).

Between 1989 and 1996, the Vietnam economy experienced a fast growth rate with a peak at 9.5% in 1995. More specifically, the economic growth rate of Vietnam increased remarkably from 4.7% in 1989 to the highest percentage at 9.5% in 1995 and 9.3% in 1996. Of particular note, the period between 1994 and 1996 was a golden age for the economic growth of Vietnam. During this period, Vietnam was known as a new economic dragon in Southeast Asia with the high annual average growth rates of real GDP and per capita real GNP at over 9% and 7% respectively. Furthermore, van Donge, White and Nghia (1999) stated that the fast growth of the Vietnam economy in this period is resulted

from the contributions of past and ongoing reforms, including the issuance and the amendment of Vietnam's laws on state budget, on state and non-state enterprises, on credits and banking, and on domestic and foreign investments as well as the expansion of trade and financial associations of the Vietnam economy with international communities, for instance, joining in the Association of South-East Asian Nations (ASEAN) and the ASEAN Free Trade Area in 1995, having the normalized relations with the United States in 1994, the reconnections with the International Monetary Fund (IMF) and the World Bank, and implementing the financial liberalization and the interest rate liberalization in the market. Not only that, Ardeshir and A Haroon (2002) confirmed that the rapid growth of the Vietnam economy is driven by the unprecedented level of investment in the economy with a percentage 27.3% of GDP along with the high level and the big share of foreign direct investment (FDI) inflows accounting for 29% of gross investment. Accordingly, this fast growth helped improve the Vietnam's gross national savings and the state budget significantly, in which the budget moved from a deficit at 9.8% of GDP in previous periods to a balance of payments in this period (Ardeshir and A Haroon, 2002).

3.2.4. The period 1997 - 1999: Transformation in the context of the Asian crisis

The Asian financial crisis started in Thailand in 1997 and expanded to other East Asian countries, which then affected and resulted in the disruptions of trade and investment in Vietnam. In fact, this financial crisis did not directly affect the Vietnam's economy due to the effective control of capital in the economy, but as a result of the financial crisis, a decline in foreign direct investment (FDI) and the increasing competition in export markets have negatively influenced the economic growth of Vietnam in this period. During the period 1997 - 1999, the number and total value of foreign direct investment (FDI) projects in Vietnam declined significantly, which also reduced total gross investment to 25% of GDP. Some foreign direct investment (FDI) projects were dissolved and seriously influenced by the foreign trade. Indeed, the budget deficit rose because the government increased its expenditures to lessen the effect of the regional slowdown and boost the domestic demand through a repressive consumption. Nevertheless, the budget deficit was small, accounting for only 1.7% of GDP in Vietnam in this period (World Bank, 2001b). In the meanwhile, the exports of Vietnam's goods to East Asia countries reduced significantly from 28.8% in 1996 to 11.4% and only 7.8% in 1997 and 1998 respectively. The devaluation of Vietnam dongs currency in the region, more specific, the Vietnam

government devalued the currency by four times in the 1997 - 1999 period also further decreased the competitiveness of Vietnam (Central Institute for Economic Management (CIEM), 2001). Consequently, the Vietnam economy experienced a downward trend of GDP growth rate with a drop from 8.2% in 1997 to 5.8% in 1998 and then 4.8% in 1999. Besides, due to the poor state of the Vietnam financial system, the low profitability of the state-owned enterprises (SOEs) and the declining economic growth rate of Vietnam during this period, the savings rate of Vietnam remained comparatively low in comparison to other East Asian countries (World Bank, 2001b).

3.2.5. The period 2000 - 2007: Overcome the financial crisis and further growth

After the financial crisis period in Asia, the Vietnam economy recovered its growth momentum in 2000 through the structural reform programs, consisting of the promotion of the non-state sector and the equitization of the state-owned enterprises (SOEs). Specifically, the enactment of new Enterprise Law in 2000 facilitated business activities and created a more level playing field for non-state enterprises as well as promoted the development of private sector, leading to a rapid increase in the number of newly established enterprises, especially new private enterprises. In regards to the equitization of state-owned enterprises (SOEs), although it met some difficulties resulting in a low process of equitization, for instance, the management board was unwilling to support the equitization, so it was difficult for the enterprises to evaluate its values and there was an unequal treatment between state and non-state enterprises in the market, the high profile of equitization, which was collected in Vietnam in the period 2000 - 2006, confirmed a positive and radical change in the production structure (Minh and Long, 2008). Furthermore, these positive structural reforms bring a big success for the Vietnam economy. The Vietnam economy experienced a strong growth with an average percentage of 7.2% over the period 2000 -2006 and was successfully transformed from one of the poorest countries to a low and middle income country in the world in 2009 (International Monetary Fund (IMF), 2011).

3.2.6. From 2007 onwards: Globalization and a stabilized growth

The participation of Vietnam in the World Trade Organization (WTO) in 2007 opened up new opportunities for its economic growth to become more integrated into the global economy. Additionally, the Vietnam economy experienced a huge number of foreign direct investment (FDI) projects and a high level of exports and imports in 2007. However, one

year later, the world economy faced the great recession (the 2008 global financial crisis) that seriously affected the Vietnam economic growth. More specifically, due to the global financial crisis, the exports of Vietnam to other countries decreased dramatically, thus leading to a decline in the growth rate from 7.1% in 2007 to 5.7% in 2008 and 5.4% in 2009 and a serious budget deficit in Vietnam. In the meanwhile, a large number of private enterprises were struggling with debt or even went into bankruptcy because of an increase in borrowing costs resulting from an unstable growth of Vietnam economy with two-digit inflation (the inflation rate was 23.16% in 2008). After that, in 2009, the Vietnam government launched a stimulus package of US$8 billion to solve bad debts from the banking sector, resulting in a temporary increase in GDP at 6.4% in 2010 before facing with the soaring inflation in 2011. In 2011, the Vietnam's economic growth rate was 6.2%, but as a consequence of an enormous inflation rate in 2011, the economic growth rate of Vietnam dropped to 5.2% in 2012, which was the lowest rate within 13 years (Anne, Monica and Arild, 2013). Afterwards, the Vietnam economy experienced a stabilized, but low growth rate from 5.4% in 2013 to 6.2% in 2016. Overall, over the period 2007 - 2016 the economic growth of Vietnam has fluctuated and decelerated from 7.1% to 6.2%.

3.3. The Vietnamese pension schemes

As above mentioned, demographic changes in Vietnam, which is observed through the phenomenon of rapidly ageing population, have a significant influence on the economic growth. The proportion of the elderly in the population is dramatically increasing due to a declining fertility rate and an increasing life expectancy. More specifically, the total fertility rate (TFR) declined sharply from 4.81 children per woman in 1979 to 2.33 in 1999 and then to only 1.82 in 2016 (which is lower than replacement rate), while the life expectancy at birth increased significantly from 66.8 in 1979 to 75.6 in 2016. Furthermore, the population projections indicates that the elderly population in Vietnam will continue to increase remarkably from 8.7% in 2010 to 10% in 2017 and 24.8% in 2049 and enter the so-called "ageing phase" from 2017 onward. Nevertheless, in fact, only a small percentage of the elderly population is receiving public pensions, while most of Vietnamese elderly live on their own or live in poor and vulnerable conditions and receive the material support from their family members (Vietnam Ministry of Labor, War Invalids, and Social Affairs (MoLISA), 2005). A low and unstable income of the majority of Vietnamese elderly serious requires the development of pension schemes so that it can protect them. Indeed, as

a consequence of population ageing, a huge public expenditure for the elderly on pensions and health and medical care is required, which will affect the pension fund and the government budget as well as the economic growth of Vietnam.

On the other hand, after 30 years of the implementation of *Doi moi* (renovation) programs in 1986, Vietnam has transformed from one of the poorest nations to a low and middle income country in the world since 2008 and experienced a remarkable economic growth. Along with the Vietnam's remarkable economic growth, its social insurance system contains the Vietnamese pension schemes has been developing and helped Vietnam to achieve the Millennium Development Goals in advance, such as reducing the poverty, reducing the unemployment rate, improving the living standards of the elderly, and maintaining the income for Vietnamese people (Gaiha and Thapa, 2007). Nonetheless, the development of Vietnamese pension schemes might affect the savings behavior of individuals and households, meaning that these pension schemes might affect private savings in Vietnam.

3.3.1. The Vietnamese pension scheme: Current situation and its challenges in the context of a rapidly ageing population

The Vietnamese pension scheme is one of three main pillars of the social insurance system, which was launched in 1962. Before 1995, the pension scheme of Vietnam was non-contributory defined benefit (DB), which was controlled by public agencies under the supervision of the government. Only retirees, who worked in the state sector before retirement, received the benefit from the pension scheme. Based on the number of working years and the wage at the time of retirement, the retirement benefit for a retiree was identified and paid by the social insurance fund. The fund was formed through a contribution of employers relying on the payroll and subsidies from the government budget, and was managed and ensured by the government. During the period 1962 - 1994, especially in the wartime, the pension scheme helped to maintain the income and the living standards of insured individuals and their family. However, the demographic changes, a remarkable economic growth along with the growing private sector resulting from *Doi moi* (renovation) programs required a reform of the pension scheme. As a result, a publicly-managed pay-as-you-go defined-benefit (PAYG DB) scheme was formed in 1995, which was administered by Vietnam Social Security (VSS) under the guarantees of the Vietnam government. Along with the administration of Vietnam Social Security (VSS), the Vietnam

Ministry of Labor, Invalids and Social Affairs (MoLISA) was responsible for policy formulation and the Ministry of Finance was in charge of financial strategy. Due to this reform, there are two types of beneficiaries in the current pension scheme, including pre-1995 and post-1995 pensioners. Pre-1995 retirees are receiving the benefits from the government budget, while post-1995 pensioners are entitled to and received the benefits from the Vietnam Social Security (VSS) fund.

The pension scheme has a significant development when the Social Insurance Law was promulgated in 2007 with some new regulations that contributors, contribution rates and benefit rates are regulated. The current pension scheme is mandatory for all employees working in the state or non-state sector in Vietnam with an indefinite duration contract or a contract valid for three months or more. Indeed, the pension scheme is voluntary for other Vietnamese people at working age who are from 15 years old and not included in the mandatory scheme).

3.3.1.1. The coverage rate and issues of the contributory pension scheme

Table 3.2 below shows that the number of contributors and the coverage rate of the mandatory scheme increased over time from 2.3 million in 1995 to 8.5 million in 2008 and 12.7 million persons in 2016, corresponding to 9.01% in 1996, 19.01% in 2008, and 23.39% in 2016. The annual growth rate of participants in the period 2000 - 2008 was the highest about 9%, as compared to that in other periods, in which almost participants working in state sector (accounting for 80% of the active contributors in 2008), while only 20% of participants was from non-state sector (Vietnam Social Security (VSS), 2008). A low percentage of participants working in non-state sector in the pension scheme resulted from two main reasons. Firstly, in order to increase the company profits by reducing the costs, including the cost of paying the social insurance for its employees, some non-state companies ignored the Social Insurance Law and did not contribute the social insurance for their employees. Meanwhile, the regulations are complicated and non-state employees lacked of information and guide from government authorities. Secondly, the wage in the non-state sector is low and employees in this sector do not see the higher benefits from the pension scheme for their long contribution time, especially in the case, several researches such as Gian, Paulette and Long (2009), Long and Wade (2009b), (OECD) (2008) and Long (2008) estimates that the pension fund in Vietnam will depleted and even deficit over the next 30 years.

Table 3.2: Number of participants in the period 1995 - 2008

Year	Number of participants (1,000 persons) (1)	Labor force (1,000 persons) (2)	Coverage rate (as percentage of labor force) = (1) : (2)
1995	2,276	35,409	6.43
1996	3,231	35,866	9.01
1997	3,572	36,896	9.68
1998	3,765	37,207	10.12
1999	3,860	37,583	10.27
2000	4,128	37,610	10.98
2001	4,376	38,563	11.35
2002	4,445	39,508	11.25
2003	4,987	40,574	12.29
2004	5,820	41,586	14.00
2005	6,190	42,527	14.56
2006	6,747	43,339	15.57
2007	8,179	44,174	18.52
2008	8,539	44,916	19.01
2009	9,103	49,322	18.46
2010	9,343	50,393	18.54
2011	10,113	51,398	19.68
2012	10,436	52,348	19.94
2013	11,057	53,246	20.08
2014	11,646	53,748	21.67
2015	12,291	53,984	22.77
2016	12,735	54,445	23.39

Source: Long (2012) and General Statistics Office of Vietnam (GSO) (2009 - 2016)

Nevertheless, the coverage rate of the Vietnamese pension scheme, which is calculated by the number of contributors as a percentage of the total labor force, was very low and from only 6.43% of the total labor force in 1995 to 19.01% and 23.39% of the total labor force in 2008 and 2016, respectively. This low coverage rate was resulted from two reasons: the Vietnamese pension scheme was inherently limited to employees in the state sector and few workers participated in the voluntary scheme. Specifically, only 65,000 people in the non-state sector took part in the voluntary pension scheme in 2007 and the number of self-employed workers participating in the voluntary pension scheme was extremely limited (Vietnam Social Security (VSS), 2008). Moreover, although the voluntary social insurance policy was implemented in 2008, and then, the Law on Social Insurance in 2014 opened up many favorable policies for people to participate the voluntary social insurance. Specifically, all Vietnamese citizens aged 15 and above, who did not belong to the compulsory social insurance, can apply for the voluntary social insurance. The current laws does not regulate the maximum age of people participating in the voluntary social insurance. However, after nine years of implementation of the voluntary social insurance policy, only 200,000 people out of a total of nearly 40 million people working in the informal sector, self-employed laborers, housemaids, farmers, and fishermen had participated in the voluntary social insurance. This number was very low as compared to the expectation and goal of Vietnam Social Security. Additionally, the number of people participating in the voluntary social insurance was only equal to 1/60 of the number of people participating in the compulsory social insurance, with only more than 1,000 billion dongs out of 373,350 billion dongs of the total revenue of social insurance funds. Unfortunately, the number of participants in the voluntary social insurance tends to decrease (Vietnam Social Security (VSS), 2016).

Furthermore, the proportion of active contributors to regulated ones, which was called the compliance rate of the scheme, was low for non-state sector. According to the Ministry of Labor, Invalids and Social Affairs (MoLISA, 2008), the compliance rate of non-state sector was only 26.5% in 2007, while that of state and foreign-invested enterprises was 99%. A low compliance rate of non-state sector was caused by the low wage of employees, complicated regulations and the lack of information and guide from government authorities.

Another issue of the current contributory pension scheme was that the regulations of seemed difficult for vulnerable and poor people to access. Martin et al. (2007) and Long

and Wade (2009a) stated that pension benefits contributed to reduce the probability of poverty of households with the elderly as well as maintain their living standards. However, only 2% of pension spending was for the poorest group, while a half was for the two highest income groups. In fact, the pension scheme in Vietnam did not support the poor people, and its payments were regressive (World Bank, 2007).

3.3.1.2. Contribution rates and pension benefits

With regards to the contributions of employers and employees in the Vietnamese pension scheme, both of them contribute to the pension funds in Vietnam and their contribution rates have changed over time depending on the Vietnam's Social Insurance Law with the main purpose of obtaining the balance of this pension funds.

Table 3.3: Contribution rates to the pension scheme

Year	Total (%)	Employers (%)	Employees (%)
From 1/1/2007 to 31/12/2009	16	11	5
From 1/1/2010 to 31/12/2011	18	12	6
From 1/1/2012 to 31/12/2013	20	13	7
From 1/1/2014 onwards	22	14	8

Source: The Vietnam's Social Insurance Law in 2007.

The Vietnam's Social Insurance Law in 2007 regulated the contribution rates in the pension funds in different periods, which is shown in Table 3.3. The contribution rates are different between employees, who receive the wages are stipulated by the state and other employees, who receive contract-based wages. More specifically, the common minimum salary is used to compute the contributions of the former employees, while the salary in the labor contract is used to compute the contributions of the later employees. From 1/5/2016, the minimum wage is 1210,000 VND (or about US$55), and the contribution is not more than 20 times the minimum wage (or about US$1.100). Employees in different enterprises such as state, foreign-invested and non-state enterprises have different minimum wages, thus they have different contribution wages. The contribution wage of employees in state and foreign-invested enterprises is 1.5 times higher than that of non-state sector employees.

According to Vietnam's Social Insurance Law in 2007, people can receive the pension benefits when satisfying both requirements, including the age of beneficiaries is 55 and 60

for women and men respectively and the beneficiaries must have at least 20 years of contributions. The pension benefits is calculated by multiplying the base earning by a service factor, in which the base earning is computed by the average monthly wage during a certain period of time, for instance, the average monthly wage of the last 5 years for employees working in the state sector. The service sector is measured with 3% for the first fifteen years and 2% thereafter, or minus 1 percent for each year of early retirement. For the beneficiaries, if their contributions have been paid for in excess of 30 years for men and 25 years for women, they can receive an additional lump sum payment of half a month's average salary for each year of the excess. Nevertheless, the total pension benefits of beneficiaries do not exceed 75% of the base earning. Before the year 2007, the pension benefits were adjusted based on the minimum wage. Since 2007, the pension benefits have adjusted relied on the Consumer Price Index (CPI) and the government has played a key role in deciding adjustment levels of pensions. The individuals cannot postpone retirement at normal retirement age, but they can work and receive pensions after retirement (The Vietnam's Social Insurance Law, 2007).

Also, the Organisation for Economic Cooperation and Development (OECD) (2008) stated that Vietnam was one of countries having the highest pension benefit rate with the replacement rate of the Vietnamese pension scheme at about 72%, but in terms of absolute numbers, the benefits for Vietnamese beneficiaries were low from only $50 to $70 in 2008, which were lower than Vietnam's GDP per capita at $US85 (Nguyen, 2009). This fact also indicated that there exists a significant imbalance between contributions and benefits of the beneficiaries in the Vietnamese pension system. In recent times, due to a higher inflation rate, the total revenue of the Vietnam pension system is lower than its real revenue, thus leading to a higher imbalance of pension fund. In addition, although the pension benefits were adjusted by the government in relation to the changes in inflation rate over time, the ratio between total revenue and total expenditure of the pension system in Vietnam has fallen during the period 2000 - 2016.

The ratios between total revenue and total expenditure of the pension system in Vietnam between 2000 and 2006 are calculated from the revenue and expenditure data in the Vietnam's social insurance system. However, in fact, the contributions of total revenue and total expenditure of the Vietnamese pension system accounts for a large proportion in the revenue and expenditure values of the social insurance system in Vietnam, thus using the

revenue and expenditure values of the Vietnam's social insurance system can represent as well as reflect the revenue and expenditure values of the Vietnamese pension system (Pham, 2009). On the other hand, from 2007 onwards, the revenue and expenditure data of the Vietnamese pension system is collected directly from the annual reports of Vietnam Social Security (VSS). Therefore, the ratios between total expenditure and total revenue of this Vietnamese pension system during the period 2007 - 2016 can be calculated through the data of the Vietnam Social Security (Vietnam Social Security (VSS), 2017).

Table 3.4: The ratio between total revenue and total expenditure of the pension system in Vietnam during the period 2000 - 2016

Year	Total expenditure (Billions VND)	Total expenditure as a percentage of total revenue (%)	Ratio between revenue and expenditure (times)
2000	3,335	25.69	3.89
2001	4,936	30.50	3.28
2002	5,572	36.94	2.71
2003	7,792	33.03	3.03
2004	9,865	36.75	2.72
2005	12,759	39.39	2.54
2006	16,780	45.73	2.19
2007	14,465	60.89	1.64
2008	21,360	69.01	1.45
2009	28,418	75.67	1.32
2010	35,187	70.49	1.42
2011	44,261	70.81	1.41
2012	59,097	65.67	1.52
2013	82,000	73.52	1.36
2014	118,750	91.35	1.09
2015	146,911	104.23	0.96
2016	161,100	103.01	0.97

Source : Pham (2009) and the Vietnam Social Security (VSS) annual reports.

As seen in Table 3.4, the ratio between total expenditure and total revenue of the Vietnamese pension system has declined steadily from 3.89 times to 0.97 times during the period 2000 - 2016, which can be explained by the fact that the adjustments of pension benefits for beneficiaries according to the changes in inflation rate were more rapidly than that of contributions from employers and employees in the pension system in Vietnam. Indeed, due to the pension reform, the Vietnamese pension scheme now has to pay pension benefits for two types of beneficiaries, including pre-1995 and post-1995 beneficiaries, while the participation and contribution rates in the Vietnamese pension scheme is low and depends mainly on the post-1995 employees. Furthermore, although the number of participants and the coverage rate in the Vietnamese pension scheme has increased, most of beneficiaries worked in the state sector where they received the higher benefits as compared to employees worked in other sectors and the new participants contributing to this scheme, who are working in the non-state sector is limited.

3.3.1.3. Some challenges of the pension scheme in the context of a rapidly ageing population in Vietnam

As above mentioned, the family planning policy in Vietnam since 1970 and an increasing life expectancy resulting from the improvement of living standards caused the phenomenon of rapidly ageing population in Vietnam. Specially, the population prospects for Vietnam by General Statistics Office of Vietnam (GSO, 2011) estimates that the proportion of the elderly aged 60 and over in the population in Vietnam will increase remarkably from 11.6% in 2020 to 24.8% in 2049, which are double and triple as compared to the elderly population rate in 2000. Meanwhile, the working age population will reach its assumed peak in 2030 and then will decline rapidly. Indeed, the Vietnamese average life expectancy is estimated to rise from 69.1 years in 2000 to 74.2 years in 2025 and 78.3 years in 2050. The decrease in the child dependency ratio resulting from a sharp decline in fertility rate and an increase in the elderly dependency ratio along with a longer life expectancy will put a strong pressure on the working age population in Vietnam in the near future (General Statistics Office of Vietnam (GSO), 2011).

Along with a rapidly population ageing in Vietnam, some challenges regarding the long term sustainability of the Vietnamese pension scheme are emerging. Firstly, the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) scheme will face with a high dependency ratio, especially for the elderly dependents in both absolute and relative

numbers in the coming decades. Secondly, in fact, the Vietnamese people tend to retire earlier and live longer with a longer life expectancy at retirement ages for both men and women that will obviously lead to longer retirement duration, and then in turn will put a strong pressure on the pension fund balance. According to Kieu (2009), the average retirement ages for men and women in 2008 were 55 and 51 respectively, which was corresponding to 5 years and 4 years earlier than the normal retirement age of men and women. The average life expectancy was 71 for men and 74 for women at the same time. Therefore, the average number of retirement years was 16 years for males, 23 years for females, and 19.5 years for both male and female retirees. Nevertheless, a 28-year contribution of employees only provides enough for a 10-year pension benefit of retirees, thus the remaining 9.5 years of pension benefit will be paid by the previous pension fund, meaning that this pension fund will be depleted in the future. Thirdly, with a current contribution percentage of employees, the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) pension scheme in Vietnam will not be financially feasible. Specially, Gian, Paulette and Long (2009) indicated that the Vietnamese pension funds will be zero from 2034 and totally depleted in 2039. Similarly, Long and Wade (2009b) used stochastic simulations and showed that the Vietnamese pension fund will be unbalanced since 2038 and depleted in 2051. They suggested that in order to have a balanced fund, the best solution is to increase the contribution rate by 10% to 30% as compared to the current contribution rate. The Organisation for Economic Cooperation and Development (OECD) (2008) also proposed that a contribution rate should be 40%. Due to a heavier burden for contributors resulting from a higher contribution rate, the contribution evasion will happen more prevalent, affecting the financial sustainability of the Vietnamese pension scheme. Finally, as a consequence of implicit pension debts (IPDs) in the future, the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) pension scheme will have to deal with generational inequity. Long (2008) applied open-system approach to estimate IPDs for Vietnam and found that without transformations of the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) pension system during the period 2000 - 2050, the pension fund will depleted and even deficit, which in turn will negatively impact the government budget.

Table 3.5: The estimated pension debts in Vietnam in the period 2000 - 2050

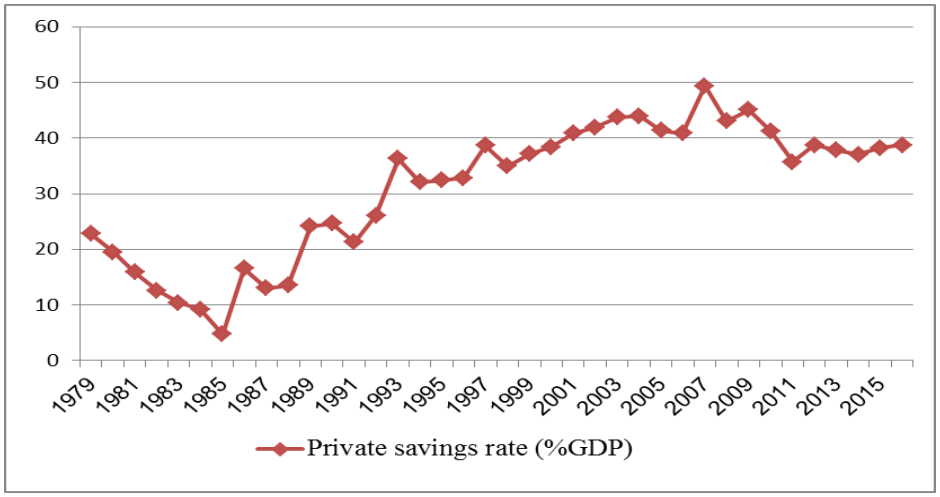
Discount rate	Total pension debts (as % of GDP 2000)
3%	108
5%	63
6%	50

Source: Long (2008)

Also, according to Long (2008), the pension liabilities of Vietnam, which is considered as a percentage of GDP in 2000, is estimated to be 108%, 63% and 50% corresponding to a discount rate of 3%, 5% and 6%, which will be a big issue and put an extremely pressure on the pension fund balance in Vietnam over the next 30 years.

3.4. A brief view of dependency ratios, economic growth, and private savings in Vietnam

Figure 3.10: Private savings rate (% of GDP) in Vietnam in the period 1979 - 2016

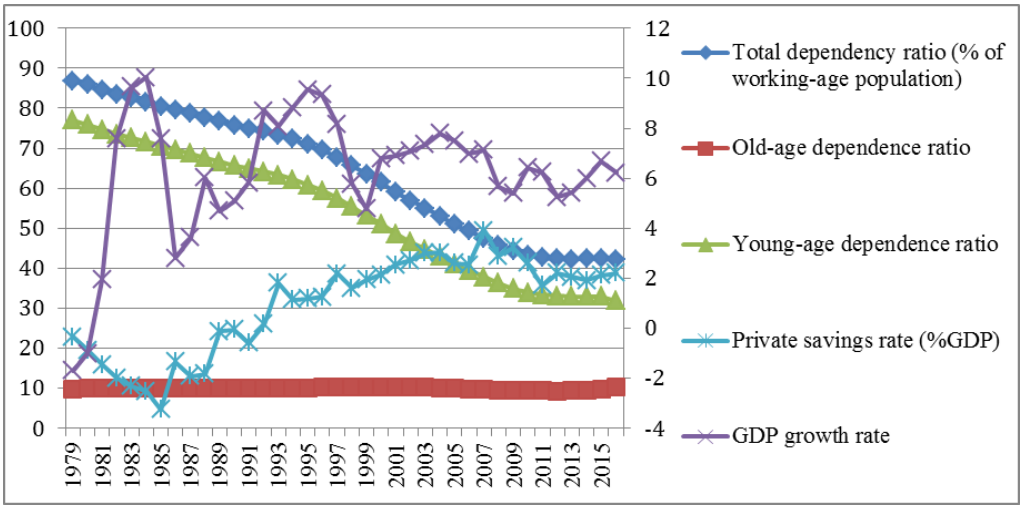


Source: Authors' calculations from the data of General Statistics Office of Vietnam (GSO).

As seen in Figure 3.10, before launching *Doi moi* (renovation) programs in 1986, there was a downward trend in private savings rate in Vietnam. The private savings rate of Vietnam decreased significantly and dropped to the bottom at 4.73% of GDP in 1985. The downward trend in private savings rate before 1986 was caused by the poor performance of the Vietnam's economy. The Vietnam's economic growth failed to achieve its targets over the period along with a large fiscal imbalance and the hyperinflation, thus leading to declining incomes of Vietnamese people. In the next 30 years, Vietnam observed both upward and downward trends of private savings rate. The

private savings rate in Vietnam has fluctuated and unstable over time, but overall, it is an upward trend in the period 1985 - 2016.

Figure 3.11: Dependency ratios, GDP growth rate, and private savings rate in Vietnam, 1979 - 2016



Source: General Statistics Office of Vietnam (GSO), Statistical Yearbook of Vietnam.

Regarding the total dependency ratio, the youth dependency ratio and the elderly dependency ratio, from 1985 onwards, there were two opposite trends between the youth dependency ratio and the old age dependency ratio in Vietnam. Vietnam has observed an upward trend for the young age dependency ratio due to a dramatic decrease in fertility rate, while observed a downward trend for the old age dependency ratio in Vietnam in the period 1985 - 2016. Besides, the significant downward trend of the total dependency ratio was due to a remarkable decline in the youth dependency ratio resulting from a rapidly decreasing fertility rate, which was higher than an increase in the elderly dependency ratio during the period.

On the other hand, the private savings rate as a percentage of real GDP has fluctuated, consisting of both upward and downward trends over years, but overall, it is an upward trend between 1985 and 2016. Similarly, Vietnam has experienced a fluctuation of GDP growth rate or unclear trend in the period 1985 - 2016. The graph of this indicator contains a mixed upward and downward trend over the period 1985 - 2016, but in general, we can see an upward trend in GDP growth rate between 1985 and 2016.

CHAPTER 4 RESEARCH METHODOLOGY

The chapter presents the research methodology employed to test the hypotheses and produce statistically significant results. This chapter starts with the research approach and research strategy choices, then performs data collection from 1985 and 2016 (the sources and the type of the data used) and develops the model specification expressing the relationships between population ageing, economic growth and private savings in Vietnam. Finally, this chapter focuses on research techniques under the testing order, including the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, the vector autoregressive (VAR) model, the Johansen cointegration test, the Vector Error Correction Model (VECM), and the Pair-wise Granger Causality and the VEC Granger Causality/Block Exogeneity Wald tests that can be employed in the research.

Specifically, the Augmented Dickey-Fuller (ADF) unit root test of Dickey and Fuller (1979) and the Phillips-Perron (PP) unit root test will be applied to test the stationary of the variables and then establish the order of integration in the data series. The reason of using both the unit root tests is that if both tests produce the same conclusion from the data set, the results obtained are more robust. After testing and obtaining the stationary of the variables, the cointegration test is applied to identify the number of cointegrating vectors based on the results of Trace and Maximum Eigenvalue statistics. If there exists a single cointegration, we will conduct two-step Engle-Granger residual-based test, while if there exists more than one cointegrating relationships, the Johansen's (1991 and 1998) cointegration test will be employed. Additionally, if the Johansen cointegration test indicates that there exists the cointegrating (long run) relationship among the stationary variables (I(1)), the Vector Error Correction Model (VECM) will be performed to disaggregate the short run dynamics and the long run relationship. Besides, the Vector Error Correction Model (VECM) helps explain the adjustment of any short run deviations from the long run equilibrium and answer whether the short run dynamics are affected by the estimated long run equilibrium relationship, and if does, the Pair-wise Granger Causality test and the VEC Granger Causality/Block Exogeneity Wald test are applied to further examine the direction of causality between the considered variables in Vietnam.

For this research, the annual time series data for Vietnam during the period 1985 - 2016 will be analyzed by employing the Johansen cointegration test and then a Vector Error Correction Model (VECM) to determine the cointegrating (long run) relationship and the

short run dynamics. The reasons for applying two methods are that it presents the advancement over any single equation estimation technique because of its possibility of solving the multiple cointegrating vectors and these approaches allow the research to separate the long run equilibrium relationship from the short run dynamics. Additionally, in order to confirm the short term relationship and check for the direction of causality between the considered variables, the Pair-wise Granger Causality test and the Block Exogeneity Wald test are conducted.

Then, the impulse response and variance decomposition tests are carried out to analyze the response of private savings to a shock in each explanatory variable and determine the important variables, which can explain the large proportion of variation of private savings in Vietnam. From that, the study can identify the variables will have a significant effect on private savings in Vietnam in the future.

Furthermore, several important diagnostic tests: Jarque-Bera test for the normality, White and ACRH tests for heteroscedasticity and the VEC residual LM test for the serial correlation and CUSUM test for the stability will be added to check for the reliability of the residuals of the dynamic VECM in order to achieve the best linear unbiased estimators of the OLS regression model for the research.

4.1. Research approach

According to Saunders et al. (2009), there are two main types of research approaches that usually employed by researchers for the research design, including the deductive approach and the inductive approach. This section will answer the question "whether the research should use the deductive approach or the inductive approach" or explain the choice of the researcher about the kind of research approach which will be applied in this study.

Under the deductive approach, theories and hypotheses are developed, and then a research strategy is designed to test these hypotheses. By contrast, for the inductive approach, the data is collected and analysed, and then theories are established as a result of the data analysis. In other words, the deductive approach is used to test theories, while the use of induction approach aims to build theories (Saunders et al., 2009).

Furthermore, Saunders et al. (2009) mentioned that each approach has its advantages, thus choosing the suitable approach for a study relies mainly on the emphasis of the research and the nature of the research topic. A topic has a large number of existing literatures that

contributes to outline a theoretical framework and hypotheses will be most appropriate for conducting the deduction approach, whereas, a new topic that has a little existing and even unclear literatures is suitable for applying the inductive approach.

For this study, the researcher starts developing hypotheses based on existing theories, and then the data of population ageing, economic growth and private savings will be collected and then analysed to confirm or reject these hypotheses. This means that the deductive approach is carried out in this research.

4.2. Research methodologies

After choosing the deductive approach for this study, a research methodology, which is considered as a general orientation of investigation, is designed to conduct the research as well as obtain the answers of research questions or problems (Bryman and Bell, 2007). There are two types of research methodology, including the quantitative research and the qualitative research. The next part will compare and contrast qualitative and quantitative research methodologies before selecting the most suitable research strategy for this study.

4.2.1. The quantitative research and the qualitative research

Quantitative research is considered as a research strategy emphasizing quantification in the collection and the analysis of the data. The quantitative research requires a deductive approach to investigate the linkage between the theory and the research, in which we put attention on the testing of theories. Indeed, the hypotheses in the quantitative research are deduced from the theories and tested to confirm or reject these hypotheses. On the other hand, the qualitative research is a research strategy concentrating on words rather than quantification in the process of collecting and analysing the data. This strategy gives a priority for the application of an inductive approach in explaining the relationship between the theory and the research, in which a big concern is for creating the theories (Byman and Bell, 2007).

The quantitative research is applied to draw a typical sample from the population of interest and build a generalized behaviour of the sample, while the use of qualitative research aims to achieve effective explanations by identifying which events cause which consequences (Hyde, 2000).

Hussey and Hussey (1997) also stated that the qualitative research is more subjective in nature than the quantitative research because the qualitative research concentrates on

"examining and reflecting on perceptions to gain an understanding of social and human activities", while the quantitative research focuses on measuring the phenomena through collecting and analysing the numerical data, and then employing the statistical tests.

4.2.2. Selecting a research strategy

From the above evaluation of the qualitative and quantitative research strategies, it is appropriate to carry out the quantitative research in this study. The most important reason for conducting this strategy is that the deductive approach favours the use of quantitative research (Amaratunga et al., 2002). Moreover, the quantitative research brings the convenience for the researcher when conducting a study because it is the traditional model of research consisting of trustful procedures and rules for conducting the research. In addition, the quantitative research is well worked out with the numerical data and statistical tests because this kind of research can provide the abilities to verify the data and select the most suitable elements to facilitate analysis that make the researcher feel safer when conducting the research (Creswell, 2003).

4.3. Data collection and model specification

4.3.1. Data collection

The data for this study is the annual time series data over the period 1985 to 2016, which is collected from the annual "Statistical Yearbook of Vietnam".

In this thesis, private savings is known as the personal savings or the individual savings. Private savings is calculated through the national accounts identities, which is the difference between total savings and public savings as a percentage of GDP. All the values of national accounts are collected from the annual "Statistical Yearbook of Vietnam".

Other explanatory variables, including the youth dependency ratio and the elderly dependency ratio, life expectancy, social insurance funds, which are the consequences of and affect the population ageing of a country, and GDP growth rate, GDP per capita, and inflation rate, which are considered as the underlying factors of the economic growth of a country, are also taken from the annual "Statistical Yearbook of Vietnam".

More specifically, the youth dependency ratio is the proportion of young age dependents (the minors aged less than 15 years old) to the working age population (people aged 15 - 60). The old age dependency ratio is the proportion of the elderly (those older than 60 years old) to the working age population (people aged 15 - 60). Both the young age and old

age dependency ratios show the characteristics of population ageing in Vietnam and are collected from the annual "Statistical Yearbook of Vietnam" and the Population Projections report for Vietnam.

According to the World Health Organization (2006), life expectancy refers to the average number of years that a new born is expected to live in the condition of the current mortality rates remain constant in the future, which is collected from the annual "Statistical Yearbook of Vietnam" and the World Development Indicators (WDI), World Bank.

Social insurance funds equal social insurance revenues minus its expenses, in which pension funds is the main part of social insurance funds. This funds is collected from the annual "Statistical Yearbook of Vietnam" and the Vietnam Social Security (VSS) reports, then is transferred as a percentage of GDP.

The economic growth, which is expressed by GDP growth rate, measures how fast the economy of a nation is growing. It is a measure of the rate of change that a country's Gross Domestic Product experiences from one year to another. The values of annual real GDP, which are used to calculate GDP growth rate, are collected from the annual "Statistical Yearbook of Vietnam".

Landefeld, Seskin and Fraumeni (2008) stated that the income is represented by GDP per capita, which is a measurement of Gross Domestic Product (GDP) of a nation divides the population and adjusts for the inflation. Besides, Landefeld, Seskin and Fraumeni (2008) also indicated that the production of nation's output will generate the income (salary, rent and others) for the citizens who own these production factors, thus Gross Domestic Product (GDP) will equal to the earned income of the citizens through production factors in a country. In this case, Gross Domestic Product (GDP) is considered as the national income that allows the researcher to compare the standard of living across countries and over time. Hence, the research will use Gross Domestic Product per capita (GDP per capita) to represent the income per capita and this indicator is collect from the annual "Statistical Yearbook of Vietnam".

The Organisation for Economic Cooperation and Development (OECD, 2018) indicates that the inflation refers to rising consumer prices and the cost of living that affect the individual's standards of living. The inflation is measured in index by consumer price index (CPI), which is a measure of price changes in consumer goods and services over a

certain time period or is measured in terms of the annual percentage change in prices of consumer goods and services.

4.3.2. Model specification

The causal research is the most suitable research type and will be conducted in the research because this type of research can identify the existence of a cause and effect linkage between the dependent variable (private savings) and the explanatory variables as well as measure the degree of the effect of a change in an explanatory variable towards a change in dependent variable (DJS Research Ltd., 2005). Furthermore, the causal research is consistent with and worked under the chosen quantitative research, in which the data of variables is in numerical form and then is used to determine a mathematical model, while the theories or hypotheses of the study expressing the phenomena or trend (Sibanda, 2009).

Based on Life Cycle Hypothesis, other related theories, and Feldstein (1977) who introduced social security (represented by pension funds) into life cycle savings hypothesis and stated that pensions affect private savings, the function of private savings in relation to population ageing can be described as follows:

$$PSR_t = f\,(YDR_t, ODR_t, LFE_t, SIF_t)$$

This above function expresses the impact of the explanatory variables representing for population ageing, including the young age dependency ratio *(YDR)*, the old age dependency ratio *(ODR)*, life expectancy *(LFE)* and social insurance funds rate *(SIF)* on the dependent variable (private savings rate *(PSR)*) that also can be rewritten as follows:

$$PSR_t = \alpha_0 + \alpha_1 * YDR_t + \alpha_2 * ODR_t + \alpha_3 * LFE_t + \alpha_4 * SIF_t + \mu_t$$

Where: *t* represents time series.

α represents the coefficient of the explanatory variables

PSR_t represents private savings rate as a percentage of GDP

YDR_t and ODR_t refer to the young age dependency ratio and the old age dependency ratio

LFE_t represents the life expectancy

SIF_t represents social insurance funds rate as a percentage of GDP

μ_t is the disturbance or error term, which represents the effects of other variables that are not mention on the variation of the dependent variable in the model.

Regarding to the relationship between economic growth and private savings, the private savings function can be rewritten as follows:

$$\boldsymbol{PS_t = f\ (GDPgr_t,\ GDPper_t,\ IFR_t)}$$

In this above function, PS_t represents private savings, $GDPgr_t$ represents GDP growth rate, $GDPper_t$ represents GDP per capita, and IFR_t represents inflation rate.

According to Greene (2012), in the econometric model, both the dependent variable and independent variables can use the natural logarithms of the real time series data to not only linearize the trend of data, but also eliminate the heteroscedasticity of the time series, while this transform do not change the cointegration of the original series. Moreover, the logarithm helps find the root cause for an effect, in other words, figure out how fast this indicator is growing (James, Lothar and Saleem, 2015).

From that, some variables in Model 2 are transformed into logarithms. Specifically, the author takes the logarithms of two variables (real private savings and real GDP per capita) because these two variables are expressed in current Vietnamese Dong (VND), while GDP growth rate (GDPgr) and inflation rate (IFR) are shown in term of the percentage.

Based on this above analysis, an economic model will be developed to examine the linkage between private savings and the explanatory variables representing for the economic growth:

$$\boldsymbol{LogRPS_t = \beta_0 + \beta_1 * GDPgr_t + \beta_2 * LogRGDPper_t + \beta_3 * IFR_t + \gamma_t}$$

Where: t represents time series.

β represents the coefficient of the explanatory variables

$LogPS_t$ represents Log real private savings.

$GDPgr_t$ represents GDP growth rate.

$LogRGDPper_t$ represents Log real GDP per capita

IFR_t represents the inflation rate.

γ_t is the disturbance or error term, which represents the effects of other variables that are not mention on the variation of the dependent variable in the model.

4.4. Research techniques

Under the quantitative research, the statistical method is an appropriate method that will be applied to analyse the numerical data of this research (Quinlan, 2011). Besides, Nwakeze

(2014) stated that the demographic and macroeconomic time series data sets are usually non-stationary and using these data sets in the regression analysis may produce doubtful results, thus there is a need to undertake well developed econometric techniques for handling non-stationary time series data. More importantly, in order to investigate the short run and long run relationships between population ageing, economic growth and private savings in Vietnam in the period 1985 - 2016, the time series econometric techniques analyzing the time series data will be employed. Specifically, the study, firstly, uses the unit root tests to determine the stationary of the variable or the order of integration in a time series, selects the optimal lag length through the VAR model, and then applies the Johansen cointegration test to determine the existence of the cointegrating (long run) vectors as well as estimates the cointegration equation through a Vector Error Correction Model (VECM) to detect the short run dynamics and the long run equilibrium relationship between the variables involved in, and answer whether the short run dynamics are affected by the estimated long run relationship. And in case of existing the short run relationship, the Granger Causality tests include the Pair-wise Granger Causality test and the VEC Granger Causality/Block Exogeneity Wald test are employed to further examine the direction of causality between the variables that are taken into consideration in this study. Indeed, the impulse response and variance decomposition tests are performed to analyze the response of private savings to a shock in each explanatory variable and determine the important variables that will have a significant effect on private savings in Vietnam in the future. Finally, other important diagnostic tests: Jarque-Bera test, White and ACRH tests and the VEC residual LM test and CUSUM test will be added to check for the reliability of the residuals of the dynamic VECM.

4.4.1. Unit root tests for stationarity

According to Brooks (2002) and Sjo (2008), the unit root tests are employed to determine the order of integration for time series. In accordance with the Johansen procedure, conducting the unit root tests aims to identify that whether the variables are integrated of order 1 (which is presented by $I(1)$) or not. In addition, Sjo (2008) confirmed that performing the unit root tests is important and needed to create the Johansen cointegration approach valid because the time series containing unit roots may produce either a long run linkage (cointegration) or exhibit a spurious linkage depending on the data is stationary or non-stationary respectively. Moreover, although linear combinations of the variables, in

general, contain unit roots, there still exist some stationary linear combinations, in which the variables combined are said to be cointegrated.

Besides, according to Gujarati (2010), majority of time series analysis used the secondary data that has constant mean ($E(x_t)$) and variance ($V(x_t)$) over time t, meaning that the data is needed for time series analysis usually has unit root or is stationary. However, if the time series variables are stationary, applying the regression analysis of this time series data will mainly cause the appearance or generation of spurious regression problem or has a high value of R-squared, proposing no significant relationship between the variables. This also leads to the ambiguous and invalid findings and conclusions. Hence, in order to detect the stationarity of a time series, solve the stationary problems as well as establish the order of integration in a time series, the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test, which are considered as the most common approaches verifying the property of the data and ensuring the trustworthy and reliability of the regression model, will be carried out (Ahmad, 2015).

The Dickey-Fuller (DF) test was the first unit root test introduced by Dickey and Fuller in 1979 with the purpose of detecting the presence of a unit root in a time series data. There were three types of this Dickey-Fuller (DF) test, as follows:

(i) Test for a unit root

$$\Delta y_t = \varphi * y_{t-1} + \sum_{i=1}^{p-1} \varphi_i y_{t-1} + u_t$$

(ii) Test for a unit root with a constant

$$\Delta y_t = \beta_0 + \varphi * y_{t-1} + \sum_{i=1}^{p-1} \varphi_i y_{t-1} + u_t$$

(iii) Test for a unit root with a constant and deterministic time trend

$$\Delta y_t = \beta_0 + \beta_1 t + \varphi * y_{t-1} + \sum_{i=1}^{p-1} \varphi_i y_{t-1} + u_t$$

Where: y_t represents the value of a variable in the research at time period t.

$\Delta y_t = y_t - y_{t-1}$ is the difference in the value of a variable at time t and time t-1.

β_0 is a constant term.

t represents time trend.

u_t is an error term.

For the purpose of this study, y_t represents the values of PSR, YDR, ODR, LFE and SIF in Model 1 showing the relationship between population ageing and private savings rate (PSR), and the values of LogRPS, GDPgr, LogGDPper, and IFR in Model 2 demonstrating the linkage between economic growth and private savings in the context of Vietnam.

Before conducting the Dickey-Fuller (DF) test, Dickey and Fuller (1976, 1979) indicated that it is necessary to identify the best among three types of the Dickey-Fuller (DF) test. For this issue, Verbeek (2004) suggested the graphical inspection solution, which was considered as a simple way to explore the best type. If we saw a clear upward or downward trend in the plot of a series, the test with time trend would be the most suitable test to run.

The null hypothesis and the alternative hypothesis of all three equations (i) - (iii) is that:

H_0: $\varphi^* = 0$ means that the time series data contains a unit root

H_1: $\varphi^* < 0$ means that the time series data is stationary

To answer the data contains a unit root or not, firstly, the T test statistic $\tau = \frac{\varphi^*}{\sqrt{\text{var}(\varphi^*)}}$ is calculated and then compared to the corresponding critical value at different significance levels. If the value of T test statistic is negatively less than the critical value (or in absolute value, the test statistic value is higher than the critical value), the null hypothesis is rejected, meaning that there is no presence of a unit root for a series y_t with constant, trend or none. Moreover, a stationary process is called an $I(0)$ process, while the unit root process is called an $I(1)$ process.

The Augmented Dickey Fuller (ADF) unit root test is an extension of the Dickey-Fuller (DF) test, which also examines the same hypothesis of the Dickey-Fuller (DF) test. If the null hypothesis of the Augmented Dickey Fuller (ADF) unit root test is rejected, it can be concluded that there exists a stationary time series.

Similar to the Dickey-Fuller (DF) test and the Augmented Dickey Fuller (ADF) test, the Phillips-Perron (PP) unit root test is also employed in testing for unit roots. The null hypothesis of the Phillips-Perron (PP) unit root test [H_0: $y_t \sim I(1)$] demonstrates a non-stationary series, while the alternative hypothesis [H_1: $y_t \sim I(0)$] represents a stationary time series. If the test statistic value, in absolute value, is higher than the critical value, the null hypothesis of the Phillips-Perron (PP) unit root test is rejected, so there is no presence of a unit root for a series. However, the difference between the Phillips-Perron (PP) unit root

test and the Dickey-Fuller (DF) and the Augmented Dickey Fuller (ADF) unit root tests is that the Phillips-Perron (PP) unit root test can automatically modify the test statistic to correct for autocorrelation that may occur in the residuals (Brooks, 2002).

Another popular test can be applied to test for the stationary of the variable is the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test uses the null hypothesis [H_0: $y_t \sim I(0)$] to check for the stationary of a time series, while uses the alternative hypothesis [H_1: $y_t \sim I(1)$] to test for the existence of a unit root in the data series. If the one-sided LM statistic value, which is calculated from the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, is greater than the KPSS critical value for significance levels (α) of 1%, 5%, and 10% corresponding to the test contains a constant term and/or a linear trend term, the null hypothesis of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is rejected. This means that the time series is non-stationary. However, the KPSS test is only valid in a large sample (Tripathy, 2011).

4.4.2. The Vector Autoregressive (VAR) model

The vector autoregressive (VAR) model of Sims (1980) was known as the multivariate model, was used in case of unknown which variables are endogenous or exogenous to analyze the multivariate time series as well as capture the dynamic behavior of economic and financial time series. For a vector autoregressive (VAR) model, there is no immediate feedback among the variables and this model is not simultaneous. This is only a system of equations, in which the current values of each variable is explained by its previous values and previous values of the other variables.

The bivariate model is the simplest vector autoregressive (VAR) model including two variables (y_{1t}, y_{2t}), and its values rely on the previous values (y_{1t-1}, y_{2t-1}) and the error terms. This model is represented in the following:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix} + \begin{pmatrix} \beta_{11}\alpha_{11} \\ \alpha_{21}\beta_{21} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix}$$

In this model above, u_{1t} denotes a white noise term with E(u_{1t}) = 0 and E(u_{1t}, u_{2t}) = 0. Moreover, this above vector autoregressive (VAR) model can be extended to contain j variables $y_{1t}, y_{2t} \ldots y_{jt}$, and each current value relies on the previous values of j variables and the error terms.

When running the vector autoregressive (VAR) model, it is necessary to determine the optimal lag length of vector autoregressive (VAR) model. If the optimal lag length is not determined, the estimates in the model will be able to wrong. Specifically, selecting a higher order lag length than the true lag length may rise the mean-square forecasting errors of the vector autoregressive (VAR), whereas, selecting a lower order lag length than the true lag length generates autocorrelated errors (Braun and Mittnik, 1993).

From that, Brooks (2002) proposed two common approaches, including the likelihood ratio test and the information criteria (Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBIC)), in which the information criteria approach was more powerful than the likelihood ratio test, to determine the optimal lag length. The optimal lag length was determined based on the maximum value of the likelihood ratio or the minimum value of information criteria (Brooks, 2002). Nevertheless, in case of having contradictive results of AIC and SBIC, the choice of the optimal lag length was based on SBIC criteria because this criterion penalized more and usually would provide the correct model with few lags as compared to the model with many lags that AIC would offer (Gutierrez *et al*., 2007).

On the other hand, if these criteria AIC and SBIC give conflicting results regarding the lag length, the Lagrange Multiplier (LM) residual serial correlation test was an alternative method that would be employed to check for serial correlation at each lag length as well as to select the optimal lag length where the serial correlation is rejected in the LM test. Specifically, the optimal lag length was determined by choosing the smallest VAR lag interval and raising it to a length where the serial correlation is removed (Boswijk and Franses, 1992).

After choosing the optimal lag length for unrestricted VAR model, it is worth noting that the lag length, which is used in the cointegration test and a Vector Error Correction Model (VECM), is one less than the VAR system lag or calculated by the selected optimal lag length in the VAR system minus one because the unrestricted VAR model is run for non-stationary series (or the series in level form) and the cointegration model and Vector Error Correction Model (VECM) are run for the stationary series (the series in first differences) (Gutierrez *et al*., 2007).

4.4.3. The cointegration test

As above mentioned, the regression of the non-stationary variable X on the non-stationary variable Y may cause the spurious regression model with the misleading and invalid estimation results. Additionaly, as Brooks (2002) stated, using non-stationary time series

may violate the given assumptions for asymptotic analysis; clearly, the *t*-ratios and *F*-statistic will not follow a *t*-distribution and *F*-distribution respectively. Nonetheless, if the time series variables are themselves non-stationary in level form, but the linear combination of these variables are stationary, meaning that the series are said to be cointegrated in the model. In this case, it is appropriate to apply the cointegration test, because it is a useful econometric technique can be done to test the correlation between non-stationary time series variables. In practice, many economic series, which are non-stationary (or contain unit roots), may move away from equilibrium for a while, but there still exists forces on the series that make these series converge upon the long run values (Brooks, 2002). Testing of cointegration can be performed by the two-step Engle-Granger residual-based test (1987) and the Johansen and Juselius (1990) estimation technique.

Besides, Brooks (2002) also mentioned three necessary stages before performing the cointegration test. Firstly, unit root tests, more specific, the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests, and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test in case of a large sample, which are presented above, are performed to check for the stationary of each variable and determine the order of integration for the time series. According to Granger and Newbold (1974), the econometric model often uses time series data, thus testing for the stationary of the series is an important step because using the non-stationary variables in a linear regression may cause the spurious regressions problems, for instance, a very high value of R-square and t-statistics, leading to meaningless results. Furthermore, testing for the stationary of the series is necessary for removing the likelihood of spurious regressions and avoiding the violation of the assumptions that are made for asymptotic analysis, for instance, the *t*-ratios and *F*-statistic does not follow a *t*-distribution and *F*-distribution respectively (Brooks, 2002). In addition, Greene (2012) affirmed that the prerequisite for applying the cointegration procedure that is the variables are integrated of the same order or the variables are non-stationary in their level form, but can be transformed into a stationary series by differencing d times, meaning that the variables are to be integrated of order d.

The second step is to estimate an unrestricted vector autoregressive (UVAR) model. In this step, the Trace test and Maximum eigenvalue test are conducted to determine whether the variables are cointegrated or not as well as identify the number of cointegrating vectors existing in the model. If there is no cointegrating vector in the model, meaning that the

variables are not cointegrated and there is no long run relationship. If there is one cointegrating vector in the model, Engle-Granger test is used to measure the cause and effect short term relationship between the considered variables. By contrast, if there found more than one cointegrating vectors, indicating that there may exists both the short run dynamics and the long run equilibrium relationship between the considered variables. In this case, the Vector Error Correction Model (VECM) is then employed to explore the short run dynamics and answer whether the short run dynamics are affected by the estimated long run equilibrium relationship.

Then, the Granger Causality test and the VEC Granger Causality/Block Exogeneity Wald test will be performed in the third step aiming to explore the causal relationship between the considered variables. Besides, if the Vector Error Correction Model (VECM) found that the residual series is white noise, the impulse response functions and variance decompositions will be analyzed in this step.

Furthermore, other important diagnostic tests: Jarque-Bera test for the normality, White and ACRH tests for heteroscedasticity and the VEC residual LM test for the serial correlation and CUSUM test for the stability will be added to check for the reliability of the residuals of the dynamic VECM and determine whether the residuals can be used for achieving the best linear unbiased estimators of the OLS regression model for the research.

4.4.3.1. The two-step Engle and Granger residual-based test

The two-step Engle and Granger residual-based test of Engle and Granger (1987) is used to test for (a single) cointegration, which is presented by the simple regression equation:

$$y_t = \beta_0 x_t + u_t$$

Assume that all variables x and y are non-stationary (or I(1)). The regression equation is estimated by using OLS method, and the residuals ($\hat{u}_t$) obtained from the regression is then tested by the ADF unit root test.

$$\Delta u_t = \varphi^* u_{t-1} + \sum_{i=1}^{p-1} \varphi_i u_{t-1} + v_t$$

It should be note that in case of including the deterministic component, for instance, a constant or a time trend in the OLS regression equation, the ADF test will be conducted without including this deterministic component. The null hypothesis of unit root equation: $H_0 : \hat{u}_t \approx I(1)$, meaning that the potentially cointegrating regression residuals contains a

unit root, whereas, the alternative hypothesis: $H_1 : \hat{u}_t \approx I(0)$, meaning that the residuals are stationary. Therefore, if the null hypothesis is rejected, implying that the stationary linear combination of the non-stationary variables exists in the model, in other words, the non-stationary variables are cointegrated.

Nevertheless, there are some limitations regarding to the Engle and Granger residual-based test. Brooks (2002) and Enders (2010) affirmed that the significant drawback of the Engle and Granger test was that this method could only estimate one cointegrating relationship between two variables. Specially, Enders (2010) found that the Engle and Granger approach requires placing the dependent variable on the left-hand side and the independent variables on the right-hand side of the equation to find the regression, which indicates the cointegration of the variables. On the contrary, when interchanging the variables of the equation, it is possible to find the regression that is not cointegrated or there is no cointegration in this case. This opposite result of the Engle and Granger test revealed that the test for cointegration might be different depending on the order of variables, thus making the Engle and Granger method unreliable at different times. Furthermore, the Engle and Granger residual-based test consists of two steps, in which the first step generates the residual series and then the second step uses these errors in the first step to estimate a regression, which thus, might cause unreliable estimation results due to carrying the errors in the first step into the estimation in the second step (Enders, 2010).

4.4.3.2. The Johansen test based on VARs

Unlike the Engle and Granger (1987) residual-based cointegration test, the Johansen vector autoregression (VAR) approach, which was introduced by Johansen in 1988 and developed by Johansen and Juselius (1990), is more generally applicable because this procedure allows to detect and deal with more than one cointegrating vectors. In other words, the Johansen methods allows the testing for cointegration of two or more time series, each of the series is integrated to order one *I*(1). Indeed, the Johansen cointegration approach will enable to investigate the restricted versions of the long run cointegrating vector(s) and the short run speed-of-adjustment parameters (Enders, 2010). Nevertheless, there exist some drawbacks in this cointegration approach. Enders (2010) mentioned the first limitation of this approach is that it may take some times to interpret the results because all variables in the vector autoregression (VAR) system are treated symmetrically, which is in contrast to the standard univariate models that have a clear explanation regarding exogenous and

endogenous variables. Moreover, according to Canova (2007), the prediction accuracy of a fitted model depends mainly on the degrees of freedom. For which, the multidimensional vector autoregression (VAR) model requires a large number of degrees of freedom to produce accuracy estimates. Nonetheless, the Johansen vector autoregression (VAR) model only uses a limited number of degrees of freedom, thus will cause the imprecise estimates containing large standard errors.

In spite of the drawbacks of the Johansen vector autoregression (VAR) procedure, Afzal (2007) also recommends applying this method for the current researches due to its superior small sample properties and because it is currently the most reliable test for cointegration of several time series variables.

Assume that n time series variables ($n \geq 2$) are non-stationary and integrated of order one $I(1)$, meaning that these variables are cointegrated, a vector autoregressive (VAR) model with k lags can be formed as follows:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_k Y_{t-k} + u_t$$

Where: Y_t represents an $N \times 1$ column vector of dependent variables I(1) and u_t represents an $N \times 1$ column vector of innovations.

In order to apply the vector autoregressive model (VAR), all the variables in the system should be stationary. Thus, the most important step before utilizing the Johansen cointegration test is that the vector autoregressive model (VAR) above is transformed into a Vector Error Correction Model (VECM) because the VECM allows dealing with the stationarity of data. The Vector Error Correction Model (VECM) containing first difference terms and the cointegration relationships can be expressed as follows:

$$\Delta Y_t = \prod Y_{t-k} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots\ldots + \Gamma_{k-1} \Delta Y_{t-k-1} + \varepsilon_t$$

Where $\prod = \left(\sum_{i=1}^{k} \beta_i \right) - I_n$ and $\Gamma_i = \left(\sum_{i=1}^{j} \beta_i \right) - I_n$

In this Vector Error Correction Model (VECM), Δ represents difference operator, t represents the time trend (from 1985 to 2016), k is the lagged period. Y_t represent all the variables in the research which shown as a column vector. $\prod$ is the error correction term (ECT) presents the long run linkage between the variables in Y_t process. Γ_i denotes coefficient matrices.

The rank of ECT or $\prod$ is used to confirm or reject the null hypothesis that the series (the variables) are cointegrated or the existence of cointegration in the vector (those variables). The rank of ECT or $\prod$ equals zero, meaning that there is no cointegration among the variables in the research. Meanwhile, the rank of $\prod$ is equal to the number of variables (k), meaning that Y_t is a stationary process. Indeed, the rank of $\prod$ is between zero and the number of variables ($0 < \prod < k$), indicating that $\prod$ cointegrating vectors exists among these considered variables used in the research.

From that, Johansen and Juselius (1990) propose two likelihood ratio test statistics, including the Trace test and the Maximum Eigenvalue statistic to determine the number of cointegrating vectors.

4.4.3.2.1. Trace test

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_r)$$

In this above formula, T denotes the sample size, r is the number of cointegrating vectors under the null hypothesis, k is the number of variables, λ are the eigenvalues obtained from $\prod$ matrix.

The null hypothesis of at most r cointegrating vectors against the alternative hypothesis of more than r cointegrating vectors is tested by the Trace Statistics. More specifically, the Trace Statistics tests the null hypothesis under this testing sequence, $r = 0, 1, 2, \ldots$ k-1, in which the null hypothesis for λ_{trace} will be presented as follows:

H_0: r = 0	H_1: 0 < r < 1
H_0: r = 1	H_1: 0 < r < 2
……	……
H_0: r = k-1	H_1: r = k

4.4.3.2.2. Maximum Eigenvalue statistic

$$\lambda_{\max(r,r+1)} = -T \ln(1 - \lambda_{r+1})$$

The null hypothesis of r cointegrating vectors against the alternative hypothesis of r+1 cointegrating vectors is tested by the Maximum Eigenvalue statistic. This test is more powerful than the Trace test and contains the alternative hypotheses (H_1) are dissimilar to the alternative hypotheses of the Trace test. Also, the null hypothesis for the Maximum

Eigenvalue test is under the testing sequence that similar with the Trace test which are r = 0, 1, 2 … k-1, thus the hypothesis for the Maximum Eigenvalue test will be as in the following:

H_0: $r = 0$	H_1: $r = 1$
H_0: $r = 0$	H_1: $r = 2$
……	…….
H_0: $r = k - 1$	H_1: $r = k$

The value of r continues to increase until the null hypothesis is not rejected at the first time ($r = k$), we can stop testing.

In general, the cointegration test through the Trace test and Maximum Eigenvalue statistics are employed to determine the number of cointegrating vectors in the research. Through the Eviews econometric software, we get the Trace value and the Maximum Eigenvalue, which then are compared with its t-statistics values to decide whether the variables are cointegrated or not. If the Trace value and Maximum Eigenvalue are greater than its corresponding t-statistics values, the null hypothesis of cointegration ($r = 0$) is rejected, implying that there is a long run cointegration between the variables in the vector and so on.

Nonetheless, it is worth noting that when applying the Johansen cointegration test, the research faces with a problem of how to determine the deterministic components in levels of data or the cointegration equation, for instance, a constant or a time trend. Selecting the deterministic components of the model is one of the most important steps because the empirical specification of the deterministic elements may negatively affect the reliability of cointegration test and each possible combination of the deterministic variables may lead to a different result of the test statistics. As a result, Johansen (1992) suggested one way of plotting the data for getting some intuitive ideas. However, sometimes, the graph of the data provided unclear information that was difficult for the researcher to select the deterministic components. In this case, Johansen (1992) proposed the other method - the Pantula principle to decide the appropriate deterministic factors of the specific model.

In fact, there are five models, including the model 1 with no deterministic trend in data and no intercept or trend in cointegration equation, the model 2 with no linear trend in data but an intercept (no trend) in cointegration equation, the model 3 with a linear trend in data and intercept (no trend) in cointegration equation, the model 4 with a linear trend in data and

intercept and trend in cointegration equation, and the model 5 with a quadratic deterministic trend in data and intercept and trend in cointegration equation. In practice, we rarely use the model 1 and the model 5, in meanwhile, only focus on the model 2, the model 3 and the model 4. In addition, the model 2 seems to be most restrictive, while the model 4 seems to be the least restrictive.

The Pantula principle displays the estimations of three models (the models 2, 3 and 4) and the results of the number of cointegrating vectors for each model in relation with the most restrictive hypothesis (the number of cointegrating vectors r = 0 and the model 2) and the least restrictive hypothesis (r = the number of variables putting in the vector autoregressive (VAR) model minus 1 = n - 1 and the model 4). The Pantula principle, firstly, is conducted with the most restrictive model or model 2 with no deterministic factors by comparing the rank statistic with its corresponding critical value. If the rank statistic is greater than its corresponding critical value, the model is rejected. Then, we keep going on the model 3 with a restricted intercept in the cointegration equation. If this model is still rejected, we continue to the model 4 with an unrestricted constant and linear trend. If the model is still rejected, the testing is performed again with the next rank. It is worth noting that whenever the null hypothesis is not rejected at the first time, we can stop testing the model (Irandoust and Ericsson, 2004).

Furthermore, once the cointegrating vectors is determined or a long run relationship between the considered variables exists in the model, the following steps in the Johansen technique are, firstly, to identify the normalised cointegrating vector(s) by considering one of the variables in the model as a dependent variable, thus its coefficient will equal unity, and then measure the speed-of-adjustment coefficient (∏). If the speed-of-adjustment parameter is equal to zero, indicating that the variable in question is weakly exogenous and does not respond to a discrepancy from the long run equilibrium relationship. On the other hand, if the speed-of-adjustment parameter is different from zero, thus this variable responds to a discrepancy from the long run equilibrium relationship (Enders, 2010).

In general, the Trace test and Maximum Eigenvalue statistic are carried out to determine the number of cointegrating vectors existing in the model. Two cases may be occurred. If there is no cointegation (no long run linkage), the vector autoregressive (VAR) model is estimated (which was presented in section 4.4.2). By contrast, if there contains one or more cointegrating vectors, the Vector Error Correction Model (VECM) is performed below to identify the long run equilibrium relationship and short run dynamics between the

considered variables. In other words, the cointegrating vector is an indication indicating the existence of a long run linkage between these variables. A cointegrating relationship shows a long term trend, meaning that it is possible for the cointegrating variables deviate from its relationship in the short run, but this also forces to return to its equilibrium position in the long run. If the system returns to the long run equilibrium, the movements of the variables must respond to the magnitude of the disequilibrium (Enders, 2010).

4.4.4 Vector Error Correction Model (VECM)

The long run relationship between the non-stationary variables in level form is determined by conducting the cointegration regression in the research, while the dynamic adjustments between the first differences of the variables are measured by employing the Error Correction Model (ECM). Furthermore, the Error Correction Model (ECM) is performed aiming to correct for the deviation from the long run trend (Brooks, 2002).

A simple error correction term is that $\varepsilon_t = y_t - \beta x_t$, in which β is the cointegrating coefficient, ε_t is the error term from the regression of y_t on x_t. Thus, the Error Correction Model (ECM) can be defined as follows:

$$\Delta y_t = \alpha \varepsilon_{t-1} + \gamma \Delta x_t + u_t$$

Where u_t is independently and identically distributed (i.i.d.). Δy_t, Δx_t is the first difference of y_t and x_t, respectively. ε_{t-1} is one period lagged value of the residuals from the estimation of equilibrium error term or the disequilibrium error term happened in the previous period representing the speed of adjustment toward the long run values.

The simple Error Correction Model (ECM) above can be applied in the multivariate system. In this research, all variables in Model 1 in terms of the impact of population ageing on private savings, including private savings rate (PSR), the young age dependency ratio (YDR), the old age dependency ratio (ODR), life expectancy (LFE) and social insurance funds rate (SIF) and in Model 2 regarding to the relationship between private savings (LogRPS) and economic growth, which is represented by GDP growth rate (GDPgr), GDP per capita (LogRGDPper), and inflation rate (INF), which are considered as endogenous variables, while the constant term is considered as exogenous variable.

In the first model of the impact of population ageing on private savings rate, the Error Correction Model (ECM) can be developed in the following equations:

$\Delta PSR_t = \alpha_0 + \alpha_1 \Delta PSR_{t-1} + \alpha_2 \Delta YDR_{t-1} + \alpha_3 \Delta ODR_{t-1} + \alpha_4 \Delta LFE_{t-1} + \alpha_5 \Delta SIF_{t-1} + \alpha_6 ECT_{t-1} + u_{1t}$

$\Delta YDR_t = \beta_0 + \beta_1 \Delta PSR_{t-1} + \beta_2 \Delta YDR_{t-1} + \beta_3 \Delta ODR_{t-1} + \beta_4 \Delta LFE_{t-1} + \beta_5 \Delta SIF_{t-1} + \beta_6 ECT_{t-1} + u_{2t}$

$\Delta ODR_t = \gamma_0 + \gamma_1 \Delta PSR_{t-1} + \gamma_2 \Delta YDR_{t-1} + \gamma_3 \Delta ODR_{t-1} + \gamma_4 \Delta LFE_{t-1} + \gamma_5 \Delta SIF_{t-1} + \gamma_6 ECT_{t-1} + u_{3t}$

$\Delta LFE_t = \phi_0 + \phi_1 \Delta PSR_{t-1} + \phi_2 \Delta YDR_{t-1} + \phi_3 \Delta ODR_{t-1} + \phi_4 \Delta LFE_{t-1} + \phi_5 \Delta SIF_{t-1} + \phi_6 ECT_{t-1} + u_{4t}$

$\Delta SIF_t = \sigma_0 + \sigma_1 \Delta PSR_{t-1} + \sigma_2 \Delta YDR_{t-1} + \sigma_3 \Delta ODR_{t-1} + \sigma_4 \Delta LFE_{t-1} + \sigma_5 \Delta SIF_{t-1} + \sigma_6 ECT_{t-1} + u_{5t}$

In the second model of the relationship between economic growth and private savings, the Error Correction Model (ECM) can be developed in the following equations:

$\Delta LogRPS_t = \partial_0 + \partial_1 \Delta LogRPS_{t-1} + \partial_2 \Delta GDPgr_{t-1} + \partial_3 \Delta LogRGDPper_{t-1} + \partial_4 \Delta IFR_{t-1} + \partial_5 ECT_{t-1} + u_{1t}$

$\Delta GDPgr_t = \varepsilon_0 + \varepsilon_1 \Delta LogRPS_{t-1} + \varepsilon_2 \Delta GDPgr_{t-1} + \varepsilon_3 \Delta LogRGDPper_{t-1} + \varepsilon_4 \Delta IFR_{t-1} + \varepsilon_5 ECT_{t-1} + u_{2t}$

$\Delta LogRGDPper_t = \varphi_0 + \varphi_1 \Delta LogRPS_{t-1} + \varphi_2 \Delta GDPgr_{t-1} + \varphi_3 \Delta LogRGDPper_{t-1} + \varphi_4 \Delta IFR_{t-1} + \varphi_5 ECT_{t-1} + u_{3t}$

$\Delta IFR_t = \tau_0 + \tau_1 \Delta LogRPS_{t-1} + \tau_2 \Delta GDPgr_{t-1} + \tau_3 \Delta LogRGDPper_{t-1} + \tau_4 \Delta IFR_{t-1} + \tau_5 ECT_{t-1} + u_{4t}$

Where ECT_{t-1} is the lagged error correction term or the error correction mechanism, which is derived from the long run cointegrating relations between these variables.

$$ECT^1_{t-1} = PSR_{(-1)} - \Omega_1 (YDR_{(-1)}) - \Omega_2 (ODR_{(-1)}) - \Omega_3 LFE_{(-1)} - \Omega_4 (SIF_{(-1)})$$

And $ECT^2_{t-1} = LogRPS_{(-1)} - \varpi_1 (GDPgr_{(-1)}) - \varpi_2 (LogRGDPper_{(-1)}) - \varpi_3 IFR_{(-1)}$

In the above ECT^1_{t-1} and ECT^2_{t-1} models, Ω and ϖ coefficients estimate the long run effects of any independent variables representing for population ageing and economic growth on private savings as this independent variable increases a unit or one percent. Besides, all coefficients in the overall Vector Error Correction Model (VECM) measure the short run impact of any independent variables on private savings as this variable increases a unit. The coefficient of the error correction term (ECT) in the VECM presents the speed of adjustment toward the long run equilibrium and a cointegration relationship exists as the expected sign of coefficient of the VECM is significantly different from zero. Indeed, the error correction term (ECT) in the VECM is reasonable if the coefficient of the error correction term (ECT) is in negative number and not lower than -2. In other words, the error correction term (ECT) is considered to be good if its absolute value range is between 0 and 1, but not more than 2 (Loayza and Ranciere, 2005).

These equations above set up a vector autoregression (VAR) model in first difference, which is also known as a VAR type of Error Correction Model (ECM). Therefore, a Vector Error Correction Model (VECM) is formed by combinining a vector autoregression (VAR) in its first difference form with a vector of cointegrating residuals.

To sum up, the Vector Error Correction Model (VECM) is developed to explore whether the short run dynamics are affected by the estimated long run equilibrium conditions. Furthermore, the Vector Error Correction Model (VECM) is considered as an alternative way to determine the strength of obtained long run relationship and check for the stability of the long run coefficients. Also, this VECM helps correct any disequilibrium in the short run by estimating the speed of adjustment at which the dependent variable will return to the equilibrium as a response to a change in the independent variables. Specifically, if the coefficient of the error correction term (ECT), which is known as the coefficient of speed of adjustment between short run dynamics and long run equilibrium relationship, is negative, meaning that there exists the adjustment mechanism in this model in the short run. By contrast, the positive coefficient of the error correction term (ECT) indicates that any disequilibrium in the variable continues to grow, but it also expresses incomplete specifications in the model (Banerjee et al., 2011).

4.4.5. The Granger Causality test and the Block Exogeneity Wald test

In fact, the regression estimation may include the dependence of one variable on other variables, but it is not means the causation. According to Granger (1969), the causality only occurrs when the available information of one variable is helpful and can be used to predict the other variable. Indeed, the causality relies on the available information at a given time, thus time series can provide the valuable inference and make strong statements concerning the causality between two variables.

Besides, while the causality can give the information of one variable resulting in another variable, the Granger causality can bring the information of whether the existence of a short run relationship between the current value of one variable and the past values of the other variables or not. In other words, the Granger causality test examines whether the lagged variables join in the equation for the another variable. More importantly, the Granger causality test is applied to determine the direction of causality between two variables (Enders, 2010), more specific, between private savings and each of the demographic and macroeconomic explanatory variables so as to answer private savings is

driven by the population ageing and economic growth variables (the young age dependency, the old age dependency, life expectancy, social insurance funds rate in Model 1 and GDP growth rate, GDP per capita, inflation rate in Model 2), or answer whether private savings leads to the change in each of these explanatory variables. Besides, Engle and Granger (1987) divided the results of the Granger causality test into three types: unidirectional or one-way causality, bidirectional or two-way causality and non-directional causality where one variable does not affect another variable, in which the direction of causal association can be either positive or negative.

On the other hand, as Brooks (2008) stated, in case of having many lags of the variables, it is difficult for these variables to determine which the set of lagged variables has a significant influence on each of the dependend variable, and which another does not. In order to solve this problem, the VEC Granger Causality/Block Exogeneity Wald test is carried out by restricting the lags of a variable to zero so as to identify whether to include an additional variable into a VAR. Additionally, Brooks (2008) suggested that the VEC Granger Causality/Block Exogeneity Wald test can be done by conducting joint tests on all the lags of a particular variable in an equation to investigate the significance of the variables in the VAR so as to determine which the lags of one variable Granger cause another variable in the model.

4.4.6. Impulse response function and variance decomposition

Impulse response and variance decomposition tests are considered as useful tools in determining Granger causality in macroeconomic activity. These analyses aim to examine "the behavior of an error shock to each variable on its own future trend and the future behavior of the other variables in the VECM system" (Enders, 2010).

With regards to an impulse response function, when putting a unit shock to the error of each variable in each equation, we can see the influences on the VAR system over time. The size and significance of the impact of an error shock on the time path of the VAR system are affected by the magnitude of the current and following shocks. Moreover, the system will achieve the stability if the shock gradually tapers off (Brooks, 2008). For the purpose of research, the research will analyze the magnitude and the persistence of the responses of private savings to shocks in its own and in the explanatory variables involved in the VECM.

Also, according to Brooks (2008), variance decompositions offer the information regarding the degrees or the proportions of the shocks of its own dependent variable and the

explanatory (independent) variables that contribute in explaining the percentage of the movements of the dependent variables. More specifically, variance decomposition analysis provide the information of the contributions of its own private savings and the remaining variables in the VECM model in explaining the movement of the dependent variable (more specific, private savings rate (PSR) in Model 1 and Log real private savings (LogRPS) in Model 2). This also means that due to the dynamic structure of the VAR, a shock to a specific variable will not only directly impact that variable, but also affect all the other variables in the VECM system. On the other hand, it should be note that the requirement of applying the variance decomposition is that all the variables are cointegrated and this analysis is helpful in measuring the rate of change in the dependent variable (PSR and LogRPS) in response to the movements in the demographic and macroeconomic explanatary variables in the models.

4.4.7. Diagnostic test for Ordinary Least Square (OLS) model

In order to have the best linear unbiased estimators, several diagnostic tests, including Jarque-Bera test, White Heteroscedasticity and Autoregressive Conditional Heteroskedasticity (ARCH) tests, serial correlation LM test need to be performed to test the presence of the normality, heteroscedasticity and serial correlation of the residuals in the Ordinary Least Square (OLS) regression model.

4.4.7.1. Jarque-Bera test

Jarque-Bera test is employed to test for the normality of the error term. The error of a regression model is normally distributed when the skewness of the error, which is known as a measure of the asymmetry of the distribution of the series around its mean, is equal to zero or very close to zero and the kurtosis of the error, which is a measure of the peakedness or the flatness of the distribution of the series, is equal to 3 or very close to 3 (Mukherjee, White and Wuyts, 1998).

The hypothesis for Jarque-Bera test is as follows:

H_0: There is normally distribution of errors in the regression model

H_1: There is not normally distribution of errors in the regression model

If the p-value of Jarque Bera test is less than the significance level (α), we can reject the null hypothesis of the test.

4.4.7.2. White and Autoregressive Conditional Heteroskedasticity (ARCH) tests

Heteroscedasticity means that variance or error terms does not present constantly between the observations in a regression model. The problem of heteroscedasticity is that it causes an inefficient regression model with no minimum variance and a t-test statistic bias. Hence, in order to detect this problem and achieve an unbiased and reliable OLS model, White Heteroscedasticity test is the most popular test that can be used with the purpose of identifying whether heteroscedasticity exists in the OLS regression model or not.

The null and alternative hypothesis for White Heteroscedasticity test is that:

H_0: There is no heteroscedasticity in the OLS regression model

H_1: There is heteroscedasticity in the OLS regression model

If the p-value (is seen in Prob. Chi-Square value) is lesser than the significance level (α) at the 0.01, 0.05 or 0.1 significance levels or the Obs*R-squared is greater than the critical value of the test, the hypothesis of White Heteroscedasticity test is rejected, meaning that there is heteroscedasticity in the model.

Similar to White Heteroscedasticity test, Autoregressive Conditional Heteroskedasticity (ARCH) test is also used to determine whether the heteroscedasticity exists in the regression model or not. ARCH test helps further solidify and strengthen the results was found in White Heteroscedasticity Test.

The null and alternative hypothesis for ARCH test is as follows:

H_0: There is no ARCH effect (no heteroscedasticity) in the model

H_1: There is ARCH effect (heteroscedasticity) in the model

If the p-value (Prob. Chi-Square value) of Obs*R-squared in the test is smaller than the level of significance (α) or the Obs*R-squared value of the test is greater than the test critical value, the null hypothesis of ARCH test is rejected.

4.4.7.3. Breusch-Godfrey LM test for serial correlation

In regards to the serial correlation problem, the Breusch-Godfrey LM test is conducted for testing the null hypothesis of no serial correlation. If the p-value (is seen in Prob. Chi-Square value) of this test at the lag order h is greater than the 0.01, 0.05 or 0.10 significance levels (α), the null hypothesis of the Breusch-Godfrey LM test is rejected at the lag order h, meaning that there is no serial correlation in the residuals of the model.

4.5. Summary

The chapter discusses the research methodology that is applied to analyze the nature of the linkages between the young age dependency ratio, the old age dependency ratio, life expectancy, social insurance funds rate and private savings rate, and between GDP growth rate, GDP per capita, inflation rate and private savings. The Johansen cointegration approach is then employed to not only investigate the cointegrating (long run) linkage, but also identify the short run dynamics between the considered variables in Vietnam. Furthermore, the Pair-wise Granger Causality and the VEC Granger Causality/Block Exogeneity Wald tests are performed to further determine the direction of causality between the variables.

Specifically, the Johansen cointegration procedure is used in the research including three steps. In the first step, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test are conducted to check for the stationarity of each variable and determine the order of integration in the time series. Then, the Trace and Maximum Eigenvalue tests are performed to identify the number of cointegrating vectors in the model. Also, these tests allow the researcher to answer whether the cointegrating (long run) relationship exists or not. The following step is to conduct the Vector Error Correction Model (VECM) to explore the short run dynamics and answer whether the short run dynamics are affected by the estimated long run equilibrium relationship. Finally, the Pair-wise Granger Causality and the Block Exogeneity Wald tests are performed to confirm the existence of the short term dynamic relationships and further determine the direction of causality between the considered variables in Vietnam.

On the other hand, serveral important diagnostic tests, including Jarque-Bera test, White Heteroscedasticity and Autoregressive Conditional Heteroscedasticity (ARCH) tests, serial correlation LM test need to be performed to detect the problems regarding the normality, heteroscedasticity and serial correlation of the residuals in the OLS regression model in order to achieve the best linear unbiased estimators for the research.

CHAPTER 5 RESEARCH RESULTS AND DISCUSSIONS

The chapter aims to determine whether the short run and the long run relationships between population ageing, economic growth and private savings exist in Vietnam, and if does, which is the direction of the causality. Following Long and Toan (2015) suggestions that changes in population age structure has a significant positive effect on the Vietnam's economic growth. I organized my investigation into two sections: one section aims to investigate the impact of population ageing that is represented by the young age dependency rate, the old age dependency rate, life expectancy and social insurance funds rate on private savings rate and the remaining section aims to examine the influence of economic growth that is represented by GDP growth rate, GDP per capita and inflation rate on private savings in Vietnam. The time series data used in this research are collected from the annual Statistical Yearbook of Vietnam over the period 1985 to 2016 (the period Vietnam implemented a comprehensive economic reform known as *Doi moi* (renovation) program), in which private savings in Vietnam is calculated through the national accounts identities, which are also collected from the annual Statistical Yearbook of Vietnam.

Each section begins with the presentation of the correlation matrix and descriptive statistics of the considered variables. Then, several research techniques are conducted to analyze the data series and provide the information for explaining the existing relationships between population ageing, economic growth and private savings in Vietnam. Firstly, the unit root tests include the Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron (PP) unit root test with its estimation equation only contains a constant term are applied to detect the stationary of each of the demographic and macroeconomic variables in the study in order to avoid the spurious regression problems. After confirming the stationary of the variables in the same order (I(1)) and due to having the multivariate time series, the Johansen cointegration approach is employed to determine whether there is a presence of cointegrating (long run) relationship among the variables. Before conducting the Johansen cointegration test, it is necessary to choose the optimal lag length based on the minimized values of both AIC and SC criteria in the unrestricted VAR model because a wrong choice of lag length may lead to the inconsistent estimates of a VAR model and produce the invalid estimation later. In addition, the unrestricted VAR model is run for the non-stationary series, while the Johansen cointegration test and the Vector Error Correction Model (VECM) later are run for the stationary series in first difference, thus the lag for the

Johansen cointegration test and the VECM is determined by the unrestricted VAR system optimal lag length minus one.

In the Johansen cointegration test step, we can identify the number of cointegrating vectors base on the results of the Trace and Maximum Eigenvalue statistics with an intercept and no trend model. If the Johansen cointegration test indicates that there exist more than one cointegrating (long run) vectors among the stationary variables (I(1)), the Vector Error Correction Model (VECM) will be performed to disaggregate the short run dynamics and long run relationship between private savings and the explanatory variables. More specifically, we conduct a Vector Error Correction Model (VECM) to estimate the long run regression model to determine the long run correlation between private savings and the explanatory variables. Besides, the results of a Vector Error Correction Model (VECM) helps detect the short run dynamics between the variables, explain the adjustment of any short run deviations from the long run equilibrium as well as answer whether the short run dynamics are affected by the estimated long run equilibrium relationship, and if does, the Pair-wise Granger Causality test and the VEC Granger Causality/Block Exogeneity Wald test are conducted to further examine the direction of the causality between the variables in the short term in Vietnam. Then, the impulse response and variance decomposition analyses are implemented to examine the response of the dependent variable (private savings) to a shock in that dependency variable and each explanatory variable and identify the important variables, which contribute to a large proportion in explaining the variation of private savings in Vietnam that will may have a significant impact on private savings in Vietnam in the near future. Finally, several diagnostic tests are conducted for the residuals in the dynamic VECM to check for the existence of normal distribution, heteroscedasticity, serial correlation, and the stability of the residuals in order to achieve the best linear unbiased estimates model for the research.

5.1. The impact of population ageing on private savings in Vietnam

5.1.1. Correlation matrix and descriptive statistics

This section analyzes the correlation matrix and descriptive statistics for the considered variables, including private savings rate (PSR), young age dependency ratio (YDR), old age dependency ratio (ODR), life expectancy (LFE) and social insurance funds rate (SIF). These results provide the information on the variables to be analyzed and shown in the following tables.

Table 5.1: Correlation matrix between the variables in Model 1

	PSR	YDR	ODR	LFE	SIF
PSR	1	-0.830361	-0.562301	0.888790	-0.118969
YDR	-0.830361	1	0.707149	-0.979593	-0.237632
ODR	-0.562301	0.707149	1	-0.724203	-0.094622
LFE	0.888790	-0.979593	-0.724203	1	0.155681
SIF	-0.118969	-0.237632	-0.094622	0.155681	1

Source: The results are calculated by author using EViews 8.0 software.

Table 5.1 shows that YDR, ODR and SIF are to be negatively correlated with PSR, meaning that these three variables move in opposite direction as compared with the direction of PSR. Whereas, LFE are found to be positively correlated, suggesting that this variable may have a positive influence on private savings rate. On the other hand, there are high positive correlations between LFE and PSR and between YDR and PSR, which implies the strong impacts of an increase in life expectancy and the children dependency ratio on private savings rate in Vietnam during the period 1985 - 2016.

Table 5.2: Descriptive statistics in Model 1

	PSR	YDR	ODR	LFE	SIF
Mean	19.59388	51.44109	9.881031	71.44214	2.255825
Median	24.60958	51.19500	10.06500	71.54900	2.293495
Maximum	30.10500	69.57600	10.38000	75.77770	3.479246
Minimum	0.900000	31.90300	9.300000	65.01800	0.864163
Standard Deviation	10.16275	13.75177	0.375922	3.441256	0.664329
Skewness	-0.916230	-0.100221	-0.275488	-0.217243	-0.165699
Kurtosis	2.294463	1.474194	1.517092	1.596320	2.487047
Jarque-Bera	5.140926	3.157681	3.336786	2.878795	0.497261
Probability	0.076500	0.206214	0.188550	0.237071	0.779868

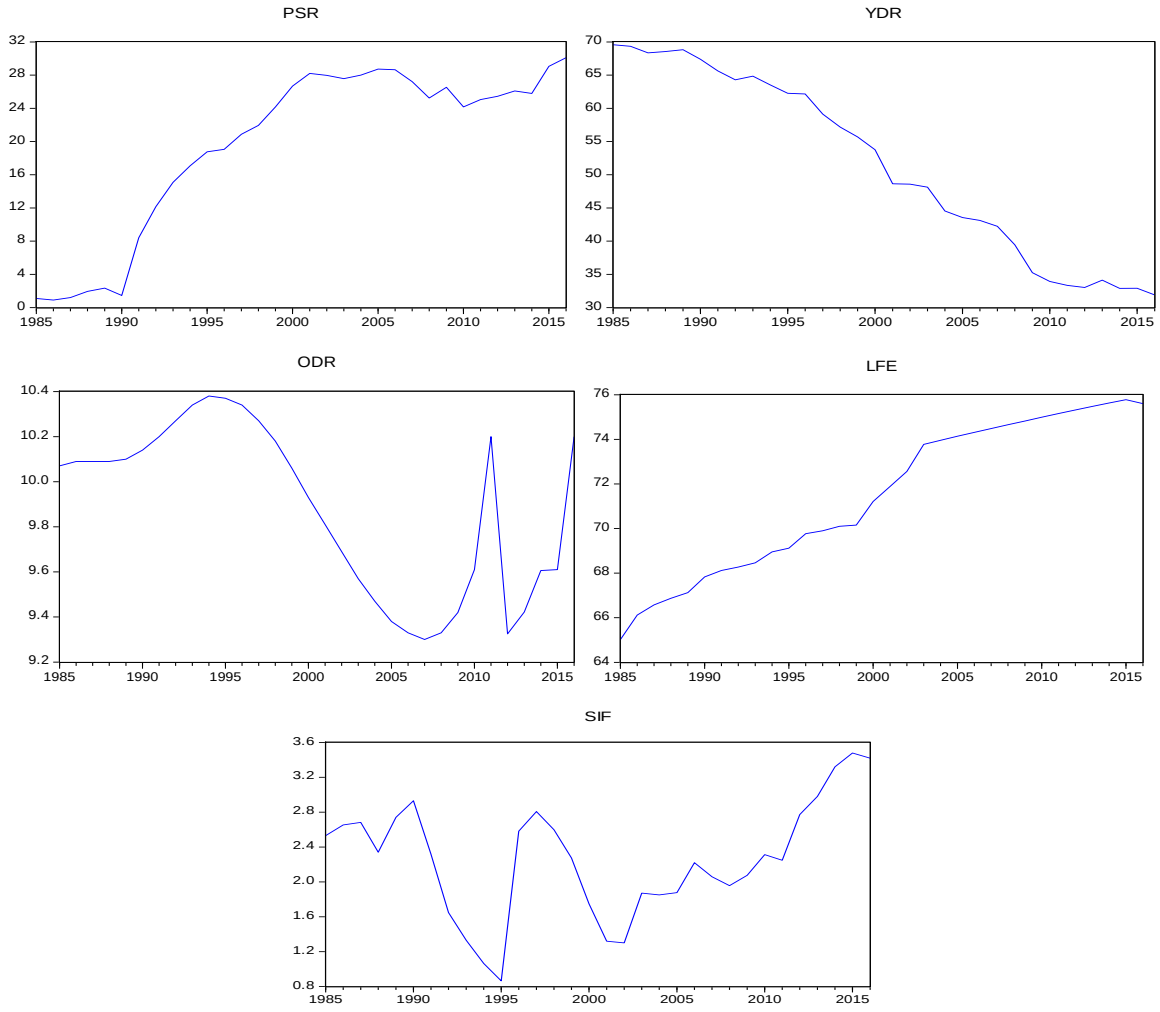
Source: The results are calculated by author using EViews 8.0 software.

According to Mukherjee, White and Wuyts (1998) regarding skewness and kurtosis statistics and based on the results in Table 5.2, it found that all the explanatory variables YDR, ODR, LFE and SIF have the skewness values close to zero and three variables except ODR in Model 1 are negatively skewed, implying that these three variables have long left tail. Indeed, the statistic for kurtosis indicates that the kurtosis value of all the four explanatory variables are close to 2 meaning that the distributions of these variables are flat relative to the normal and this may be a sign of a skewed distribution. Additionally, basing on the results of Jarque-Bera statistic test, the null hypothesis of a normally distribution of the data is accepted because all p values of the Jarque-Bera test is greater than the critical value, indicating that all variables are normally distributed at all the significance levels.

5.1.2. Graphical data analysis

A trend analysis will present to detect the movements in the value of the variables over time and analyze the possible causes of such movements.

Figure 5.1: Trends in the variables in Model 1 during the period 1985 - 2016



Private savings rate as a percentage of GDP shows a mixture of upward and downward trends during the period 1985 to 2016. Five years after Vietnam implemented a comprehensive economic reform known as Doi moi (renovation) program in 1986, the private savings rate in Vietnam was very low due to the consequence of a bureaucratic subsidized centrally-planned mechanism with a very low growth rate or even no growth of the Vietnam economy in previous decades. In the following decades, private savings rate has recorded an upward trend as a result of the success of Doi moi (renovation) policy programs was launched by the Vietnamese government that helped boost the economic growth, control an economic crisis as well as open up new opportunities for the Vietnam economy to become more integrated into the global economy. Besides, from 2007 to 2016, we can see a high growth rate, but is fluctuated in private savings rate in Vietnam, perhaps as a result of the active participation of Vietnam into the world trade organization and opening up the economy, but, sometimes, its effects on the economy is beyond the control of the Vietnam government.

As a result of population ageing, the young age dependency ratio displayed a rapid downward trend from 1985 to 2000 due to a fast decrease in fertility rate in Vietnam in this period resulting from the Vietnam's population control policy (or the Vietnam's two-child policy) since 1980s, but the following period, this upward trend was not clear and this dependency rate fluctuated little. By contrast, the average life expectancy, in general, showed a significant upward trend that is evidence of achievements in medical and health care services, and a better life quality of life. However, when checking carefully the data year by year, trend in life expectancy contains both upward and downward trends in the period 1985 to 2016.

Trend in the elderly dependency rate have been a small fluctuation between 9% and 10% for the entire research period. This can be explained that for over 30 years ago, there was a big change in the population structure between the children group and the working age group, but the picture of change in the population structure between the working age group and the elderly group was not clear. In the meanwhile, the working age population accounts for a large proportion in the total population in Vietnam. Thus, the proportion of elderly dependents to the working age population has not changed much. One point worth noting is that in the 2000s, there was a sharp increase in the elderly dependency ratio between 2010 and 2011 and the highest rate recorded in 2011 and 2016. This situation can

be explained that there was a large number of adults transfer from working age group to the old age group between 2010 and 2011, and one year later as a consequence of the high death rate of the elderly leading to a significant decline in the old age dependency. For the following years, the rapid ageing of Vietnam's population was increasing and as General Statistics Office of Vietnam (GSO, 2011) mentioned, Vietnam's population enters the so-called "ageing phase" from 2017 onward, thus it is understandable when the ratio of dependent elderly population to the working age population regularly increased and reached a peak again in 2016. General Statistics Office of Vietnam (2011) also predicts the old age dependency rate in Vietnam will continue to rise, but with a slower speed.

Social insurance funds rate representing for pensions funds rate as a percentage of GDP have been a mixture of high and low movements for the entire research period. Before 1995, the pensions fund was non-contribution defined benefit (DB), which was financed by the subsidies from the government budget and a small contribution of employers and employees. However, in this period, the Vietnam economy was weak and experienced a budget deficit for a long time, thus leading to a remarkable declining trend. From 1995, a publicly-managed pay-as-you-go defined-benefit (PAYG DB) scheme was formed to replace the old DB pension scheme along with the administration of Vietnam Social Security (VSS), thus the pension fund was significant improved for three years later. However, the burden of pension funds in this period was that it has to pay for two types of beneficiaries: pre-1995 and post-1995 pensioners, leading a downward trend. Consequently, when the Social Insurance Law was promulgated in 2007, with some new regulations that the current pension scheme is mandatory for all employees working in the state and non-state sectors in Vietnam relying on their contract and is voluntary for other Vietnam people at working age from 15 years old and not included in the mandatory scheme. This fact is strong evidence supporting an upward trend of social insurance fund rate in Vietnam from the last ten years.

5.1.3. Unit root tests for the variables in Model 1

Unit root test is the most common and effective method to test whether the series contains a unit root or not and then determine the orders of integration for the time series data. Besides, these tests allow this study avoid the spurious regression as well as give more robust results.

This part starts with testing the time series properties of the data by using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. As mentioned in Chapter 4, before applying these unit root tests, we need to know which version exists in the estimation equation: a constant or deterministic time trend or none. In this case, the data are plotted above can be used to identify which version exists for conducting the unit root tests. It is easy to see that all the considered variables does not start from the original point and have not a clear upward or downward trend in this time series data. Thus, the estimation equation for the unit root tests of the time series only contains a constant term.

Table 5.3 below presents the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests that were performed on each of the variables in Model 1.

Table 5.3: The results of the ADF and PP unit root tests in Model 1

Variables	ADF value in level form	Critical value	ADF value in first difference	Critical value	Level of integration
PSR	-1.735195	-2.960411	-4.068754	-2.963972*	I(1)*
YDR	-0.013810	-2.963972	-4.788530	-2.963972*	I(1)*
ODR	-1.695923	-2.960411	-6.006648	-2.963972*	I(1)*
LFE	-2.474746	-2.960411	-4.374541	-2.963972*	I(1)*
SIF	-1.519839	-2.960411	-4.345820	-2.963972*	I(1)*
Variables	**PP value in level form**	**Critical value**	**PP value in first difference**	**Critical value**	**Level of integration**
PSR	-1.629586	-2.960411	-4.094611	-2.963972*	I(1)*
YDR	-0.030807	-2.960411	-4.792267	-2.963972*	I(1)*
ODR	-1.609429	-2.960411	-6.006648	-2.963972*	I(1)*
LFE	-2.214239	-2.960411	-4.398090	-2.963972*	I(1)*
SIF	-1.798752	-2.960411	-4.235293	-2.963972*	I(1)*

Source: The results are calculated by author using EViews 8.0 software.

*Note: * denotes the rejection of the null hypothesis of unit root at the 5% significance level. The corresponding critical values for the ADF and PP unit root tests is collected from MacKinnon (1996) one-sided values.*

For both the Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron (PP) unit root test, the ADF test statistic values of all variables in Model 1, in absolute value, are

smaller than its corresponding critical values at level form, thus we cannot reject the presence of unit root for all the variables at their level form. In other words, all the variables in Model 1 are not stationary at their level form. However, when checking the stationary in first difference for the data series at the 5% significance level, the null hypothesis of non-stationary is rejected, indicating that in the first difference level, the time series is stationary. Overall, the series has a unit root or are non-stationary at their level form, but become stationary in first difference. This means that all variables are integrated of the same order of one (I(1)) at the 5% significance level.

In general, the ADF and PP unit root tests confirm the stationary of the variables of the same order in Model 1. In addition, as Afzal (2007) mentioned above, the usual Johansen cointegration methodology will be valid, if there are at least two non-stationary variables, which are to be integrated of the same order (I(1)). In the Model 1, there are five non-stationary variables in the level form, but become stationary of the order one (I(1)), implying that the Johansen cointegration approach can be applied in the following part.

5.1.4. The Johansen cointegration test for Model 1

Due to having the multivariate time series, the multivariate cointegration technique, which was introduced by Johansen (1988) and Johansen and Juselius (1990), was applied to determine whether there is a presence of long run relationship between the variables. The results for each step in the Johansen cointegration approach will be presented.

5.1.4.1. The selection of the optimal lag length in a cointegrated VAR model

After confirming the stationary of the variables of the same order (I(1)), the next important step in the Johansen cointegration test is to choose the optimal lag length because the optimal lag length is necessary to make the appropriate error term and produce the valid estimation. A wrong choice of lag length may lead to the inconsistent estimates of a VAR model.

The study only contains 32 observations and there are five variables in Model 1, thus the unrestricted VAR model is estimated with all the five variables from the lags 1 to lags 4 to determine the optimal lag length.

In the Table 5.4 below, LR is sequential modified LR test, FPE is final prediction error, AIC and SC represent Akaike information criterion and Schwarz information criterion. HQ is Hannan-Quinn information criterion.

Table 5.4: AIC and SC for the optimal lag length in the unrestricted VAR model 1

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-94.29990	214.0168	0.005107	8.878564	10.30593	9.314923
2	-74.78934	23.69140	0.009136	9.270667	11.88750	10.07066
3	-44.18141	26.23537	0.010704	8.870101	12.67640	10.03372
4	35.82891	40.00516*	0.000895*	4.940792*	9.936559*	6.468048*

Source: The results are calculated by author using EViews 8.0 software.

*Note: * indicates lag order selected by the criterion*

Table 5.4 indicates that the optimal lag length for unrestricted VAR model is four, which is determined by both the minimized values of both AIC and SC criteria.

5.1.4.2. Trace and Maximum Eigenvalue test statistics

In this step, the Trace and Maximum Eigenvalue statistics are performed with an intercept and no trend model along with (1 3) lag intervals (from 1 to the unrestricted VAR system optimal lag length minus one) at the 0.05 significance level to determine the number of cointegrating vectors, which then to be estimated in the following Vector Error Correction Model (VECM). Table 5.5 below presents the results from the Trace test and the Maximum Eigenvalue test.

Table 5.5: The Johansen cointegration test results for Model 1

Hypothesized No. of CE(s)	Trace Statistic	5% Critical value	Max-Eigen Statistic	5% Critical value
None	197.0827*	69.81889	114.7331*	33.87687
At most 1	82.34957*	47.85613	37.20326*	27.58434
At most 2	45.14632*	29.79707	26.08831*	21.13162
At most 3	19.05801*	15.49471	18.94348*	14.26460
At most 4	0.114525	3.841466	0.114525	3.841466

Source: The results are calculated by author using EViews 8.0 software.

*Notes: * denotes rejection of the null hypothesis of Trace test and Maximum Eigenvalue test at the 0.05 significance level.*

If the computed value of the test statistic is greater than its corresponding critical value, the null hypothesis of at most r cointegrating vectors is rejected. The results of the Johansen

cointegration test indicates that the computed values of both Trace test and Maximum Eigenvalue test are greater than their critical values at the 0.05 significance level when the hypothesized number of cointegration equation(s) (or the hypothesized no of CE) equal to *none, at most 1, at most 2 and at most 3.* However, we cannot reject the null hypothesis of at most 4 cointegrating vectors because the computed values of Trace test and Maximum Eigenvalue test at r = 4 are 0.114525 and 0.114525 less than its critical value (3.841466) at the 0.05 significance level. This also confirms the existence of four cointegrating vectors (or stable long run relationships) among these I(1) variables at the significance level of 5%.

In this case, the spurious and inconsistent regression problems, which usually occurred with the regression of non-stationary data series, can be avoided. Indeed, the existence of cointegrating (long run) relationships among the five I(1) variables suggest that the Vector Error Correction Model (VECM) can be applied to disaggregate the short run dynamic and long run relationships between YDR, ODR, LFE, SIF and PRS in Vietnam.

5.1.5. The Vector Error Correction Model (VECM) for Model 1

5.1.5.1 The long run relationship (the cointegrating vectors)

Since the Johansen cointegration test results indicated that the cointegrating vectors exist among the stationary variables (I(1)), we estimate the long run regression model. The first normalized equation below provides the long run relationship between the dependent variable (PSR) and the explanatory variables (YDR, ODR, LFE, SIF).

Table 5.6: The first normalized long run cointegration equation for Model 1

The dependent variable: PSR

Variable	Coefficient	Standard error	t-statistic
Constant	1734.566	-	-
PSR	1.000000	-	-
YDR	-2.669635	0.16106	-16.5749
ODR	-43.29043	2.00091	-21.6354
LFE	-16.27093	0.79382	-20.4971
SIF	-11.78639	0.75960	-15.5165

Sources: The results are calculated by author using EViews 8.0 software.

The cointegrating (long run) relationship results given in Table 5.6 can be rewritten in the regression model as follows:

$$PSR = -2.670*YDR - 43.290*ODR - 16.271*LFE - 11.786*SIF + 1734.566$$

The value and sign of the coefficients show how the explanatory variables affect the dependent variable (significant or insignificant, positive or negative effect). The common rule regarding the degree of the significance of the relationship is that when the value of coefficient of the variable is double than its standard error value, the relationship is significant. Hence, the results given in Table 5.6 indicate all four significant negative long run associations of YDR, ODR, LFE and SIF with PSR as well as confirm Hypothesis 1 that there is a statistically significant and negative long run relationship between the young age dependency ratio, the old age dependency ratio, life expectancy, social insurance funds rate and private savings rate in Vietnam.

Specifically, the highest negative coefficient for ODR of 43.290 signifies a strong negative effect of the old age dependency rate (ODR) on private savings rate (PSR) in Vietnam whereby a 1% increase in the elderly dependency rate will lead to a greatly decrease in private savings rate in Vietnam by 43.29%. The statistically significant expected sign of the coefficient of ODR also implies that the old age dependency rate is an important factor in determining private savings in Vietnam. Similarly, the young age dependency rate (YDR) has a significant negative effect on private savings rate (PSR), suggesting that in the long run, a 1% increase in the minor dependency ratio (YDR) will cause a reduction in private savings rate (PSR) by 2.67%. As compared to other three explanatory variables in the long run model, the coefficient of YDR is the smallest, meaning that in the long run the effect of YDR on PSR is modest. This finding is suitable with the context of Vietnam where the population ageing is becoming a considered problem with a demographic transformation due to a rapid decline in fertility rate and an increase in the elderly population along with a higher longevity. Indeed, the Vietnam' population enters the so-called "ageing phase" from 2017 onward with the remarkable characteristic of the high and increasing proportion of the elderly aged 60 and over in the total population (General Statistic Office of Vietnam (GSO), 2011).

Furthermore, the Modigliani's (1970) simplified model in Chapter 2 indicated that the coefficients of the young age dependency ratio and the old age dependency ratio will be negative and the influence of ODR will be much greater than that of YDR because the

consumption of the children will be probably less than that of the elderly (Modigliani, 1970). Additionally, Modigliani (1970) also explained for the significant negative correlations was that the aged tends to consume more for their lives in relation with a lower income after retirement, thus the higher the elderly rate is, the lower private savings rate the aged saves. For the minors (aged below 14), they do not have income and their consumption depends entirely on the income of the working age adults in the household, thus the higher rate of the minors to the working age population (aged 15-60) will lead to a reduction in private savings rate. In fact, both the coefficients of YDR and ODR in the research are negative and ODR has a much stronger impact on PSR than YDR, which is consistent with the Life Cycle Hypothesis of Modigliani (1970).

Also, this finding was similar to the research results of Horioka (1997) in the case of Japan, Thornton (2001) in the case of the United States, and Modigliani and Cao (2004) in the case of China. These studies confirm the significant negative associations of the young age dependency rate and of the old age dependency rate with the private savings rate and the high proportion of the elderly population is the main reason causing a sharp decrease in savings rate in these countries where ageing is becoming a significant issue. Furthermore, Horioka (2010) revealed that China has experienced an upward trend of household savings rate until now, which is because the increase in the elderly dependency ratio has been less pronounced than the decline in the child dependency ratio, while the consumption of both the children and the elderly depends on the income of working age people in the households, especially for the children who do not have the income and depends entirely on their family income. Similar to the context of China, the demographic change in Vietnam, as mentioned in Chapter 3, has been shown by the fast decrease in the youth dependency ratio and the small increase in the elderly dependency ratio during the period 1985 - 2016, while the Vietnam's private savings rate as a percentage of GDP seems to be higher. Accordingly, the negative linkage between the children dependency ratio, the elderly dependency ratio and private savings rate in Vietnam during this period is suitable with the demographic trends and the overall picture of private savings in Vietnam. This finding, on the other hand, provides strong evidence confirming the application of the Life Cycle Hypothesis in the context of Vietnam where this hypothesis is less likely to apply because of its cultural peculiarities, for instance, the uncertainty of income and the greater prevalence of intergenerational transfer within the family affecting the savings of the elderly. Unlike Japanese and Chinese in Horioka's studies in 1997 and 2010, the

motivation for precautionary savings, which is known as the savings occur to ensure people against the risk of living too long, was unclearly in Vietnam. In fact, although the Vietnamese seniors aged 60 years and over were born in the war period in the 1950s when the economy, social security, and private insurance were undeveloped, thus the older generations have not been accustomed to save throughout their life due to their poor living standards. This led to a negative relationship between the elderly population and private savings rate in Vietnam. On the other hand, for the Asian culture, "family relationship" plays an important role, thus the elderly usually tends to save more for the bequest of young generations. However, the research found a negative relationship between the elderly dependency rate and private savings rate in the long run in Vietnam. This may imply that the Vietnam's older generations have a weak bequest motivation for savings.

Besides, the significant negative correlation between the elderly dependency ratio and private savings rate in this research conforms to a priori expectations. Specifically, in the case of Japan, Horioka (1997) predicted that as the older population grows, the Japanese savings rate would decrease. This prediction is also true for Vietnam because population ageing now is a global trend and takes a place in almost countries in the world. Hence, the ageing put a prevalent concern on its possible influences on savings and economic growth in a country. General Statistics Office of Viet Nam (GSO, 2011) reports that the estimated number of the elderly aged 60 (or 65) and over accounts for 24.8% (or 18.06%) of the total population of Vietnam in the year 2049. Also, General Statistics Office of Viet Nam (GSO, 2011) confirms that a rapid economic growth of Vietnam during 1980s to present has been due mainly to a great share of working age population in the total population resulting from the fact that the large number of children in previous period matured and are entering the workforce in Vietnam that is so-called "golden population structure" or "population bonus" period. Along with the fast growth of the Vietnam economy and the "golden population structure" period, an upward trend of Vietnam's private savings rate in the period 1985 - 2016 is displayed and can be explained by the higher savings of working age group as compared to the dissaving of the elderly group in the economy. Nevertheless, the benefits of "golden population structure" in Vietnam in recent decades will disappear in the near future for 30 - 40 years due to a decrease in working age population resulting from a rapid decrease in fertility rate and an increase in the elderly population over time. Consequently, there will be a downward trend in private savings rate in Vietnam in the future as the elderly population grows.

Other empirical studies that have been performed on the cointegrating relationship also found the similar result of negative effects of the youth dependency ratio and the elderly dependency ratio on private savings rate including Horioka and Watanabe (1997), Faruquee and Husain (1998), Schmidt-Hebbel and Serven (2000), Kinugasa and Mason (2004), Thanoon and Baharumshah (2005), Koga (2006), Loayza, Erlandsen and Nymoen (2008), Agrawal and Sahoo (2009), Agrawal et al. (2009), and Apergis and Christou (2012). These authors revealed that the negative associations of the young age dependency ratio and the old age dependency ratio with private savings rate was observed in most developing countries, which was caused by problems and challenges these countries faced, more specific, their poor development for a long time, the underdeveloped social security and private insurance systems along with changes in demographic structure resulting from a declining fertility rate and a high proportion of old age dependents in the total population that make people less motivated to save. Especially in the process of ageing when there were a higher number of the elderly consumers, who still needed to consume for their lives, while their income declined remarkably after retirement, along with the high rate of the youth population who have no income in relation with a declining working age population as a result of a rapid decline in fertility rate, thus leading to a significant decrease in private savings rate in these developing countries.

With regards to life expectancy, the results revealed its significant negative impact on private savings rate in Vietnam in the long run at the 5% significance level. Specially, a 1 unit change in the life expectancy (LFE) will lead to a decline in private savings rate (PSR) in Vietnam by 16.27%. This finding contradicts the Life Cycle Hypothesis of Modigliani and Brumberg (1954) that by expecting to live longer, people tends to save more during their working age period due to the longer retirement period. Also, this result contradicts the studies of Heller and Symansky (1998) and Lee et al. (2000) that were conducted in developed countries, and Li, Zhang and Zhang (2007), Li, Li and Chan (2012), Prettner (2012) and El Mekkaoui and Oliveira (2014), who applied an overlapping generations model in their analysis and approved the positive relationship between an increase in longevity and an increase in private savings rate. Conversely, this negative correlation in Vietnam is similar to the study of Bloom et al. (2007) and can be also explained through the standard life cycle theory. According to the standard life cycle theory, the elderly lives in the second period of the life cycle that negatively affects their savings behavior, more specific, the seniors tend to save less in older ages. Thus, a longer life expectancy will not

lead to an increase in the private savings of the elderly; even in this case, it will reduce their savings in old age, thereby causing a decrease in private savings in general. Indeed, the negative linkage between an increase in life expectancy and private savings rate in Vietnam is caused by the weak incentives from underdeveloped social security and private insurance systems in Vietnam along with the weak motivations of the Vietnamese elderly for savings accumulation for their retirement period. The weak motivation for accumulating savings for the retirement period usually occurs in both the underdeveloped and developing countries like Vietnam where people live in low income and poor living standards, thus it is difficult for them to save for their future, or it occurs in the high income countries, as Doshi (1994) mentioned, where the standard of living is high and people do not worry about their future life, hence, they do not desire to prepare future expenditures in older ages.

Likewise, the social insurance funds rate has a significant negative influence on private savings rate in Vietnam in the long run. A 1% increase in the social insurance funds rate (SIF), which is expressed in term of the rate of social insurance revenue to GDP, will decrease private savings rate (PSR) in Vietnam by 11.79%. The negative value of correlation coefficient between the social insurance funds rate and private savings rate in Vietnam is in accordance to the asset substitution effect of the Feldstein's life cycle savings theory (1974). According to this life cycle savings theory, if pensions were considered as a substitute of income, people would not need to save to be wealthy for and during their retirement period. In Vietnam, as Long (2012) and the Vietnam Social Security (VSS, 2017) reported, the pension scheme has gradually improved. Although the level of subsidization for pensioners is low as a result of underdeveloped social security and private insurance systems, it still ensures the minimum living conditions for retirees. Relying on the asset substitution effect of the Feldstein's life cycle savings theory (1974), the negative long term relationship between the social insurance funds rate and private savings rate is because of having the higher pension insurance in the society resulting from the development of Vietnam's pension scheme, the employees know that they will receive higher pension benefits from the public pension scheme after retirement, which makes them reduce their savings associated with the retirement during their working lives. Moreover, the negative long run linkage between the social insurance funds rate and private savings rate in Vietnam is also found by Edwards (1996) for 36 Latin American countries and Börsch-Supan et al. (2006) for three large continental European countries

with large pay-as-you-go pensions systems: France, Germany and Italy, who stated that the pensions diminish private savings due to the asset substitution effect. On the contrary, this positive linkage is in contradiction to the Bailliu and Reisen's viewpoint (1998), who confirmed that the development of pension funds contributes significantly to the higher private savings. Bailliu and Reisen (1998) gave a clear explanation that for developing countries, the fast ageing process along with the remarkable development of pension funds leads to the higher long term savings level of the individuals for their future retirement period, and for the emerging economies with the slow ageing process, it requires the higher savings for the sustainable finance investment and the economic growth; hence, these countries have promoted the development of pension funds to increase the private savings as well as the aggregate savings in the economy.

5.1.5.2. Short run analysis: A dynamic Error-Correction Model

Although the Johansen cointegration test suggested that four conintegrating relationships exist among the analysed variables, for the purpose of my study only the first cointegration relating private savings to the demographic variable (population ageing) in Vietnam is relevant, the Vector Error Correction Model (VECM) is then conducted with one cointegrating vector to detect the short run dynamics between these variables as well as answer whether the short run dynamics are affected by the estimated long run equilibrium relationship. And if does, the Pair-wise Granger Causality test and the Block Exogeneity Wald test are applied to further examine the direction of causality between the considered variables.

The statistical significance and size of the Error Correction Term (ECT) in a VECM represent the speed or degree and the tendency of adjustment at which the dependent variable adjusts to changes in the independent variables. Specifically, the negative coefficient of the Error Correction Term (ECT) confirms the ability of the explanatory variable to correct any disequilibrium in the short run as well as shows the extent of the variable to return back to its long run equilibrium position. By contrast, the positive coefficient of the Error Correction Term (ECT) implies that any disequilibrium in the variable continues to grow, but it also shows incomplete specifications in the short run VECM. The endogenous variables in the VECM are lagged explanatory variables and one lagged ECT. Indeed, the value of R-squared shows the joint significance in the model. If the lagged explanatory variable has a significant coefficient value, it can be deduced that

this explanatory variable is important in predicting the current movement of private savings and the adjustment towards previous equilibrium error term. Table 5.7 below presents the results of the dynamic error-correction model.

Table 5.7: The results of the short run Vector Error Correction Model for Model 1

Variables	Coefficient	Std. Error	t-Statistic	P-value
D(PSR(-1))	-0.471882	0.226557	-2.082838	0.0614
D(PSR(-2))	-0.237233	0.242691	-0.977512	0.3493
D(PSR(-3))	-0.308671	0.216566	-1.425302	0.1818
D(YDR(-1))	-0.597744	0.347822	-1.718537	0.1137
D(YDR(-2))	-0.578148	0.299015	-1.933509	0.0793
D(YDR(-3))	-0.002272	0.236098	-0.009621	0.9925
D(ODR(-1))	-10.10019	3.365762	-3.000863	0.0121
D(ODR(-2))	-5.469055	2.469203	-2.214907	0.0488
D(ODR(-3))	-3.933454	1.827762	-2.152060	0.0545
D(LFE(-1))	-2.311085	1.808675	-1.277778	0.2276
D(LFE(-2))	-0.620533	1.395372	-0.444708	0.6652
D(LFE(-3))	-0.249424	1.258094	-0.198255	0.8465
D(SIF(-1))	-4.694948	1.311477	-3.579894	0.0043
D(SIF(-2))	-3.205592	1.304125	-2.458041	0.0318
D(SIF(-3))	-2.501000	1.252266	-1.997180	0.0711
Constant (C)	1.404339	0.763529	1.839272	0.0930
ECT	-0.349616	0.084633	-4.130959	0.0017
ECT1	0.007693	0.086241	0.089200	0.9305
ECT2	0.010202	0.015655	0.651661	0.5280
ECT3	-0.047919	0.012722	-3.766735	0.0031
ECT4	0.035077	0.033832	1.036793	0.3221
R-squared: 0.785101		Adj. R-squared: 0.472520		
F-statistic: 2.511674				

Sources: The results are calculated by author using Eviews 8.0 software

Based on the above results of Vector Error Correction Model (VECM) estimates, the VECM equation of private savings rate is rewrite as follows:

$$D(PSR) = -0.349*[PSR(-1) + 2.67*YDR(-1) + 43.291*ODR(-1) + 16.271*LFE(-1) + 11.786*SIF(-1) - 1734.566] + C(2)*D(PSR(-1)) + C(3)*D(PSR(-2)) + C(4)*D(PSR(-3)) + C(5)*D(YDR(-1)) + C(6)*D(YDR(-2)) + C(7)*D(YDR(-3)) + C(8)*D(ODR(-1)) + C(9)*D(ODR(-2)) + C(10)*D(ODR(-3)) + C(11)*D(LFE(-1)) + C(12)*D(LFE(-2)) + C(13)*D(LFE(-3)) + C(14)*D(SIF(-1)) + C(15)*D(SIF(-2)) + C(16)*D(SIF(-3)) + 1.404 + \varepsilon_t$$

Where:

$$ECT = \mu_{t-1} = PSR(-1) + 2.670*YDR(-1) + 43.290*ODR(-1) + 16.271*LFE(-1)) + 11.786*SIF(-1) - 1734.566$$

The ECT, ECT1, ECT2, ECT3 and ECT4 represent the short run ability of private savings rate, young age dependency ratio, old age dependency ratio, life expectancy, and social insurance funds rate to return its long run equilibrium position.

As seen in Table 5.7, the coefficient of the error correction term (ECT) for the estimated private savings rate equation (D(PSR)) is both statistically significant and negative, which confirms the ability to act properly to correct any disequilibrium in the short run. Specifically, the coefficient of the error correction term (ECT) is (-0.349), which implies that private savings rate has the tendency to correct its previous period disequilibrium with the rate of 34.96% annually.

On the other hand, the VECM equation estimation is conducted with the different dependent variables include the young age dependency ratio D(YDR), the old age dependency ratio D(ODR), life expectancy D(LFE) and social insurance funds rate D(SIF) to find the different error correction terms (ECT1, ECT2, ECT3 and ECT4) for these four dependent variables. The estimated results only found the ability of D(LFE) to correct the previous period disequilibrium due to its statistically significant and negative coefficient of ECT3, while three remaining error correction terms (ECT1, ECT2 and ECT4) with the positive coefficients indicate that it is impossible for three lagged variables D(YDR), D(ODR) and D(SIF) to correct its previous period disequilibrium. Additionally, the coefficient value of ECT3 is small (-0.048), implying that the annual speed of adjustment of D(LIFE) from its disequilibrium is low about 4.8% per year.

Furthermore, according to Engle and Granger (1987), in the VECM, the lagged coefficients of explanatory variables capture the short term influences on the dependent variable D(PSR). The results given in Table 5.7 show the short run negative coefficient values of three lagged explanatory variables of the young age dependency ratio D(YDR), the old age dependency ratio D(ODR) and social insurance funds rate D(SIF) with different estimated values and signs, indicating that the young age dependency ratio, the old age dependency ratio and social insurance funds rate have significant short run impacts on and can explain the changes in private savings rate. By contrast, the lags of life expectancy D(LFE) does not have a short term effect on D(PSR), meaning that in the short run private savings rate is non-responsive to life expectancy in Vietnam. Overall, the evidence is not enough to confirm the significant short run impact of the young age dependency ratio, the old age dependency ratio, life expectancy and social insurance funds rate on private savings rate inVietnam.

More specifically, there is only one negative short term relationship between the second lag of D(YDR) and D(PSR) with its correlation coefficient is (-0.58) at the 10% significance level. This means that the young age dependency ratio only affects the private savings rate (D(PSR)) at the second lag and it can explain only 0.58% change in D(PSR). This negative (although small) short run relationship is similar to the finding of a small, negative long run correlation between the young age dependency rate (YDR) and private savings rate (PSR) in Vietnam, which is in line with the Life Cycle Hypothesis of Modigliani (1970).

Similarly, the first and second lagged variables of D(ODR) have statistically significant and negative short run effects on D(PSR) with the coefficient values of -10.10 and -5.47 respectively at the 5% significance levels, meaning that in the short term a 1% rise in D(ODR) causes a decline in D(PSR) in Vietnam by 10.10% and 5.47% respectively. This statistically significant and negative short run linkage is similar to the finding of a strong negative long run correlation between the old age dependency ratio (ODR) and private savings rate (PSR) in Vietnam, which is consistent with the Life Cycle Hypothesis of Modigliani (1970) and conforms to a priori expectations that as the older population grows, private savings rate will decrease.

Likewise, the coefficients of the correlation between the first and second lagged variables of D(SIF) and D(PSR) are statistically significant and negative at the 5% significance

levels with its values -4.69 and -3.21 respectively. This also indicates that in the short run a 1% increase in D(SIF) leads to a decline in D(PSR) in Vietnam by 4.69% and then 3.21%. In the context of Vietnam, we also found the same negative association between the social insurance funds rate and private savings rate in the long run, which is in accordance to the asset substitution effect of the Feldstein's life cycle savings theory (1974), whereby if pensions is considered as a substitute of income, people will not need to save to be wealthy for and during their retirement period, thus depressing their savings.

The statistical values of F statistic and R squared help identify the overall significance of the model. Based on the results of VECM in Table 5.7, R-squared of 0.785101 means that 78.51% of variation in D(PSR) in Vietnam can be explained by variation in D(YDR), D(ODR), D(LFE) and D(SIF). Additionally, the null hypothesis of F test statistic is that all independent variables are equal to 0, implying that all the independent variables are insignificant to the dependent variable. In the VECM, F-statistic value is 2.811674 higher than the critical F value of 2.67 (with the degree freedom of 4 (or the numerator which is calculated by the number of coefficients minus 1 at the 0.05 level of significance) and the denominator of 32 (which is the total sample size), thus the null hypothesis of the F test statistic is rejected. This means that there is sufficient evidence confirming the statistically significance of the overall model at the 5% significance level.

5.1.6. Granger causality test

5.1.6.1. The Pair-wise Granger Causality test

In order to confirm the short run relationship between private savings rate and the explanatory variables involved in the VECM above, the Pair-wise Granger Causality test is applied to the first differenced variables. This test is considered as the most common approach and is appropriate for determining whether the causality exists or not and the direction of causality between the time series variables in the short term.

The results of the Pair-wise Granger Causality test given in Table 5.8 indicate that none of the coefficients are statistically significant because the p-values do not reject the null hypothesis. Hence, there is no meaningful Granger causality present between YDR and PSR, ODR and PSR, LFE and PSR and SIF and PSR. In other words, in the short run all the demographic variables in Model 1: the young age dependency rate (YDR), the old age dependency rate (ODR), life expectancy (LFE), and social insurance funds rate (SIF) does not Granger cause the change in private savings rate (PSR) in Vietnam either. In this case,

Hypothesis 2 about the direction of causality running from the demographic variables to private savings rate in Vietnam is rejected.

Table 5.8: The Pair-wise Granger Causality test results for Model 1

Null Hypothesis:	Obs	F-Statistic	Prob.
YDR does not Granger Cause PSR	29	0.35388	0.7868
PSR does not Granger Cause YDR		3.85737	0.0233
ODR does not Granger Cause PSR	29	0.43027	0.7334
PSR does not Granger Cause ODR		2.06895	0.1335
LFE does not Granger Cause PSR	29	0.57860	0.6352
PSR does not Granger Cause LFE		1.99347	0.1444
SIF does not Granger Cause PSR	29	0.99328	0.4143
PSR does not Granger Cause SIF		0.56498	0.6438

Sources: The results are calculated by author using Eviews 8.0 software

The Pair-wise Granger Causality test results contradict the results obtained from the short run VECM above. More clearly, the short run dynamic VECM found two significant negative short run impacts of the lags of D(ODR) and D(SIF) on D(PSR) at the 5% significance level and one negative effect of the second lag of D(YDR) on D(PSR) at the 10% significance level, and there is no short run relationship between life expectancy and private savings rate in Vietnam.

5.1.6.2. VEC Granger Causality/Block Exogeneity Wald test

Beside the Pair-wise Granger Causality test, the VEC Granger Causality/Block Exogeneity Wald test is employed aims to determine whether the lags of the excluded variable have any effect on the dependent variable (D(PSR)). The null hypothesis of Block Exogeneity Wald test is that the lagged coefficients of the excluded variables have no significant influence on the dependent variable. If the p value of this test is less than the significance level at least 10%, the null hypothesis is rejected, suggesting that the lagged variables Granger cause the dependent variable.

Table 5.9: The results of VEC Granger Causality/Block Exogeneity test for Model 1

Dependent variable: D(PSR)			
Excluded	**Chi-sq**	**df**	**Prob.**
D(YDR)	6.892366	3	0.0754
D(ODR)	9.739447	3	0.0209
D(LFE)	2.401279	3	0.4934
D(SIF)	13.23106	3	0.0042
All	19.83013	12	0.0704

Sources: The results are calculated by author using Eviews 8.0 software

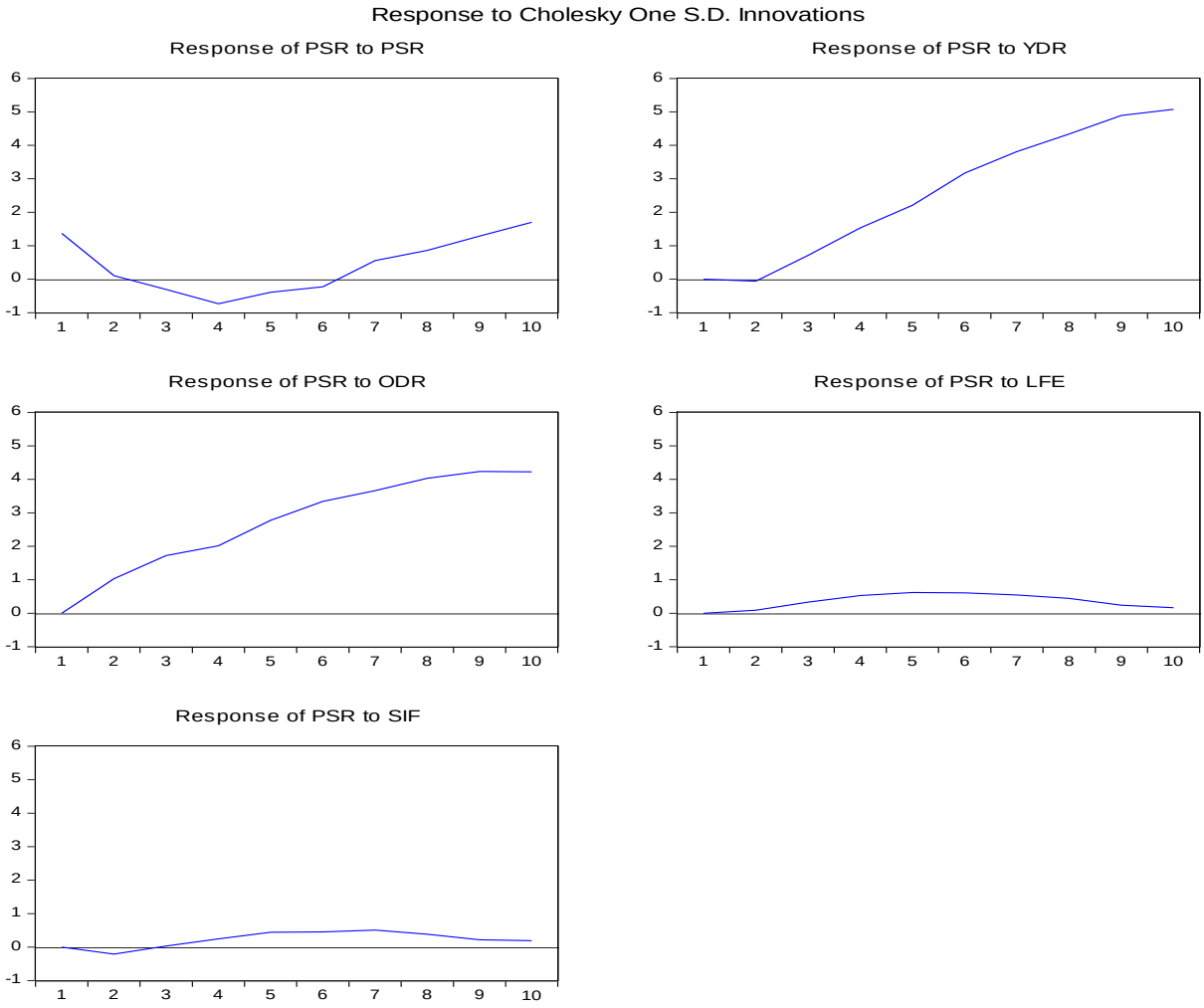
In the Block Exogeneity test, D(PSR) is the dependent variable, the remaining variables are the excluded variables. The results given in Table 5.9 indicate that the null hypothesis of no causality regarding the lags of two excluded variables D(ODR) and D(SIF) is rejected at the 0.05 significance level and of D(YDR) is rejected at the 0.1 significance level. This means that in the short run there exists a causality running from the young age dependency rate, the old age dependency rate and social insurance funds rate to private savings rate in Vietnam. This result does not correspond to the Pair-wise Granger Causality test results relating to the short run effects of D(YDR), D(ODR) and D(SIF) on D(PSR), but it is similar to and in favor of the short run VECM results.

Furthermore, as seen the results of the joint block exogeneity test, the Chi-square statistic value (χ^2) is significant at the 0.1 significant level, meaning that all lags of the excluded variables D(YDR), D(ODR), D(LFE) and D(SIF) may influence the endogenous variable D(PSR). In other words, there exists the short run effects of four lagged excluded variables on D(PSR), suggesting that D(LFE) may still have an influence on D(PSR) in the long run. Indeed, although the Pair-wise Granger Causality test found no causality between D(LFE) and D(PSR) in Vietnam in the short run, this causality may be valid in the long run.

5.1.7. Impulse response function and variance decomposition for Model 1

According to Brooks (2008), the impulse response and variance decomposition analyses are used to examine the influence of a shock to each variable on its own future trend and on the future trend of the other variables in the VECM.

Figure 5.2: Impulse response function for Model 1



The impulse response results indicates that the response of PSR to its own innovations is significant negative from the period 1 to period 4, after that, a positive increase does occur over time. The reason for PSR responding in this way could be due to the Vietnam's economic growth prospects in the future along with the advantage of the golden population structure for the next about 30 - 40 years and the ability of the individuals to save more for their future lives, resulting in an increase in the private savings rate. Similarly, the response of PSR to a shock in YDR is negative from the period 1 to period 2, then significant increases over time. Indeed, the response of PSR to a shock in ODR is positive over time. On the other hand, the responses of PSR to LFE and SIF are positive from the period 1 to period 6 and period 7 respectively, after that, a negative decrease does occur over time. Nevertheless, the mixed findings also imply that it is not clear to confirm that the long term equilibrium will be reached again.

In terms of variance decompositions as given in Appendix 1, 100% of the variation in PSR is due to changes in PSR alone in period one. At the period two, the variation of PSR is attributed mainly to changes in its own innovations (62.83%) and ODR (35.28%) and SIF (1.51%). In the period 10, the variation of PSR is a result of only 4.07% change in its own shock and 49.41% and 45.20% changes in YDR and ODR shocks respectively. In general, it can be concluded that the young age dependency ratio and old age dependency ratio seem to explain a large proportion of private savings rate than life expectancy and social insurance funds rate will do in the future, suggesting that the influences of the young and old age dependency ratios on private savings rate will may have significant in Vietnam in the future.

5.1.8. Diagnostic tests for the residuals in the dynamic VECM1

Several diagnostic tests are conducted for the residuals in the dynamic VECM to check for the existence of the normal distribution, heteroskedasticity, serial correlation, and the stability of the residuals in order to achieve the best linear unbiased estimates model for the research. The results of diagnostic tests are shown in Table 5.10 and 5.11 and Figure 5.3.

Table 5.10: The results of diagnostic tests for the residuals in VECM1

Tests	**The Null Hypothesis**	**F-Statistic**	**Prob. Chi-square**
Jarque-Bera	Normally distributed	5.425423	0.066357
White Heteroscedasticity with no cross terms	No heteroscedasticity	0.417751	0.7628
ARCH	No ARCH effect (no heteroscedasticity)	1.962900	0.1401

Sources: The results are calculated by author using Eviews 8.0 software

For Jarque - Bera test, if its Prob. Chi-square value is greater than the significance level value (α = 5%), the null hypothesis of existence of normal distribution of the residuals is accepted, meaning that the residuals are normally distributed. As seen in Table 5.10, the Prob. Chi-square value for Jarque-Bera test is 0.07 greater than the 0.05 significance level, suggesting that the residuals of the dynamic VECM are normally distributed at the 0.05 significance level.

The Prob. Chi-square values of White Heteroscedasticity and ARCH tests are 0.76 and 0.14 respectively that are greater than all the significance levels, thus we cannot reject the

null hypothesis of no heteroscedasticity at any level of significance. This means that the residuals of the dynamic VECM have not met heteroscedasticity problem.

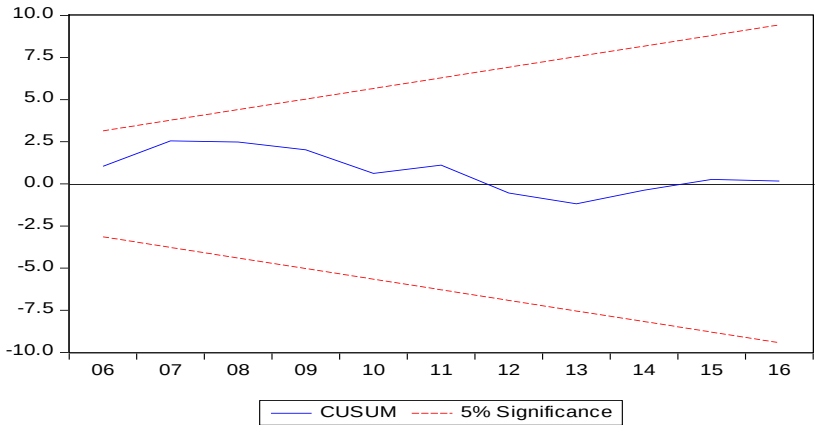
Table 5.11: VEC residual serial correlation LM test results for Model 1

Lags	LM-Stat	Prob
1	44.76450	0.0089
2	32.53579	0.1431
3	17.67297	0.8560
4	27.89134	0.3129
5	22.01525	0.6349
6	30.22407	0.2160
7	28.43819	0.2881
8	29.19262	0.2559

Sources: the results are calculated by author using EViews 8.0 software.

The p values of the VEC residual serial correlation LM test with lags from 2 to 8 are greater than all the significance levels, indicating that the null hypothesis of no serial correlation at lag order 3 is accepted. Thus, there is no serial correlation in the residuals of the dynamic VECM.

Figure 5.3: The stability of the residuals in Model 1



As seen in the Figure 5.3 above, the graph is in the red borders, indicating that CUSUM test confirms the stability of the residuals in the regression model.

To sum up, the results obtained from diagnostic tests confirm the reliability of variables that can be used to produce the best linear unbiased estimators of the OLS regression model for Model 1.

5.2. The impact of economic growth on private savings in Vietnam

5.2.1. Correlation matrix and descriptive statistics

The section uses the correlation matrix and descriptive statistics to analyze and give the general information on the variables, including Log real private savings (LogRPS), GDP growth rate (GDPgr), Log real GDP per capita (LogRGDPper), and inflation rate (IFR). The statistical results of these tests are represented in the following tables.

Table 5.12: Correlation matrix between the variables in Model 2

	LogRPS	GDPgr	LogRGDPper	IFR
LogRPS	1	0.20235	0.83361	-0.73519
GDPgr	0.20235	1	-0.22167	-0.57706
LogRGDPper	0.83361	-0.22167	1	-0.29877
IFR	-0.73519	-0.57706	-0.29877	1

Sources: the results are calculated by author using EViews 8.0 software.

As seen in Table 5.12, there is a positive correlation between LogRPS and GDPgr, and between LogRPS and LogRGDPper, while IFR found to be negatively correlated with LogRPS. The results also indicate that GDPgr, LogRGDPper and LogRPS move in the same direction, whereas, IFR and LogRPS move in opposite directions. On the other hand, the high correlations between LogRGDPper and LogRPS and between IFR and LogRPS denote the strong impacts of GDP per capita and inflation rate on private savings in Vietnam in the period 1985 - 2016.

The results in Table 5.13 show that three variables LogRPS, GDPgr and LogRGDPper have the skewness values close to zero. Almost the variables in Model 2 except IFR are negatively skewed, indicating that these variables have long left tail. Besides, the Kurtosis values present the peakedness or flatness of the distribution of the series. Because the kurtosis values of LogRPS and GDPgr are close to 3, meaning that these two variables are normally distributed. For the Jarque-Bera statistics, it is clear that all the series LogRPS, GDPgr, LogRGDPper and IFR are normally distributed at all the significance levels.

Table 5.13: Descriptive statistics in Model 2

	LogRPS	GDPgr	LogRGDPper	IFR
Mean	9.73571	6.66033	2.70579	32.11256
Median	9.94227	6.72964	2.62812	8.50000
Maximum	10.79097	9.54048	3.33659	233.54
Minimum	7.97722	2.50000	1.97438	-0.60000
Std. Dev.	0.83182	1.67714	0.39736	53.46847
Skewness	-0.70087	-0.32321	-0.02042	2.30718
Kurtosis	2.34843	2.74432	2.10716	7.97422
Jarque-Bera	3.18585	0.64431	1.06511	61.38029
Probability	0.20333	0.72459	0.58710	0.00000

Sources: the results are calculated by author using EViews 8.0 software.

More specifically, the kurtosis values of LogRGDPper is close to 2, implying that its distribution is flat relative to the normal, while the kurtosis values of IFR is so higher than 3, indicating that its distribution of this variable is peaked relative to the normal. However, the IFR series is leptokurtic since its distributions is peaked relative to the normal due to its significance probability. Furthermore, the standard deviation values of all the variables except IFR are relatively small means that these variables are not detached significantly from its mean values.

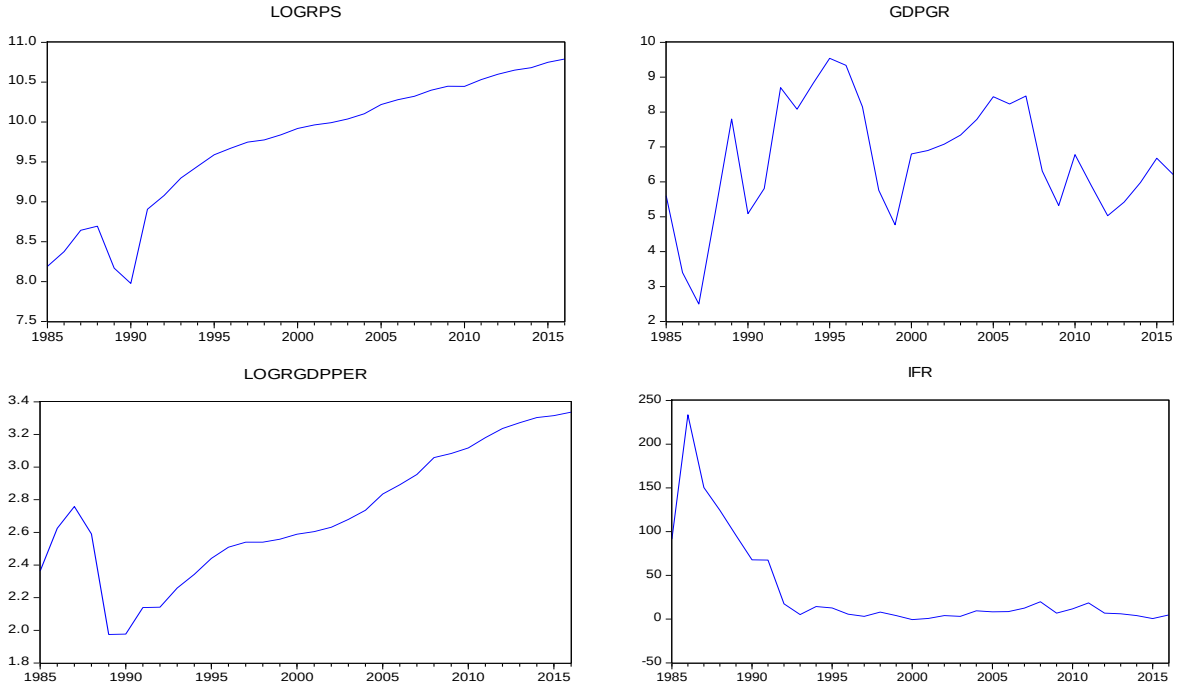
5.2.2. Graphical data analysis

A trend analysis will present to detect the movements in the value of the variables over time and analyze the past trends and the causes of such movements.

Log real private savings (where real private savings is calculated through real GDP) in Figure 5.4 show a mixture of upward and downward trends from 1985 to 2016. More specifically, Vietnam observed an increase in real private savings between 1985 and 1988 as a result of the *Doi moi* (renovation) programs in 1986. Two year later, the Vietnam economy started transform to the market economy; hence, we can see the downward trend in Log real private savings (LogRPS) that was mainly caused by the restructuring of the state-owned enterprises (SOEs), leading to a high unemployment rate and the lower income of the employees, thereby decreasing private savings. The following periods,

Vietnam has experienced the significant upward trend in LogRPS that as a result of the good policies was adopted by the Vietnam government to steer the economic growth as well as create more employment opportunities and increase the income of employees.

Figure 5.4: Trends in the variables in model 2



As for GDP growth rate in Vietnam, there has been a remarkable fluctuation in this indicator. This presents both the upward and downward trends in the period 1985 - 2016. The lowest percentage of GDP growth rate was observed in 1987, one year later Vietnam implemented the *Doi moi* (renovation) programs, which was as a consequence of a prolonged economic crisis resulting from the bureaucratic subsidized centrally-planned mechanism in Vietnam from 1976 to 1985 after the country's reunification. Besides, the highest growth rate of GDP was observed in 1995 and 1996 that was a result of the contributions of past and ongoing reforms, including the issuance and the amendment of Vietnam's laws on state budget, state and non-state enterprises, credits and bank, and domestic and foreign investment, especially was the expansion of trade and financial associations of Vietnam with international communities. Specifically, Vietnam joined in the Association of South-East Asian Nation (ASEAN) and the ASEAN Free Trade Area in 1995, started the normalized relations with the United States as well as reconnected with the International Monetary Fund (IMF) and the World Bank, and implemented the financial liberalization that contributed to the impressive growth of the Vietnam's

economy in this period, more specific, Vietnam was known as a new economic dragon in Southeast Asia (van Donge, White and Nghia, 1999).

Similar to LogRPS, Log real GDP per capita (LogRGDPper) also present both the upward and downward trends from 1985 to 2016. The lowest value was observed in 1989 and 1990 that can be explained by a high growth rate of population in this period. After that, there has a significant upward trend in LogRGDPper and its positive values reflect the economic growth of Vietnam after reforming the economy from the bureaucratic subsidized centrally-planned mechanism to the market economy with a socialist orientation.

Trend in inflation rate have been a mixture of high and low movements for the entire research period. The highest rate of inflation was observed in 1986 - the time Vietnam implemented with a comprehensive economic reform known as *Doi moi* (renovation) program, with 233.54%. The hyperinflation can be explained through two main reasons. Firstly, the consumer goods were produced too little as compared to the demands of the people in the economy in this period. Secondly, the aids from the former Soviet Union and the Socialist countries of Eastern Europe were rapidly reduced and ended in the late 1980s, while the Vietnam's economic growth was low and the state budget deficit was serious. Thus, the Vietnam government had to print more the domestic money to solve the cash shortage problem in the economy in case of the production shortage, and especially in 1985, new bank notes were issued and the exchange rate was 10 old Vietnam dongs for 1 new Vietnam dong. Consequently, the money supply excessed the production, leading to the hyperinflation in Vietnam in 1986, and this issue still continued to occur for 5 years later before decreasing by the control of the Vietnam government (Thanh, 2008).

5.2.3. Unit root tests for the variable in Model 2

The data are plotted above can be used to identify which version exists in the unit root tests. Indeed, as mentioned above, the issue of the classical linear regression model is that it requires all variables to be stationary, if not; it may lead to spurious regression. Thus, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are conducted for each of the variables with a constant term and no trend to check for the stationary of the series as well as answer whether the time series contains unit root or not. The results of these unit root tests will be shown in the following table.

Table 5.14: The results of the ADF and PP unit root tests in Model 2

Variables	ADF value in level form	Critical value	ADF value in first difference	Critical value	Level of integration
LogRPS	-1.058410	-2.967767	-3.430748	-2.976263*	I(1)*
GDPgr	-2.527560	-2.960411	-5.422854	-2.963972*	I(1)*
LogRGDPper	-0.477783	-2.960411	-4.198880	-2.963972*	I(1)*
IFR	-1.889076	-2.960411	-3.247417	-2.967767*	I(1)*
Variables	**PP value in level form**	**Critical value**	**PP value in first difference**	**Critical value**	**Level of integration**
LogRPS	-2.234646	-2.960411	-6.503958	-2.963972*	I(1)*
GDPgr	-2.486374	-2.960411	-5.426175	-2.963972*	I(1)*
LogRGDPper	-0.248386	-2.960411	-4.179944	-2.963972*	I(1)*
IFR	-1.699506	-2.960411	-9.165809	-2.963972*	I(1)*

Source: The results are calculated by author using EViews 8.0 software.

*Note: * denotes the rejection of the null hypothesis of unit root at the 5% significance level. The corresponding critical values for the ADF and PP unit root tests are collected from MacKinnon (1996) one-sided values.*

For the Augmented Dickey-Fuller (ADF) test, the ADF test statistic values of all variables in Model 2, in absolute value, are smaller than its corresponding critical values at the 0.05 significance level at the level form, meaning that all variables are not stationary at their level form. Nevertheless, when conducting the ADF test for each of the variables in the first difference level, the series become stationary. This indicates that all variables are integrated of the same order of one (I(1)) in the ADF test.

Similarly, when comparing the absolute value of the t-statistic for the Phillips-Perron (PP) unit root test with its corresponding critical value for each of the variables in Model 2, this PP test found the presence of stationary in the first difference of four variables at the 5% significance level.

Based on the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, it can be concluded that all four variables in Model 2: LogRPS, GDPgr, LogRGDPper and IFR are not stationary at their level form, but to be integrated by order one (I(1)), thus can be used in the Johansen cointegration test in the next research step.

5.2.4. The Johansen cointegration test for Model 2

5.2.4.1. The selection of the optimal lag length in a cointegrated VAR model

There are only 32 observations and four considered variables in Model 2, thus the unrestricted VAR model is only estimated with all the four variables from the lags 1 to lags 4 to determine the optimal lag length.

In the Table 5.15, LR is sequential modified LR test, FPE is final prediction error, AIC and SC represent Akaike information criterion and Schwarz information criterion. HQ is Hannan-Quinn information criterion.

Table 5.15: AIC and SC for the optimal lag length in unrestricted VAR model 2

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-72.30648	143.3936	0.008715	6.593320	7.544895	6.884226
2	-31.55717	55.30264	0.001610	4.825512	6.538347	5.349143
3	29.44486	65.35932	8.01e-05	1.611082	4.085176	2.367437
4	85.95047	44.39727*	7.10e-06*	-1.282176*	1.953178*	-0.293096*

Source: The results are calculated by author using EViews 8.0 software.

*Note: * indicates lag order selected by the criterion*

Table 5.15 indicates that the optimal lag length for unrestricted VAR model is four, which is determined by both the minimized values of AIC and SC criteria.

5.2.4.2. Trace and Maximum Eigenvalue test statistics

In this part, the Johansen cointegration test is performed with an intercept and no trend model along with (1 3) lag intervals at the 0.05 significance level to identify the number of cointegrating vectors. The results of Trace and Maximum Eigenvalue tests obtained from the Johansen cointegration test is represented in the following table:

Table 5.16: The Johansen cointegration test results for Model 2

Hypothesized No. of CE(s)	Trace Statistic	5% Critical value	Max-Eigenvalue Statistic	5% Critical value
None	134.2667*	47.85613	62.69096*	27.58434
At most 1	71.57576*	29.79707	47.16360*	21.13162
At most 2	24.41216*	15.49471	24.17874*	14.26460
At most 3	0.233418	3.841466	0.233418	3.841466

Source: The results are calculated by author using EViews 8.0 software.

*Notes: * denotes rejection of the null hypothesis of Trace test and Maximum Eigenvalue test at the 5% significance level.*

As seen in Table 5.16, both Trace test and Maximum Eigenvalue test reject the null hypothesis of *no cointegration, at most 1 and at most 2* cointegrations because in these cases, the computed values of both Trace test and Maximum Eigenvalue test are greater than their critical values at the 0.05 significance level. However, we cannot reject the null hypothesis of *at most 3* cointegrations because the computed values of Trace test and Maximum Eigenvalue test at r = 3 are 0.233418 and 0.233418 less than its critical value (3.841466) at the 5% significance level. This also confirms the existence of three cointegrating vectors (or long run relationships) among four I(1) variables at the significance level of 5%. In case of existing the cointegrating vectors among these four variables, the Vector Error Correction Model (VECM) can be then performed to disaggregate the short run dynamic and long run relationships between the variables.

5.2.5. Vector Error Correction Model (VECM) for Model 2

5.2.5.1. The long run relationship (the cointegrating vector) for Model 2

In this step, we estimate the long run regression model between the stationary I(1) variables. The first normalized equation below provides the long run linkage between the dependent variable (LogRPS) and the three explanatory variables (GDPgr, LogRGDPper, and IFR).

Table 5.17: The first normalized long run cointegration equation for Model 2

The dependent variable: LogRPS

Variable	Coefficient	Standard error	t-statistic
Constant	-6.329825	-	-
LogRPS	1.000000	-	-
GDPgr	-0.026492	0.00779	-3.39970
LogRGDPper	-1.276306	0.02884	-44.2620
IFR	0.005905	0.00040	14.9448

Sources: The results are calculated by author using EViews 8.0 software.

The cointegrating (long run) relationship results given in Table 5.17 can be rewritten in the regression model as follows:

*LogRPS = -0.026*GDPgr - 1.276*LogRGDPper + 0.006*IFR – 6.33*

The results given in Table 5.17 indicate two significant negative long run associations of GDPgr and LogRGDPper with LogRPS and one positive relationship between IFR and LogRPS in Vietnam. Specifically, the impact of GDP growth rate (GDPgr) on private savings (LogRPS) was found to yield a significant negative result at the 5% significance level. A 1% increase in GDP growth rate (GDPgr) will cause a reduction in private savings by 2.6% in Vietnam. On the other hand, the negative, but statistically significant expected sign of the coefficient of GDP growth rate (GDPgr) in the long run implies that GDP growth rate is one of the important factors determining private savings in Vietnam in the future. This negative relationship between GDP growth rate and private savings in Vietnam is not consistent with the Life Cycle Hypothesis of Modigliani (1970), which predicts that the higher economic growth, firstly, will lead to an increase in the income per capita and then cause an increase in the savings. In the context of Vietnam, as General Statistics Office of Vietnam (GSO) (2011) reported, Vietnam is now in the period of "golden population structure" or the period of "population bonus" where having the highest ratio of working age population than ever as well as a rapid decline in the dependency ratio. This optimal population structure brings significant advantages and has contributed to the fast growth of the Vietnam economy in recent times and will last for 30 - 40 years. As a result of the economic growth in Vietnam, the working age adults will receive the higher income or the higher GDP per capita growth (Long and Toan, 2015). According to the Life Cycle Hypothesis, people tend to save more as the income grows, thereby leading to an increase in their savings. If the Life Cycle Hypothesis exists in the context of a country, the economic growth brings the higher income growth that will definitely increase private savings, in other words, there would be a positive correlation between GDP growth and private savings. However, in Vietnam, we found a negative long term impact of GDP growth rate on private savings level, which is association with the Permanent Income Hypothesis of Friedman (1957). The fact can be explained that perhaps as a result of the remarkable economic growth of Vietnam and its bright prospect in the future, the working age people expects to have higher their future income than current income that makes them more confident in consumption, thus resulting in a decline in their savings.

The negative long run association of economic growth (which is represented by GDP growth rate) with private savings in Vietnam contradicts with almost previous studies of Jappelli and Pagano (1996), Gavin, Hausmann and Talvi (1997), Sinha and Sinha (1998), Saltz (1999), Kraay (2000), Mahambare, Balasubramanyam (2000), Agrawal (2000), Sahoo, Nataraj and Kamaiah (2001), Anoruo and Ahmadi (2001), the habit persistence theory of Carroll (2002), Krieckhaus (2002), Sandilands and Chandra (2003), Baharumshah et al. (2003), Sajid and Sarfraz (2008), Waithima (2009), Nurudeen (2010), Ramesh (2011) and Aswini and Mohit (2012). These studies affirmed that a faster growth rate of GDP causes the higher private savings. Furthermore, Agrawal (2000) used changes in the dependency ratio in the population to explain the positive long run relationship between GDP growth rate and private savings. He explained that for an ageing society, there would be a sharp decline in dependency ratio, meaning that the savings of the working age people in the households will significantly increase, thereby bringing a rise in private savings in the economy.

Similarly, a high negative coefficient for LogRGDPper of 1.276 in the regression model signifies a strong negative impact of real GDP per capita (LogRGDPper) on real private savings (LogRPS) in Vietnam whereby a 1% increase in GDP per capita will lead to an increase in private savings in Vietnam by 1.28%. The statistically significant expected sign of the coefficient of LogRGDPper also implies that GDP per capita is another important factor in determining private savings in Vietnam. Furthermore, the significant negative correlation between GDP per capita and private savings in Vietnam is also explained by the Permanent Income Hypothesis of Friedman (1957) whereby the Vietnamese people expect higher future income than current income as a result of the economic growth prospect of Vietnam in the future that makes them more confidence in consumption, thereby leading to decreasing private savings. Moreover, this negative relationship between GDP per capita (or income) and private savings in Vietnam is similar to the research results of Carroll and Weil (1994) for 64 countries, Jappelli and Pagano (1996) in the case of Italy and Kraay (2000) in the case of China. These authors were also in favor of the Permanent Income Hypothesis of Friedman (1957) and explained this negative relationship that the higher growth rate of the economy would bring a higher increase in the permanent income of an individual as compared to an increase in his or her current income, resulting in a higher consumption and thus depressing private savings as well as the aggregate saving in the economy. On the other

hand, the significant long run negative association of the income or GDP per capita with private savings in Vietnam contradicts with the studies of the World Bank (1993) and Loayza, Schmidt-Hebbel and Serven (2000) for developing countries where the social insurance system is weak for retirees who known as net borrowers in the economy. Loayza, Schmidt-Hebbel and Serven (2000) favored the opposite viewpoint that the higher income as a result of the economic growth makes people saving easier and thus save more that contributes to the capital accumulation for the economy, which in turn to promote the economic growth further (Horioka and Terada-Hagiwara, 2012).

On the contrary, a small positive coefficient of IFR of 0.006 indicates that inflation rate has a small, positive influence on real private savings (LogRPS). It can be deduced that in the long run, a 1% increase in inflation rate (IFR) will only increase private savings in Vietnam by 0.6%. The positive correlation between inflation rate and private savings was found in long run in Vietnam is similar to the research results of Deaton (1977), Chopra (1988), Loayza, Schmidt-Hebbel and Serven (2000) for developing countries and Gavin, Hausmann and Talvi (1997) for six East Asian fast growing economies and twenty Latin American countries. All these studies confirmed a positive impact of the inflation rate on private savings and explained that the higher inflation rate, which is known as the higher level of uncertainty arises in the economy, encourages the individuals to save more as a precaution to overcome the future financial difficulties. In order to understand more the positive association between inflation rate and private savings in Vietnam, we also use the explanation relating the meaning of the opportunity cost of holding money. As mentioned above, the reason of negative linkage between inflation rate and private savings is that the inflation is considered as the opportunity cost of holding money, meaning that an increase in the inflation rate leads to increasing the opportunity costs of holding money and raising the benefits of spending and consumption, thereby declining private savings. However, it could be concluded that the effect of inflation on the individual's savings behavior regarding to the opportunity cost of holding money did not exist in the context of Vietnam, more specific, Vietnamese customers might misunderstand the true meaning of the opportunity costs of holding money relating to inflation in the economy, thus an increase in inflation rate would not affect their consumption behavior; meanwhile, due to the existence of individual's precautionary savings behavior, a higher inflation rate occurred in the economy would lead to a higher private savings rate in Vietnam as a reaction of people in response to this uncertainty regarding the future income. Furthermore, Carroll (1992)

favored the role of the precautionary savings in explaining the positive impact of the uncertainty on private savings, especially for an ageing society. Carroll (1992) revealed that the older population tends to save more as a precaution against possible adverse changes in their income resulting from the uncertainty in life, such as a higher inflation in the economy and the unexpected living costs and healthcare expenses for a longer life, thus leading to an increase in private savings in the economy. To sum up, in case of Vietnam, the precautionary savings in response to the uncertainty regarding the future income and maybe the misunderstanding of the individuals regarding to the true meaning of opportunity cost of holding money are the essential reasons to explain why private savings does not fall with a higher inflation rate in the economy.

In general, these findings did not provide the expected outcome as well as rejected Hypothesis 3 of a significant, positive long term impact of GDP growth rate, GDP per capita and inflation rate on private savings in Vietnam.

5.2.5.2. Short run analysis: A dynamic Error-Correction Model for Model 2

Although the Johansen cointegration tests suggested that three cointegrating relationships exist among the analysed variables, for the purpose of my study only the first cointegration relating the private savings to the macroeconomic variables (economic growth) in Vietnam is relevant, the Vector Error Correction Model (VECM) will be performed with one cointegrating vector to detect the short run dynamics between these variables as well as answer whether the short run dynamics are affected by the estimated long run equilibrium relationship. And if does, the Pair-wise Granger Causality and Block Exogeneity Wald tests are employed to discover and analyze the direction of causality between the variables in Vietnam. Table 5.18 presents the results of the dynamic error-correction model.

Table 5.18: The results of the short run Vector Error Correction for Model 2

Dependent Variable: D(LogPSR)

Variables	Coefficient	Standard error	t-statistic	Prob.
D(LogRPS(-1))	-0.420474	0.207613	-2.025276	0.0623
D(LogRPS(-2))	0.366482	0.160059	2.289674	0.0381
D(LogRPS(-3))	0.046645	0.179643	0.259655	0.7989
D(GDPgr(-1))	-0.004270	0.007225	-0.591014	0.5639
D(GDPgr(-2))	-0.008794	0.007405	-1.187670	0.2547
D(GDPgr(-3))	-0.000169	0.007569	-0.022351	0.9825
D(LogRGDPgr(-1))	1.302612	0.199744	6.521415	0.0000
D(LogRGDPgr(-2))	-1.127129	0.272144	-4.141662	0.0010
D(LogRGDPgr(-3))	-0.534451	0.502559	-1.063459	0.3056
D(IFR(-1))	0.000172	0.002113	0.081250	0.9364
D(IFR(-2))	0.000635	0.001828	0.347543	0.7334
D(IFR(-3))	-0.001449	0.001020	-1.419946	0.1775
Constant (C)	0.094120	0.026267	3.583173	0.0030
ECT	-0.251288	0.171235	-1.467504	0.0164
ECT1	-2.233253	5.534747	-0.403497	0.6927
ECT2	0.335561	0.207251	1.619105	0.1277
ECT3	64.55253	32.74664	1.971272	0.0688
R-squared: 0.987807		F-statistic: 87.24354		
Adjusted R-squared: 0.976484				

Source: The results are calculated by the author using Eviews 8.0 software.

Based on the results of a VECM with the dependent variable (D(LogPSR)) given in Table 5.18, the Vector Error Correction Model (VECM) equation is rewrite as follows:

D(LogRPS) = -0.251*[LogRPS(-1) + 0.026*GDPgr(-1) + 1.276*LogRGDPPER(-1) - 0.006*IFR(-1) - 6.33] + C(2)*D(LogRPS(-1)) + C(3)*D(LogRPS(-2)) + C(4)*D(LogRPS(-3)) + C(5)*D(GDPgr(-1)) + C(6)*D(GDPgr(-2)) + C(7)*D(GDPgr(-3)) +

$$C(8)*D(LogRGDPper(-1)) + C(9)*D(LogRGDPper(-2)) + C(10)*D(LogRGDPper(-3)) + C(11)*D(IFR(-1)) + C(12)*D(IFR(-2)) + C(13)*D(IFR(-3)) + 0.094 + \varepsilon_t$$

Where:

$$ECT = \mu_{t-1} = LogRPS(-1) + 0.026*GDPgr(-1) + 1.276*LogRGDPper(-1) - 0.006*IFR(-1) - 6.33$$

The ECT, ECT1, ECT2 and ECT3 show the short run ability of private savings, GDP growth rate, GDP per capita and inflation rate to return its long run equilibrium position.

In Table 5.18, the estimated value for the coefficient of the error correction term (ECT) of the estimated private savings equation (D(PSR)) is both statistically significant and negative, which confirms the ability to act properly to correct any disequilibrium in the short run. Specifically, the coefficient of the error correction term (ECT) is (-0.251), which implies that 25.1% of previous period deviation of LogRPS from equilibrium resulting from change in the explanatory variables is corrected in the current time. In other words, the dependent variable LogRPS can return back to its long run equilibrium position at the speed of adjustment 25.1% within a year. Nonetheless, the coefficients of ECT2 and ECT3 for the estimated GDP per capita equation and inflation rate equation are positive and not statistically significant representing by its higher p-value than a 0.5 level of significance, which imply that any disequilibrium in the Log real GDP per capita and inflation rate variables continues to grow. Besides, although the estimated value of the coefficient of the error correction term (ECT) of the estimated GDP growth rate equation D(GDPgr) is negative, but not statistically significant because its p-value is more than a 0.5 level of significance. This also means that three variables GDPgr, LogRGDPper and IFR does not have the short term ability to correct any disequilibrium of these variables resulting from changes in the explanatory variables toward its equilibrium position.

Furthermore, the lagged coefficients with different estimated values and signs of only Log real GDP per capita (D(LogRGDPper)) can capture the short term influences of these variables on the dependent variable (D(LogRPS)). In other words, the lags of D(LogRGDPper) has a significant short term impact on and can explain changes in the lag of Log real private savings (D(LogRPS)). Specifically, the coefficient value of the first lag of D(LogRGDPper) is positive and significant at the 5% significance level, meaning that in the short run a 1% increase in the first lag of D(LogRGDPper) leads to an increase in the lag of LogRPS by 1.3%. This also suggests that a 1% increase in the GDP per capita in previous year brings a 1.3% increase in private saving in the current year. On the other hand, the

coefficient values of the second lag of D(LogRGDPper) is significant and negative, indicating that there is a negative correlation between the second lag of D(LogRGDPper) and the lag of Log real private savings (D(LogRPS)). A 1% increase in the second lag of D(LogRGDPper) causes a decline in the dependent variable (D(LogRPS)) by 1.12%. The findings in a VECM regarding the short run linkage between GDP per capita and private savings in Vietnam is in favor of the Life Cycle Hypothesis of Modigliani (1970) in the first lag that in case of the higher income (the higher GDP per capita), the working age adults have higher income and save more in relation with the dissaving of the elderly population, thereby leading to an increase in private savings, but also is consistent with the Permanent Income Hypothesis of Friedman (1957) in the second lag whereby as the income grows, people will receive a higher income compared to their current income and will be richer, thus increasing their consumption as well as depressing their savings.

In the overall VECM results, the value of R-squared of 0.988 in a VECM means that 98.78% of variation in D(LogRPS) in Vietnam can be explained by variation in D(GDPgr), D(LogRGDPper) and D(IFR). The value of F-statistic of 87.24 is high, indicating that the overall model is statistically significant at the significance levels.

To sum up, conducting the VECM procedure yields mixed results of the short term significant impact of GDP per capita on private savings and no influence of GDP growth rate and inflation rate on private savings indicating that Hypothesis 3 of a significant short run impact of GDP growth rate, GDP per capita, inflation rate on private savings is not supported in Vietnam.

5.2.6. Granger causality test for Model 2

5.2.6.1. The Pair-wise Granger Causality test

The Pair-wise Granger Causality test is then applied to investigate whether the causal relationship exists or not and the direction of causality between private savings and the explanatory variables in the short term.

The results of the Pair-wise Granger Causality test given in Table 5.19 indicate two bidirectional relationships between LogRGDPper and LogRPS, and between IFR and LogRPS, and the unidirectional causality running from LogRPS to GDPgr, while the causality running from GDP growth rate (GDPgr) to private savings (LogRPS) does not exist in the context of Vietnam in the short term at the 5% significance level.

Table 5.19: The Pair-wise Granger Causality test results for Model 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GDPgr does not Granger Cause LogRPS	29	2.73931	0.0677
LogRPS does not Granger Cause GDPgr		3.94375	0.0216
LogRGDPper does not Granger Cause LogRPS	29	33.6417	2.E-08
LogRPS does not Granger Cause LogRGDPper		6.67558	0.0023
IFR does not Granger Cause LogRPS	29	10.3031	0.0002
LogRPS does not Granger Cause IFR		4.74115	0.0107

Sources: the results are calculated by author using EViews 8.0 software.

These results also imply that in the short run private savings is an important factor contributing to the economic growth in Vietnam, which is in favor of the neoclassical growth model where savings contributed to a higher capital accumulation for the faster economic growth. The causality running from private savings to GDP growth is also found by Krieckhaus (2002) for 32 developing countries, Anderson (1999), Sajid and Sarfraz (2008) in the case of Pakistan, Ramesh (2011) and Aswini and Mohit (2002) in the case of India. They agreed that a higher level of savings leads to a higher level of investment and thus contributed to a higher rate of economic growth in these developing countries. Furthermore, the finding of the short run significant effect of GDP per capita (LogRGDPper) on private savings (LogRPS) in the Pair-wise Granger Causality test is similar to the result of the correlation between these two variables in the VECM.

5.2.6.2. VEC Granger Causality/Block Exogeneity Wald test

Table 5.20 presents the results of the VEC Granger Causality/Block Exogeneity Wald test, which aims to examine whether the lags of the excluded variable have any effect on the dependent variable.

In the Block Exogeneity test, D(LogRPS) is the dependent variable, the remaining variables are the lagged excluded variables. The results obtained in Table 5.20 confirm the causality between the lags of two excluded variables D(LogRGDPper), D(IFR) and D(LogRPS) at the 0.05 significance level, while there is not a causality between the lags of the excluded variables D(GDPgr) and D(LogRPS) in Vietnam. These findings mean that in the short run there exists a causality running from GDP growth and from inflation rate to

private savings, which is similar to the results in the Pair-wise Granger Causality test, but does not correspond to the short run results in a VECM.

Table 5.20: The results of VEC Granger Causality/Block Exogeneity test for Model 2

Dependent variable: D(LogRPS)			
Excluded	**Chi-sq**	**df**	**Prob.**
D(GDPgr)	2.080839	3	0.5558
D(LogRGDPper)	296.4217	3	0.0000
D(IFR)	19.02851	3	0.0003
All	836.8015	9	0.0000

Sources: the results are calculated by author using EViews 8.0 software.

Furthermore, in terms of the joint block exogeneity test, the Chi-square statistic value (χ^2) is significant at the 0.05 significant level, meaning that the lags of all the excluded variables D(GDPgr), D(LogRGDPper) and D(IFR) may influence the endogenous variable D(LogPSR). This finding confirms the existence of the short run impact of all the lags of three excluded variables on D(LogPSR). This also provides valuable information confirming Hypothesis 4 that the direction of causality runs from GDP growth rate, from GDP per capita, and from inflation rate to private savings in Vietnam. Besides, the joint block exogeneity test result suggests that the relationship among all the considered variables may be valid in the long run. In other words, beside two variables LogRGDPper and IFR, GDPgr may still have an influence on D(LogRPS) in Vietnam in the long run.

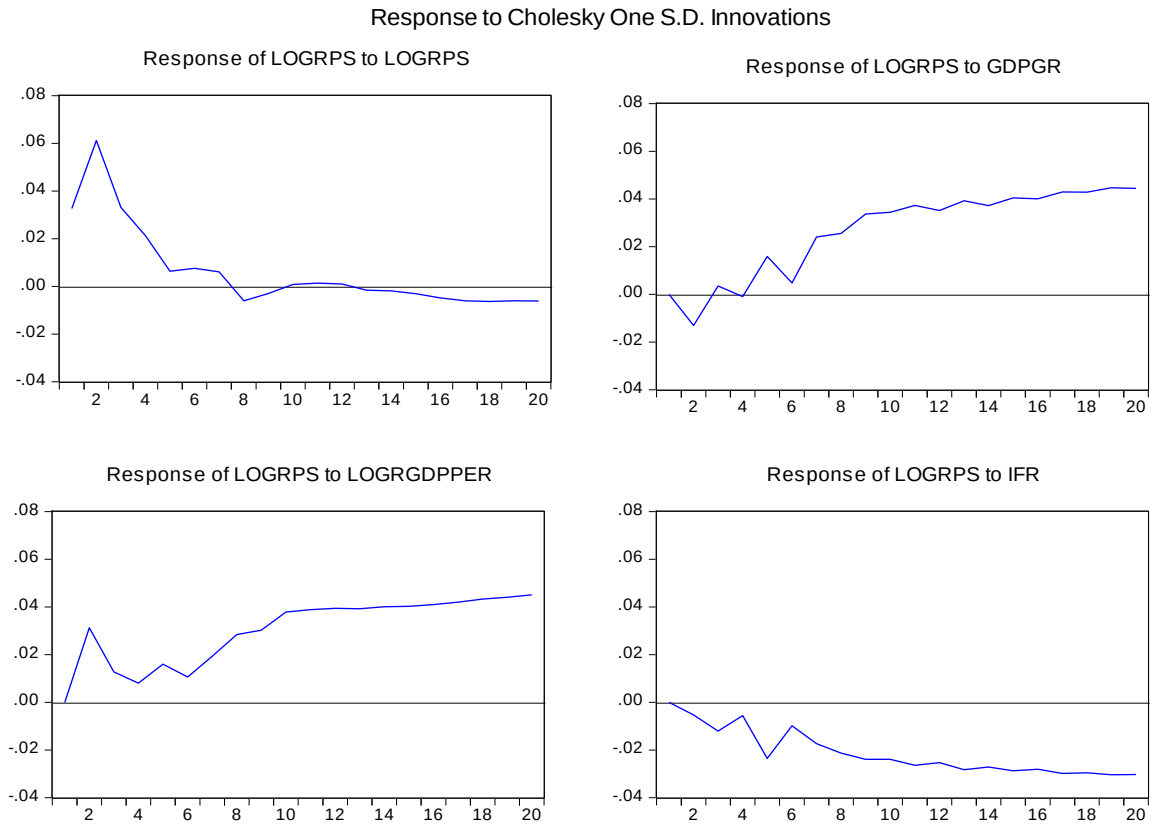
In regards to Hypothesis 5, the results obtained in the VECM model relating to the relationship between the youth dependency ratio, the elderly dependency ratio, life expectancy, social insurance funds rate and private savings rate confirm as well as are consistent with the Life Cycle Hypothesis in the cultural peculiarities of Vietnam, while the findings in Model 2 regarding the relationship between GDP growth rate, GDP per capita, inflation rate and private savings reject Hypothesis 5, in other words, these findings does not work well under the Life Cycle Hypothesis in the case of Vietnam.

5.2.7. Impulse response function and variance decomposition for Model 2

The impulse response results indicates that the response of LogRPS to its own innovations is significant positive from the period 1 to period 2, after that, a significant decline does

occur over time. The reason for LogRPS responding in this way is possible that private savings in this study is calculated through the national accounts identities and in relation with government savings. However, the budget deficit of Vietnam has occurred for a long time and it will continue to happen in the near future that will affect the confidence of private investors and savers, leading to a decrease in private savings in the future. Similarly, the response of LogRPS to a shock in inflation rate is fluctuated from the period 1 to period 6, and then will decrease significantly over time. On the contrary, the responses of LogRPS to a shock in GDPgr and a shock in LogRGDPper seem to be a positive. Between the period 1 and period 6, we can see the mixed results of an increase and a decrease in the response of LogRPS, but after that, the obvious upward trend of the response of LogRPS regarding to a shock in GDPgr and LogRGDPper are observed.

Figure 5.5: Impulse response function for Model 2



With regards to the variance decompositions as given in Appendix 2, 100% of the variation in LogRPS is due to changes in LogRPS alone in period one. At the period two, the variation of LogRPS is mainly attributed to changes in its own innovations (86.48%) and LogRGDPper (12.97%). Nevertheless, from the period 3, the variation of LogRPS is mainly attributed to changes in its own innovations (69.66%), GDPgr (22.38%) and

LogRGDPper (7.7%). In period 20, the variation of LogRPS is a result of 71.78% change in its own shocks and 23.84% and only 3.27% changes in GDPpr and LogRGDPper respectively. In general, it can be concluded that the economic growth (GDPgr) and income level (LogRGDPper) seem to explain a large proportion of private savings than inflation rate does (IFR), suggesting that the influences of the economic growth rate and income level on private savings in Vietnam may have significant in the future.

5.2.8. Diagnostic tests for the residuals in the dynamic VECM2

Some diagnostic tests are conducted for the residuals in the dynamic VECM to check for the reliability of the residuals. The results of diagnostic tests are shown in Table 5.21 and Figure 5.6 below.

Table 5.21: The results of diagnostic tests for the residuals in the VECM 2

Test	**The Null Hypothesis**	**F-Statistic**	**Prob. Chi-square**
Jarque-Bera	Normally distributed	2.548512	0.279639
White Heteroscedasticity with no cross terms	No heteroscedasticity	0.451925	0.9991
ARCH	No ARCH effect (no heteroscedasticity)	0.970460	0.3849
Breusch-Godfrey serial correlation LM test	No serial correlation	0.852879	0.1522

Sources: The results are calculated by author using EViews 8.0 software.

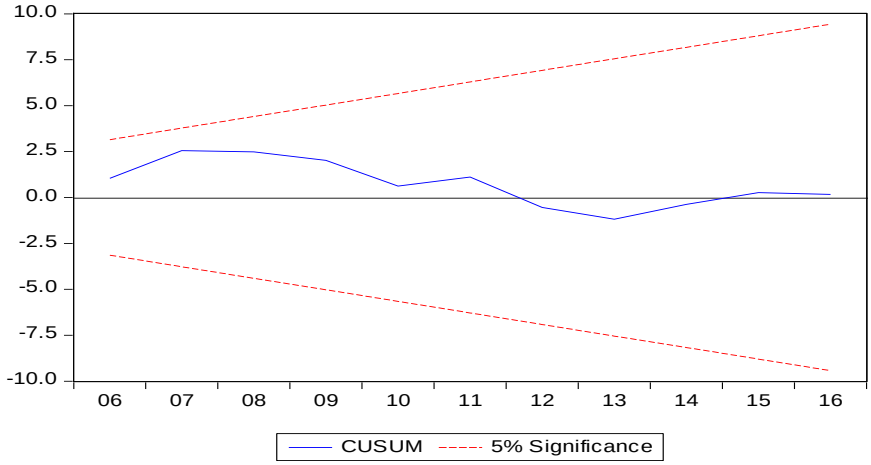
The p-value for Jarque-Bera test is 0.279 greater than all the significance levels, suggesting that the null hypothesis of normally distribution is accepted. This means that the residuals of the dynamic VECM2 are normally distributed at all the significance levels.

The Prob. Chi-square values of White Heteroscedasticity and ARCH tests are 0.999 and 0.385 respectively that are greater than all the significance levels, thus we cannot reject the null hypothesis of no heteroscedasticity at any levels of significance. This means that the residuals of the dynamic VECM have not met heteroscedasticity problem.

The Prob. Chi-square value of Breusch-Godfrey serial correlation LM test with lags 3 is 0.152 greater than all the significance levels, indicating that the null hypothesis of no serial

correlation at lag order 3 is accepted. Thus, there is no serial correlation in the residuals of the dynamic VECM.

Figure 5.6: The stability of the residuals in Model 2



The graph in Figure 5.6 is in the red borders, indicating that CUSUM test confirms the stability of the residuals in the regression model 2.

To sum up, the testing results obtained from diagnostic tests confirm the reliability of the residuals of the dynamic VECM2 that can be relied upon to produce the best linear unbiased estimators of the OLS regression model for Model 2.

5.3. Summary

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests indicated that the considered variables are non-stationary in level form, but become the stationary in the first difference (I(1)). After that, the Johansen cointegration test found four cointegrating vectors in Model 1 and three cointegrating vectors in Model 2. Since the existence of cointegrating (long run) relationships among the stationary variables (I(1)), a VECM is performed between private savings and the explanatory variables.

The VECM results reveal that in Model 1, there exists the long run equilibrium relationship between population ageing, which is represented by the child dependency rate (YDR), the elderly dependency rate (ODR), life expectancy (LFE) and social insurance funds rate (SIF) and private savings rate (PSR) in Vietnam, but the evidence for the short run correlation and the direction of the causality between private savings rate and the explanatory variables was not found in Vietnam. Specifically, all the variables: the youth dependency rate, the elderly dependency rate, life expectancy and social insurance funds rate have statistically significant and negative impacts on private savings rate in Vietnam

in the long run. The finding of the significant negative long run associations of the youth dependency ratio and the aged dependency ratio with private savings rate in Vietnam is consistent with the Life Cycle Hypothesis of Modigliani (1970) and conforms to a priori expectations. According the Life Cycle Hypothesis of Modigliani (1970), the aged tends to consume more for their lives in relation with a lower income after retirement, thus the higher rate of the elderly population is, the lower private savings rate the aged saves. Indeed, for the minors (aged below 14), they do not have income, and their consumption depends entirely on the income of the working age adults in the households, thus the higher rate of the minors to the working age population (aged 15-60) will lead to a reduction in private savings rate. This negative relationship was also found by most recent studies, including the study of Horioka (1997) in the case of Japan, Thornton (2001) in the case of the United States, and Modigliani and Cao (2004) in the case of China.

The negative long run influence of life expectancy on private savings rate in Vietnam favors the standard life cycle theory and similar to the study of Bloom et al. (2007). According to the standard life cycle theory, the retirees are living in the second period of the life cycle or the retirement period, thus their saving behavior is negatively affected, and the Vietnamese seniors tend to save less during this period. This implies that a longer life expectancy reduces the savings at older ages, thereby leading to a decrease in private savings in general. Additionally, the negative linkage between an increase in life expectancy and private savings rate in Vietnam is caused by the weak incentives from underdeveloped social security and private insurance systems in Vietnam along with the weak motivations of the Vietnamese elderly for savings accumulation for their retirement period and for living longer because it was difficult for them to save for the future in the case of they were living in low income and poor living standards.

Likewise, the social insurance funds rate has a negative long run influence on private savings rate in Vietnam, which is in accordance to the asset substitution effect of the Feldstein's life cycle savings theory (1974). This can be explained that pensions is considered as a substitute of income, as a result of the development of Vietnam's pension scheme, the employees believe that they will receive higher pension benefits from the public pension scheme after retirement, which makes them reduce their savings during their working lives.

Regarding the VECM dynamics results, the coefficient of the error correction term (ECT) for the estimated private savings rate equation (D(PSR)) is statistically significant, the coefficients of the error correction terms of other explanatory variable equations are not meaningful. In addition, the VECM results indicate that there are three negative short run correlations between D(YDR), D(ODR) and D(SIF) on D(PSR), while D(LFE) does not have a short term effect on D(PSR), implying that in the short run private savings rate is non-responsive to life expectancy in Vietnam. However, the Pair-wise Granger Causality test results show that there is no meaningful Granger causality present between private savings rate and the explanatory variables. On the other hand, the Block Exogeneity test results confirm that in the short run there exists a causality running from the young age dependency rate (YDR), the old age dependency rate (ODR) and social insurance funds rate (SIF) to private savings rate in Vietnam, which is in contradiction to the Granger Causality test results, but correspond to the short run dynamic VECM results.

With regards to Model 2 investigating the impact of economic growth on private savings (LogRPS) in Vietnam, the VECM results indicate that there exists both the short run dynamic and the long run equilibrium relationships between private savings (LogRPS) and the explanatory variables (include GDR growth rate (GDRgr), Log real GDP per capita (LogRGDPper) and inflation rate (IFR)). Specifically, as for the long run relationship among the considered variables, we found two significant negative long run associations of GDPgr and LogRGDPper with LogRPS and one significant positive correlation between IFR with LogRPS in Vietnam.

The negative long run correlation between GDP growth rate and private savings in Vietnam is in favor of the Permanent Income Hypothesis of Friedman (1957), but in fact, Permanent Income Hypothesis is an Life Cycle Hypothesis with infinite life span, whereby as a result of the remarkable economic growth of Vietnam and its bright prospect in the future, the working age people expects to have their higher future income than current income that makes them more confident in consumption, thus resulting in a decline in their savings. Similarly, in the long run GDP per capita growth significantly negative affects private savings in Vietnam. This result is also consistent with the Permanent Income Hypothesis of Friedman (1957) and can be explained that the higher growth rate of the economy will lead to a higher increase in the permanent income of an individual as compared to an increase in his or her current income, resulting in a higher consumption

and thus depressing private savings. By contrast, the inflation rate refers to the higher level of uncertainty in the economy has a positive long run impact on private savings in Vietnam, which is explained by the precautionary savings behavior of the Vietnamese individuals. More specifically, an increase in the inflation rate encourages the individuals to save more as a precaution to overcome the future financial difficulties.

Unlike the VECM dynamic findings, the Pair-wise Granger Causality test found two bidirectional relationships between LogRGDPper and LogRPS, and between IFR and LogRPS, and the unidirectional causality running from LogRPS to GDPgr, while the causality running from GDP growth rate (GDPgr) to private savings (LogRPS) does not exist in the context of Vietnam in the short term. This also means that in the case of Vietnam, private savings is an important factor contributing to the Vietnam's economic growth, which is in favor of the neoclassical growth model where savings played an vital role contributing to a higher capital accumulation for the faster economic growth. Similar to the Pair-wise Granger Causality test, the Block Exogeneity test confirm two causal relationships between the lags of two excluded variables D(LogRGDPper) and and D(IFR) and D(LogRPS). Furthermore, when considering the joint block exogeneity test in the Block Exogeneity test, we found that the lags of all the excluded variables D(GDPgr), D(LogRGDPper) and D(IFR) may influence the endogenous variable D(LogPSR), suggesting that the causality among all the variables may be valid in the long run. In other words, all three variables LogRGDPper and IFR, GDPgr may still have an influence on D(LogRPS) in Vietnam in the long run.

The testing results obtained from diagnostic tests: Jarque-Bera test for the normality, White and ACRH tests for heteroscedasticity and the VEC residual LM test for the serial correlation and CUSUM test for the stability in Model 2 confirmed the reliability of the residuals of the dynamic VECM that can be relied upon to produce the best linear unbiased estimators of the OLS regression model for the research.

CHAPTER 6 CONCLUSION AND POLICY IMPLICATIONS

The chapter presents a brief summary of the research and conclusions, then suggests policy implications to spur private savings in Vietnam through taking advantage of the golden population structure period, limiting the impact of dependency ratio, offering the attractively beneficial programs for the older people as well as reforming the pensions system, encouraging the economic growth while keeping the inflation rate under the control. Finally, this chapter discloses the limitations of the study and areas for further research.

6.1. Summary of the study and conclusion

The main purpose of the research is to investigate the impacts of population ageing and economic growth on private savings in Vietnam within the Life Cycle Hypothesis framework. Specifically, the research aims to determine whether the short run and the long run relationships between population ageing, economic growth and private savings exist in Vietnam, and if does, which is the direction of the causal relationship. Furthermore, the research tests whether the Life Cycle Hypothesis holds in Vietnam, where the Life Cycle Hypothesis may be less likely to apply due to its cultural peculiarities.

This research used seven explanatory variables (including four demographic variables: the young age dependency ratio (YDR), the old age dependency ratio (ODR), life expectancy (LFE) and social insurance funds rate (SIF) representing for the population ageing and three macroeconomic variables: GDP growth rate (GDPgr), GDP per capita (GDPper) and inflation rate (IFR) representing for the economic growth) as the important factors determining private savings (PS) to discover its impacts on private savings in Vietnam. Time series data used for the analysis was collected from the annual Statistical Yearbook of Vietnam over the period 1985 to 2016 (the period after Vietnam implemented a comprehensive economic reform known as *Doi moi* (renovation) program), in which private savings in Vietnam is calculated through the national accounts identities.

From both theoretical and empirical aspects, there was no robust consensus on the existing studies regarding to the linkages between population ageing, economic growth and private savings. Moreover, until now, no empirical study was conducted to examine both the short run and the long run relationships between the demographic, macroeconomic variables (population ageing and economic growth) and private savings in Vietnam. As a result, the research on the impacts of population ageing, economic growth on private savings in Vietnam was performed to fill the previous research gap related to this issue in Vietnam.

Following Long and Toan (2015) results that changes in population age structure has a significant positive effect on the Vietnam's economic growth. I organized my investigation into two separate models: one for investigating the impact of population ageing on private savings, another for testing the influence of economic growth on private savings in Vietnam.

The analysis of the study started with the presentation of descriptive statistics and graphical analyses of the considered variables. Preliminary data analysis showed that the variables used in the empirical analysis are all integrated to the first order, so a cointegration-error correction model, in the form of Vector Error Correction Model (VECM) seemed to be the appropriate tool for analyzing the relationship of the variables. Although the Johansen cointegration tests suggested that several cointegrating relationships (long run equilibrium relationships) exist among the analyzed variables, for the purpose of my study only the first cointegration was relevant. It relates the private savings to the demographic and macroeconomic variables (population ageing and economic growth) in Vietnam. The VECM model also allowed for the analysis of the short run dynamics around the equilibrium path. Then, the Pair-wise Granger Causality test and the VEC Granger Causality/Block Exogeneity Wald test were employed to further examine the direction of causality between the considered variables in the two models in Vietnam.

The VECM findings revealed that in Model 1, there exists the long run equilibrium relationship between population ageing, which is represented by the children dependency rate (YDR), the elderly dependency rate (ODR), life expectancy (LFE), social insurance funds rate (SIF) and private savings rate (PSR) in Vietnam. Specifically, all the variables: the children dependency rate, the elderly dependency rate, life expectancy and social insurance funds rate have statistically significant and negative impacts on private savings rate in Vietnam in the long run. The significant negative long run associations of the youth dependency ratio and of the old age dependency ratio with private savings rate in Vietnam are in line with the Life Cycle Hypothesis of Modigliani and conform to a priori expectations. Modigliani (1970) explained that the aged tends to consume more for their lives in relation to a lower income after retirement, thus the higher the elderly rate is, the lower private savings rate the aged saves. Indeed, for the minors (aged below 14), they do not have income, and their consumption depends entirely on the income of the working age adults in the household, thus the higher rate of the minors to the working age population

(aged 15-60) will lead to a reduction in private savings rate. Furthermore, in Vietnam, the substantial decline of the youth dependency ratio coupled with a practical stagnation of the old age dependency ratio resulted in a relatively high savings and high growth in the past, but as the decline of the child dependency ratio is likely to be much slower, while the elderly dependency ratio will tend to increase, the economic growth is likely to slow down as the households start to deplete the savings pool. This negative correlation was also found by most recent studies, including the study of Horioka (1997) in the case of Japan, Thornton (2001) in the case of the United States, and Modigliani and Cao (2004) in the case of China. Nonetheless, I could not find significant short run relationship between private savings and the demographic situation; it most probably is due to the small sample size and to the fact that only annual observations are available.

The negative long run influence of life expectancy on private savings rate in Vietnam favors the standard life cycle theory and similar to the study of Bloom et al. (2007). According to the standard life cycle theory, the retirees are living in the second period of the life cycle or the retirement period, thus their saving behavior is negatively affected, and the Vietnamese seniors tend to save less during this retirement period. This means that a longer life expectancy reduces the savings at older ages, thereby leading to a decrease in private savings in general. Additionally, the negative linkage between an increase in life expectancy and private savings rate in Vietnam was caused by the weak incentives from underdeveloped social security and private insurance systems in Vietnam along with the weak motivations of the Vietnamese elderly for savings accumulation for their retirement period because it is difficult for them to save for the future in case of living in the low income and poor living standards.

Likewise, the social insurance funds rate has a negative long run influence on private savings rate in Vietnam, which is in accordance to the asset substitution effect of the Feldstein's life cycle savings theory (1974). This can be explained that pensions is considered as a substitute of income, as a result of the development of Vietnam's pension schemes, the employees know that they will receive higher pension benefits from the public pension scheme after retirement, which makes them reduce their savings during their working life.

Regarding the dynamic VECM results in Model 1, the coefficient of the error correction term (ECT) for the estimated private savings rate equation (D(PSR)) is statistically

significant, showing that the cointegrating relationship indeed represents an equilibrium path among savings and the demographic variables. Indeed, the dynamic VECM results indicate that there are three negative short run correlations between the lags of the youth dependency ratio (D(YDR)), the elderly dependency ratio (D(ODR)) and social insurance funds rate (D(SIF)) on the lag of private savings rate (D(PSR)), while the lags of life expectancy (D(LFE)) does not have a short term effect on the lag of private savings rate (D(PSR)), implying that in the short run private savings rate is non-responsive to life expectancy in Vietnam. However, the Pair-wise Granger Causality test results show that there is no meaningful Granger causality present between private savings rate and the explanatory variables. On the other hand, the Block Exogeneity test results confirm the causality running from the lag of the young age dependency rate (D(YDR)), the lag of the old age dependency rate (D(ODR)) and the lag of social insurance funds rate (D(SIF)) to the lag of private savings rate (D(PSR)) in Vietnam in the short run, which contradicts the Pair-wise Granger Causality test results, but correspond to the short run dynamic VECM results.

With regards to Model 2 investigating the impact of economic growth on private savings (LogRPS) in Vietnam, the VECM results indicate that there exists both the short run dynamics and the long run equilibrium relationships between private savings (LogRPS) and the explanatory variables (include GDP growth rate (GDPgr), Log real GDP per capita (LogRGDPper) and inflation rate (IFR)). Specifically, as for the long run relationship between the considered variables, we found two significant negative long run associations of GDP growth rate (GDPgr) and of GDP per capita (LogRGDPper) with private savings (LogRPS) and one significant positive correlation between inflation rate (IFR) and private savings (LogRPS) in Vietnam.

The negative long run correlation between GDP growth rate and private savings in Vietnam, which is in favor of the Permanent Income Hypothesis of Friedman (1957), and in fact, the Permanent Income Hypothesis is an Life Cycle Hypothesis with infinite life span, whereby as a result of the remarkable economic growth of Vietnam and its bright prospect in the future, the working age people will expect higher future income than current income that makes them more confident in consumption, thus resulting in a decline in their private savings. Similarly, in the long run GDP per capita growth significantly negative affects private savings in Vietnam. This result is also consistent with the

Permanent Income Hypothesis of Friedman (1957) and can be explained that the higher growth rate of the economy will lead to a higher increase in the permanent income of an individual as compared to an increase in his or her current income, resulting in a higher consumption and thus depressing private savings. By contrast, the inflation rate refers to the higher level of uncertainty in the economy has a positive long run impact on private savings in Vietnam, which is explained by the precautionary savings behavior of the Vietnamese individuals. More specifically, an increase in the inflation rate encourages the individuals to save more as a precaution to overcome the future financial difficulties.

In terms of the short run dynamic relationship between economic growth and private savings in Model 2, the coefficient of the error correction term (ECT) for the estimated private savings equation (D(LogRPS)) is statistically significant and negative, meaning that private savings has the ability to act properly to correct any disequilibrium in the short run. Moreover, the dynamic VECM results only found the significant short term correlation between the lags of GDP per capita (D(LogRGDPper)) and the lag of private savings (D(LogRPS)), which confirmed that the lags of GDP per capita can explain changes in private savings.

Unlike the VECM dynamic findings, the Pair-wise Granger Causality test revealed two bidirectional relationships between GDP per capita (LogRGDPper) and private savings (LogRPS), and between inflation rate (IFR) and private savings (LogRPS), and the unidirectional causality running from private savings (LogRPS) to GDP growth rate (GDPgr), while the opposite direction of the causality running from GDP growth rate (GDPgr) to private savings (LogRPS) does not exist in the context of Vietnam in the short term. This also means that in the case of Vietnam, private savings is an important factor contributing to the economic growth in Vietnam, which is in favor of the neoclassical growth model where savings contributed to a higher capital accumulation for the faster economic growth. Similar to the Pair-wise Granger Causality test, the Block Exogeneity test confirm two causal relationships between the lags of two excluded variables GDP per capita (D(LogRGDPper)), inflation rate (D(IFR)) and the lag of private savings (D(LogRPS)). However, when considering the joint block exogeneity test in the Block Exogeneity test, we explored that the lag of all the excluded variables D(GDPgr), D(LogRGDPper) and D(IFR) may influence the endogenous variable D(LogPSR), suggesting that the causality among all the variables may be valid in the long run. In other

words, all three lagged variables: GDP per capita (D(LogRGDPper)), GDP growth rate (D(GDPgr)) and inflation rate (D(IFR)) may still have an influence on the lag of private savings (D(LogRPS)) in Vietnam in the long run.

To sum up, the results obtained in Model 1 regarding the impact of the young age dependency ratio, the old age dependency ratio, life expectancy, and social insurance funds rate confirm Hypothesis 1 of the significant long run relationship between these considered variables, but reject Hypothesis 1 in terms of the significant short run relationship and Hypothesis 2 about the direction of causality. On the other hand, the findings in Model 2 could not give definite evidence of the positive long run and significant short run effects of GDP growth rate, GDP per capita and inflation rate on private savings in Vietnam. This means that Hypothesis 3 and Hypothesis 4 are rejected in Vietnam. Nonetheless, when testing the direction of causality between each macroeconomic variable and private savings. The results of the causality tests provided valuable information confirming Hypothesis 6 that the direction of causality runs from GDP growth rate, from GDP per capita, and from inflation rate to private savings in Vietnam. For Hypothesis 5, these findings in Model 1 confirm and support for the Life Cycle Hypothesis in the cultural peculiarities of Vietnam, while these findings in Model 2 relating the relationship between economic growth and private savings does not work well under the Life Cycle Hypothesis in the context of Vietnam.

The impulse response functions provide a clear picture relating to the influence of a shock of each variable on its own future trend and on the future trend of the other variables in the VECM. Furthermore, the variance decompositions results suggested the important factors: the youth dependency rate (YDR) and the old age dependency rate (ODR) in Model 1 and GDP growth rate (GDPgr) and the income or GDP per capita (LogRGDPper) in Model 2 in influencing and explaining the change in private savings in the future.

Finally, several diagnostic tests include Jarque-Bera test, White and ACRH tests, the VEC residual LM tests, and CUSUM test were performed to check for the normality, heteroscedasticity, serial correlation and the stability of the residuals in the dynamic VECM. The results obtained from these tests confirmed the reliability of the residuals that can be used to produce the best linear unbiased estimators of the OLS regression model for the research. Specifically, the residuals are normally distributed, have not met

heteroscedasticity problem, and have no serial correlation at the all significance levels, and CUSUM test confirms the stability of the residuals.

6.2. Policy implications and recommendations

The important contribution of this study is the policy related implications in increasing the level of private savings in Vietnam. The government can rely on the indicators: dependency ratio, social insurance funds, GDP growth rate, GDP per capita, and inflation rate to affect the level of private savings. The policies should take advantage of the "golden population structure" period as well as limit the impact of dependency ratio, offer the attractively beneficial programs for the older people as well as reform the pensions system, encourage the economic growth, while keep the inflation rate under the control, that can boost private savings in Vietnam.

Specifically, in the long run the government, firstly, should mobilize its resources, for instance, opening opportunities of production or investment for the institutions in the market through liberalizing the rules and facilitating these institutions to product or invest to stimulate the aggregate savings. This savings will continue invest in the profitable schemes in the economy to boost the economic growth and further increase the per capita income as well as private savings.

Secondly, in order to motivate the older employees and self-employed individuals, who are near retirement age and want to save more for their future consumption during the retirement period, the Vietnam government should reform the old age pension system, encourage and facilitate the financial institutions to start the old age benefit schemes in order to bring a higher benefits for the elderly as well as promote their savings. Specifically, the funds of these schemes deposited by the individuals will use to finance the economic development projects as well as invest in other economic activities with the purpose of increasing the income of participated individuals. Besides, the government can invest in the infrastructural development projects and the industry support programs to encourage the economic activities in the economy that in turn will contribute to the GDP growth rate and income per capita growth in Vietnam. With an increased income per capita, the individuals have the higher ability to save, thereby increasing their savings.

According to Long (2008), the Vietnam's social security fund is predicted to suffer the implicit pension debts (IPDs) during the period 2000 - 2050. Long (2008) also mentioned that if the government does not reform the current publicly-managed pay-as-you-go

defined-benefit (PAYG DB) pension system, the pension fund in Vietnam will be depleted and even deficit, which will threaten the government budget and private savings. Long (2008) further suggested the four ways to reform the pension scheme. Firstly, the Vietnam government should transfer the benefits of the current pensioners to pensioners of the next generation by reducing the benefits of the current contributors to ensure inter-generational equity of the participants. In fact, the retirement benefits of the current pensioners in the public sector in Vietnam is now calculated by using the last five years' average salary, leading to the current scheme's burden of paying for the numerous rich retirees. In this case, this reform policy means that the government needs to cut the benefits of the rich pensioners along with increase the pension income tax of these pensioners, while still maintains the benefits of other pensioners who have the sufficient pension income to attain inter-generational equality. Indeed, instead of paying the benefits through statutory wage, the Vietnam government needs to adjust the benefits relying on changes in consumption price index (CPI) or inflation rate in the economy because this index helps reflect the cost of maintaining a certain standard of living of the pensioners. Secondly, it would be better if the Vietnam government transfers the pension scheme from the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) pension system to a fully funded scheme to boost private savings, but before transferring, the Vietnam government needs to consider solving the implicit pension debts (IPDs). Solving the implicit pension debts (IPDs) is a significant issue because a transition to a fully funded pension system causes the new explicit national debts equals to the net implicit pension debts, and thus seriously affects the fiscal viability of the government. In addition, it is worth noting that a transition to a fully funded scheme is certainly not feasible for Vietnam because the Vietnam government now continues to be responsible for existing pension liabilities in case of none corresponding revenues. Therefore, at this moment, the Vietnam government should move to a partially funded scheme in order to avoid raising the budget debt quickly. Indeed, one suggestion may be useful is that General Statistic Office of Vietnam or Vietnam Social Insurance (VSS) should publish outstanding pension liabilities every year to make the situation transparent. Moreover, as Long (2008) mentioned, in the current pension system in Vietnam, the current contributors have to bear "double burden" of paying not only for themselves but also for the current pensioners who are members of the PAYG scheme. In order to reduce the burden of the participants in the current pension scheme, the Vietnam government can follow the models of Friedman et al. (1996) and Estelle (1998) applied in

Latin American countries and some other transitional economies are that the government uses the revenues or assets from the privatization process of state enterprises and co-finance fiscal requirements for the current pensioners or learn the study of Kunieda (2001), who recommended that the government should allocate a part of personal pensions to notional defined contribution pension as well as commit to bring back the return rate that equals the economic growth rate for the current contributions. Thirdly, although a transition will bring a larger burden for the existing pensioners and threaten the fiscal viability of the government, and even cause the larger government debt along with a decrease in private savings, the pension scheme in Vietnam is in need of the further reform as soon as possible, especially in the difficult situation of the current publicly-managed pay-as-you-go defined-benefit (PAYG DB) pension system of Vietnam when it now covers 20% of the workforce, or only nearly 10% of the total population and the first contributions group of the post-1995 pension scheme will begin receiving their benefits in 2015. Finally, the Vietnam government should focus on the management and regulations when reforming the pension scheme. Under the poor development of the financial market in Vietnam at this time, the government should conduct the publicly managed pension scheme. More clearly, the Vietnam government should manage the pension fund along with enacting favorable policies for encouraging the diversification of investments in this fund to maintain and develop it. However, the principle is that the government should avoid using the pension fund to cover the expenditures or the budget deficit. Moreover, in the medium to the long term, the Vietnam government needs gradually privatize pension funds along with strong protection of the government for these pension funds and define the contributions in the pension scheme as investment channels in order to spur more savings of the participants in pension funds. Besides, it is necessary to establish a sound regulatory framework that not only encourages the participation of the Vietnamese employees in the private sector but also stimulates the voluntary scheme.

On the other hand, the government should maintain its budget under the control as well as recover and solve the budget deficit step by step by carefully making investments in profitable profits. In fact, the problem preventing the individuals from savings is that they fear of savings to cover the budget deficit, but not for the investment and the economic development purposes. Thus, a carefully investing in profitable projects is necessary for the government to overcome this fear of the individuals, encourage their savings along with boost the economic growth.

Furthermore, due to a prolonged period of slow economic growth after wars along with the government budget deficit, the Vietnamese government had to borrow money from the World Bank, the International Monetary Fund (IMF) and other countries to cover its budget deficit, which put strong pressure on the residents by increasing the inflation rate in the economy because the money demand of the government for paying back loans increased and the Vietnam government, in fact, had to print the currency more to cover up this budget deficit. This activity might negatively affect the confidence of private investors and savers, resulting in a negative consequence that they did not want to invest or save in the economy. Therefore, the properly controlling the budget deficit and taking measures to recover the deficit as well as put the inflation under control without affecting the confidence of private investors or savers in the economy is one of the best ways for the government to stimulate the savings of the individuals.

In the short run, the Vietnam government can promote private savings by taking advantage of the golden population structure as well as limiting the effects of old age dependency ratio through offering the attractively beneficial programs for the older people. Indeed, the government should reduce the income inequality in the country by providing opportunities for people to increase their productivity contributing to the economic growth along with increasing the income per capita. Due to the higher income per capita, the individuals have higher ability to save, thus rising private savings. Additionally, the Vietnam government can spur private savings through the expansionary monetary policy, and the bank sector should set the spread between deposit and lending rates, for example, increasing the deposit rate and decreasing the lending rate. However, it is worth noting that reducing the interest rate may create a pressure of higher inflation rate and the higher inflation rate will raise private savings only if the individuals decide save more as a result of their precautionary savings behavior in response to the uncertainty regarding future income. Hence, the Vietnam government should provide protections to all private investors and savers by keeping the inflation rate under control to reinforce the confidence of private investors and savers. Furthermore, the competition and financial innovation can reduce the spread between deposit and lending rates, but the spread should cover credit risk, which largely depends on the share of non-performing loans (including the reserves for rainy days). If it does not, the financial system will collapse unless the government saves it by spending huge sums.

6.3. Limitations of the study and areas for further study

The scope of my empirical analysis was strongly constrained by the availability of reliable data. I could only use annual time series for the period 1985 - 2016 (32 observations). A small sample size in the regression model may cause the problem that it is difficult to model reliably the relationship. However, I would emphasize that earlier observations do not and would not help, as the working of the economy changes substantially with the economic reform. Indeed, I would rather dwell on the lack of quarterly observations. If the quarterly data was available, 32 years quarterly observations would suffice and I could even drop the problematic first few years. Therefore, an extension of the number of observations should be considered in the further research because it can produce convincing results regarding the relationship between the demographic and macroeconomic variables and private savings in Vietnam.

Furthermore, there were only seven explanatory variables in two separate models, including four variables: the children dependency ratio, the elderly dependency ratio, life expectancy and social insurance funds rate representing for the population ageing variable and three variables: GDP growth rate, GDP per capita and inflation rate representing for the economic growth variable that were then used in the estimation model to investigate its impacts on private savings in Vietnam. Besides, it is difficult in measuring as well as quantifying the ageing, and there is a large number of variables can represent for the population ageing and economic growth variables, while this study was conducted with the inclusion of control variables. Specifically, in addition to chosen demographic factors such as the youth and elderly dependency ratios and the percentage of social insurance funds in GDP, there are other non-demographic factors such as the health status of the elderly population, health care expenditure of the elderly, social expenditure with the old age population, unemployment rate, the elderly labor force participation rate, education level that only affect the old age population indirectly, should be considered to produce the best findings possible. Indeed, there may be have relevant omitted variables relating to the economic growth variable, for instance, financial market development or financial depth (M2/GDP), trade terms, capital accumulation, real deposit rate or interest rate, tax and macroeconomic policies that should be taken into the study to capture the reality better. Hence, the future research should contain more variables to provide a comprehensive picture in regards to the determinants and its influences on private savings in Vietnam.

Moreover, as ageing affects the demographic structure of the population, all people are somehow influenced. As a result of population ageing, the savings of the individuals is different in each age range. More specifically, in case of the expectancy of living longer, in fact, the working age (middle aged) individuals tend to save more for their longer lives after retirement, while the older people, who are near the retirement period or retired, tend to spend more since they live more years after retirement. The future research, indeed, should conduct a study on the relationship between longevity/ageing and private savings with the assumption of holding the population age structure constant to get a better result of increase or decrease in private savings.

Finally, it would be interesting to examine this topic in comparison with developed and developing countries to discover the difference in the relationships exist in these countries, considering that the low economic development of developing countries is often associated with the poor health status of the elderly, the limitations of the health care and social insurance systems affecting ageing and the low income per capita affecting private savings.

Nevertheless, it is worth mentioning that despite all these constraints my analysis provides some useful insights relating to the determinants of private savings in Vietnam, the relationship between the demographic and macroeconomic variables (refer to the population ageing and economic growth) and private savings in Vietnam as well as contributes policy implications and recommendations through taking advantage of the advantages and limiting the drawbacks of population ageing and economic growth in order to spur private savings, which in turn to promote the Vietnam's economic growth further.

REFERENCES

1. Adams, N. A. (1971). Dependency rates and savings rates: Comment. *The American Economic Review*, 61(3), 472-475.
2. Afzal, M. (2007). Saving and investment in developing countries: Granger causality test. *Philippine Review of Economics*, 44(2), 33-44.
3. Agrawal, P. (2000). *Savings, investment and growth in South Asia*, mimeo, Indira Gandhi Institute of Development Research, Mumbai.
4. Agrawal, P. (2001). The relation between savings and growth: Cointegration and causality evidence from Asia. *Applied Economics*, 33, 499-513.
5. Agrawal, P. and Sahoo, P. (2009). Saving and growth in Bangladesh. *The Journal of Developing Areas*, 42(2), 89-110.
6. Agrawal, P., Sahoo, P. and Dash, R. K. (2009). Savings behaviour in South Asia. *Journal of Policy Modeling*, 31(2), 208-224.
7. Ahmad, F. (2015). Determinants of savings behavior in Pakistan: Long term - short term association and causality. *Timisoara Journal of Economics and Business*, 8(1), 103-136.
8. Amaratunga, D., Baldry, D., Sarshar, M. and Newton, R. (2002). Qualitative and quantitative research in the built environment: application of mixed research approach. *Work Study*, 51(1), 17-31.
9. Anderson, B. (1999). *On the causality between saving and growth: Long and short run dynamics and country heterogeneity.* Department of Economics, Uppsala University, Sweden.
10. Anne, W., Monica, V. and Arild, T. (2013). Vietnam - a new economic dragon in Southeast Asia? *Journal of Developing Societies*, 29(2), 155-187
11. Anoruo, E. and Ahmad, Y. (2001). Causal relationship between domestic savings and economic growth: Evidence from seven African Countries. *African Development Bank*, 13(2), 238-249.
12. Ardeshir, S. and A Haroon, A. L. (2002). A crouching tiger? A hidden dragon? Transition, savings and growth in Vietnam, 1975 - 2006. *ISS Working Paper 359*, the Hague, Netherlands: Institute of Social Studies.
13. Aron, J. and Muellbauer, J. (2000) Personal and corporate saving in South Africa. *The World Bank Economic Review*, 14(3), 509-544.

14. Apergis, N. and Christou, C. (2012). Dependency rate and savings: The African evidence with panel data. *International Journal of Business and Management*, 7(4), 84-95.

15. Aswini, K. and Mohit, J. (2012). Investigating the causal relationship between saving, investment and economic growth for India. *International Journal of Financial Management*, 1(2), 15-23.

16. Athukorala, P. and Sen, K. (2004). The determinants of savings in India. *World Development*, 32(3), 491-503.

17. Attanasio, O. P. and Banks, J. (1998). Trends in household saving: A tale of two countries. *Working Paper series W98/15*, London: Institute of Fiscal Studies.

18. Baharumshah, A. Z., Thanoon, M. A. and Rashid, S. (2003). Saving dynamics in the Asian countries. *Journal of Asian Economics*, 13(6), 827-845.

19. Bandiera, O., Caprio, G., Honohan, P., Schiantarelli, F. (2000). Does financial reform increase or reduce savings? *Review of Economics and Statistics*, 82(2), 239-263.

20. Bailliu, J. N. and Reisen, H. (1998). Do funded pensions contribute to higher aggregate savings? A cross-country analysis. *Review of World Economics*, 134(4), 692-711.

21. Banerjee, A., Dolado, J., Galbraith, J. W. and Hendry, D. F. (1993). *Co-integration, error-correction, and econometric analysis of non-stationary data.* Oxford University Press, Oxford.

22. Beresford, M. (1989a). *National unification and economic development in Vietnam*, London: MacMillan.

23. Beresford, M. and Phong, D. (2000). *Economic transition in Vietnam: Trade and aid in the demise of a centrally planned economy*, London: Edward Elgar.

24. Bloom, D. E., Canning, D., Mansfield, R. K. and Moore, M. (2007). Demographic change, social security systems, and savings. *Journal of Monetary Economics*, 54(1), 92-114.

25. Braun, P.A. and Mittnik, S. (1993). Misspecification in vector autoregressions and their effects on impulse responses and variance decompositions. *Journal of Econometrics*, 59(3), 319-341.

26. Bryman, A. and Bell, E. (2007). *Business research method*, 2nd Ed., Oxford: Oxford University Press.

27. Brooks, C. (2002). *Introductory econometrics for finance*. The United Kingdom: Cambridge University Press.

28. Börsch-Supan, A., Ludwig, A. and Winter, J. (2006). Ageing, pension reform and capital flows: a multi-country simulation model. *Economica, London School of Economics and Political Science*, 73(292), 625-658

29. Boswijk, H.P. and Franses, P.H. (1992). Dynamic specification and cointegration. *Oxford Bulletin of Economics and Statistics*, 54, 369-381.

30. Canova, F. (2007). *Methods for applied macroeconomic research*. Princeton: Princeton University Press.

31. Carroll, C. D. (1992). The buffer-stock theory of saving: Some macroeconomic evidence. *Brookings Papers on Economic Activity*, 23(2), 61-156.

32. Carroll, C. D. and Weil, D. N. (1994). Saving and growth: a reinterpretation. *Carnegie-Rochester Conference Series on Public Policy*, North-Holland, 4,133-192.

33. Central Institute for Economic Management (CIEM) (2001). *Vietnam's economy in 2000*. Hanoi: Central Institute for Economic Management.

34. Chopra, S. (1988). Inflation, household savings and economic growth. Ph.D. thesis, M.S. University of Baroda, India.

35. Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*, 2nd Ed., London: Sage Publications.

36. Collins, N. and Zhu, Y. (2005). The transformation of HRM in transitional economies: The case of Vietnam. *Journal of Comparative Asian Development*, 4(1), 161-178.

37. Deaton, A. S. (1991). Saving and liquidity constraints. *Econometrica*, 55, 1121-1142.

38. Deaton, A. S. and Paxson, C.H. (1993). Saving, growth and ageing in Taiwan. *Working paper No. 4330*, 47. Retrieved from: http://www.nber.org/papers/w4330.pdf?new_window=1

39. Deaton, A. S. (1977). Involuntary saving through unanticipated inflation. *The American Economic Review*, 67(5), 899-910.

40. Deaton, A. (2005). Franco Modigliani and the life cycle theory of consumption. *PLS Quarterly Review*, 58, 91-107.

41. de Freitas, N. E. M and Martins, J. O. 2014. Health, pension benefits and longevity: How they affect household savings? *The Journal of the Economics of Ageing*, 3, 21-28.

42. Dickey, D. A. and Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association,* 74(366), 427-431.

43. DJS Research Ltd. (2005). *What is causal research?* Retrieved from http://www.marketresearchworld.net/index.php?option=com_content&task=view&id=799&Itemid=64

44. Domenech, R., Taguas, D. and Varela, J. (2000). The effect of budget deficit on national saving in the OECD. *Economics Letters,* 69(3), 377-383.

45. Economist Intelligence Unit (EIU) (1991). *Indochina: Vietnam, Laos, Cambodia country profile 1991-92*. London: Economist Intelligence Unit.

46. Edwards, S. (1996). Why are Latin America's savings rates so low? An international comparative analysis. *Journal of Development Economics,* 51(1), 5-44.

47. Enders, W. (2010). *Applied econometric time series,* 3rd Ed., United States of America: John Wiley & Sons, Inc.

48. Engle, R. F. and Granger, C. W. J. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica,* 55(2), 251-276.

49. Erlandsen, S. and Nymoen, R. (2008). Consumption and population age structure. *Journal of Population Economics,* 21(3), 505-520.

50. Estelle, J. (1998). *Social security reform - Lessons from other nations*. Heritage Foundation.

51. Faruquee, H. and Husain, A. M. (1998). Saving trend in Southeast Asia: A cross-country analysis. *Asian Economic Journal,* 12(3), 195-217.

52. Feldstein, M.S. (1977). Social security and private savings: International evidence in an extended life cycle model. In Feldstein M.S. and Inman R.P. (Eds), *The economics of public services* (pp. 174-205). International Economic Association Conference Volumes. Palgrave Macmillan, London.

53. Fforde, A. and de Vylder, S. (1996). *From plan to market: The economic transition in Vietnam*. Boulder: The Westview Press.

54. Fu, J. (2013). The impact of population ageing on economy: Evidence from China and Japan. Dissertation, Doctor of Philosophy, Tohoku University, Japan.

55. Friedman, M. (1957). The Permanent Income Hypothesis. In M. Friedman, *A theory of the consumption function* (pp. 20-37). Princeton University Press. Retrieved from http://www.nber.org/chapters/c4405.pdf

56. Friedman, B., Estelle, J., Kane, C. and Queisser, M. (1996). How can China provide income security for its rapidly ageing population? *Policy Research Working Paper 1674*, Policy Research Department, Poverty and Human Resources Division, the World Bank.

57. Fry, M. J. and Mason, A. (1982). The variable rate-of-growth effect in the life-cycle saving model. *Economic Inquiry,* 20(3), 426-441.

58. Gaiha, R., and Thapa, G. (2007). Growth, equity, and poverty reduction in Vietnam: Prospects and challenges. In Giang, T. L (ed.) *Social issues under economic transformation and integration in Vietnam*, *Volume 2,* pp.7-50. Hanoi: The Publishing House of Social Labour.

59. Gavin, M., Hausmann, R. and Talvi, E. (1997). Saving behavior in Latin America: Overview and policy issues, In Hausmann, R. and H. Reisen (eds.), *Promoting savings in Latin America.* Organization of Economic Cooperation and Development and Inter-America Development Bank, Paris.

60. General Statistics Office of Vietnam (1979, 1989, 1999, 2009). *Population and housing census: Age-sex structure and marital status of the population in Vietnam*. Hanoi, Vietnam: Statistical Publishing House.

61. General Statistics Office of Vietnam (1979, 1989, 1999, 2009, 2016). *Statistical yearbook of Vietnam.* Hanoi, Vietnam: Statistical Publishing House.

62. General Statistics Office of Vietnam (2004). *Vietnam statistical data in the 20th century*. Hanoi, Vietnam: Statistical Publishing House.

63. General Statistics Office of Vietnam (2011). *Population projections for Vietnam 2009 - 2049*. Hanoi, Vietnam: Statistical Publishing House.

64. General Statistics Office of Vietnam (2016). *Population projections for Vietnam 2019 - 2049*. Hanoi, Vietnam: Statistical Publishing House.

65. Gian, T.C., Paulette, C., and Long, G.T. (2009). A social insurance forecasting and simulation model for Vietnam. *The Workshop Improving Effectiveness of Policies on Wage and Social Insurance in Vietnam*, Institute of Labour Science and Social Affairs, Hai Duong, December.

66. Gujarati, D. N. (2010). *Basic Econometrics,* 4th Ed, New York: McGraw-Hill Higher Education.

67. Gutierrez, C.E.C., Souza, R.C. and o Guillen, O.T.C. (2007). Selection of optimal lag length in cointegrated VAR models with weak form of common cycle features. *Working Papers Series 139*, Central Bank of Brazil, Research Department.

68. Granger, C. W. J. and Newbold, P. (1974). Spurious regressions in econometrics. *Journal of econometrics*, 2(2), 111-120.

69. Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37(3), 424-438.

70. Greene, W. H. (2012). *Econometric analysis*, 7th Ed. Boston: Pearson Education, Inc.

71. Haque, N. U. and Montiel, P. (1989). Consumption in developing countries: Tests for liquidity constraints and finite horizons. *Review of Economics & Statistics*, 71(3), 408-415.

72. Heller, P.S. and Symansky, S. (1998). Implications for savings of ageing in the Asian "Tigers". *Journal of East Asian Economic Association*, 12(3), 219-252.

73. Heer, B. and Süssmuth, B. (2006). The savings-inflation puzzle. *CESifo Working Paper Series No. 1645*. Retrieved from: http://www.jstor.org.libezp.utar.edu.my/stable/2118428

74. Higgins, M. and Williamson, J.G. (1997). Age structure dynamics in Asia and dependence on foreign capital. *Population and Development Review*, 23(2), 261 - 293.

75. Horioka, C.Y. (1997) A cointegration analysis of the impact of the age structure of the population on the household saving rate in Japan. *The Review of Economics and Statistics*, 79(3), 511-516.

76. Horioka, C.Y. (2010). Ageing and saving in Asia. *Pacific Economic Review*, 15(1), 46-55.

77. Horioka, C.Y. and Terada-Hagiwara, A. (2012). The determinants and long-term projections of saving rates in Developing Asia. *Japan and the World Economy*, 24(2), 128-137.

78. Horioka, C.Y. and Wan, J. (2007). The determinants of household saving in China: A dynamic panel analysis of provincial data. *Working Paper 12723*, National Bureau of Economic Research: Cambridge, 1-36.

79. Horioka, C. Y. and Watanabe, W. (1997). Why do people save? A micro-analysis of motives for household saving in Japan. *The Economic Journal*, 107(442), 537-552.

80. Hussey, J. and Hussey, R. (1997). *Business research: A practical guide for undergraduate and postgraduate students*, London: Macmillan.

81. Hyde, K.F. (2000). Recognising deductive processes in qualitative research, *Qualitative Market Research: An International Journal*, 3(2), 82-90.

82. Irandoust, M. and Ericsson, J. (2004). Are imports and exports cointegrated? An international comparison. *Metroeconomica*, 55(1), 49-64.

83. James, S., Lothar, R. and Saleem, W. (2015). *College Algebra. Chapter 4: Exponential and logarithmic functions*, 7th Ed., Pacific Grove, the United State: Brooks Cole Publishing Company.

84. Jappelli, T. and Pagano, M. (1996). The determinants of saving: Lessons from Italy. *Working Paper R-313*, the Inter-America Development Bank Conference on Determinants of Domestic Saving in Latin America, New York, the United States.

85. Johansen, S. (1992). Determination of cointegration rank in the presence of a linear trend. *Oxford Bulletin of Economics and Statistics*, 54(3), 383-397.

86. Johansen, S. (1998). Statistical analysis of cointegrating vectors. *Journal of Economic Dynamics and Control*, 12(2/3), 231-254.

87. Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration - with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

88. Jorgensen, O. H. (2011). Macroeconomic and policy implications of population ageing in Brazil. *Policy Research Working Paper 5519*, the World Bank, Latin American and Caribbean Region, Economic Policy Sector.

89. Kandiah, V. (2002). Fertility levels and trends, and their implications for policies and programmes. *Asian Population Studies Series, No.158*, the Fifth Asian and Pacific Population Conference, Bangkok, Economic and Social Commission for Asia and the Pacific, United Nations Publication, pp. 53-71.

90. Kieu, V. M. (2009). *Tham luan ve tang tuoi huu nu o Vietnam. [Discussion on retirement age for females in Vietnam]*. Unpublished manuscript, Hanoi: Viet Nam Social Security.

91. Kelley, A. C. and Schmidt, R.M. (1996). Saving, dependency and development. *Journal of population economics*, 9(4), 365-386.

92. Kraay, A. (2000). Household saving in China. *The World Bank Economic Review*, 14(3), 545-569.

93. Krieckhaus, J. (2002). Re-conceptualizing the developmental state: Public savings and economic growth. *World Development*, 30(10), 1697-1712.

94. Koga, M. (2006). The decline of Japan's saving rate and demographic effects. *The Japanese Economic Review,* 57(2), 312-321.

95. Kunieda, S., (2002). Japanese pension reform: Can we get out of inter-generational exploitation?. In *Pension Reforms in Asian Countries*, the International Symposium, Hitotsubashi University, Japan. pp. 23-63.

96. Landefeld, J. S., Seskin, E. P. and Fraumeni, B. M. (2008). Taking the pulse of the economy: Measuring GDP. *Journal of Economic Perspective,* 22(2), 193-216.

97. Lee, R., Mason, A. and Miller, T. (2000). Life cycle saving and demographic transition: The case of Taiwan. *Population and Development Review,* 26, Supplement, 194-219.

98. Leff, N. H. (1969). Dependency rates and savings rates. *The American Economic Review,* 59(5), 886-896.

99. Li, H., Zhang, J. and Zhang, J. (2007). Effects of longevity and dependency rates on saving and growth: Evidence from a panel of cross countries. *Journal of Development Economics*, 84(1), 138-154.

100. Li, X., Li, Z. and Chan, M. L. (2012). Demographic change, savings, investment, and economic growth. *The Chinese Economy*, 45(2), 5-20.

101. Lindh, T. (1999). Age structure and economic policy: the case of saving and growth, *Population Research and Policy Review,* 18(3), 261-277.

102. Loayza, N., Schmidt-Hebbel, K. and Serven, L. (2000). What drives private saving across the world? *The Review of Economics and Statistics*, 82(2), 165-181.

103. Loayza, N. and Ranciere, R. (2005). Financial development, financial fragility, and growth. *IMF Working Paper WP/05/170,* International Monetary Fund, pp.12-18.

104. Long, G. T. (2004). The pension scheme in Vietnam: Current status and challenges in an ageing society. *Discussion paper No.2*, Vietnam Development Forum (VDF).

105. Long, G. T. and Wade, P. D. (2009a). The vulnerability of the elderly to poverty: Determinants and policy implications for Vietnam. *Asian Economic Journal*, 23(4), 419-437.

106. Long, G. T. (2012). Viet Nam: Pension system overview and reform directions. In Donghyun, P. (ed.) *Pension systems and old-age income support in East and Southeast Asia: Overview and reform directions*, pp. 203 - 221. New York: Routledge - Taylor & Francis Group.

107. Mahambare, V. and Balasubramanyam, V. N. (2000). Liberalisation and savings in developing countries: The case of India. *Working Paper No. 4,* Management School, Lancaster University.

108. Mankiw, N. G. (2011). *Principles of economics*, 6th Ed., Mason, USA: South-Western College Publishing.

109. Martin, E., Ian, G., Susan, H., Andrew, M., Huyen, D.T. and Ngoc, D.L.T. (2007). The relationship between old age and poverty in Viet Nam. *United Nations Development Program (UNDP) Vietnam Policy Dialogue Paper No. 2007-08*. Hanoi: UNDP Viet Nam.

110. Mason, A. (1987). *National saving rates and population growth: A new model and new evidence* (pp. 523-560), Edited by D. Gale Johnson and Ronal D. Lee (Eds), The University of Wisconsin Press.

111. Mason, A. (1988). Saving, economic growth, and demographic change. *Population and Development Review,* 14(1), 113-144.

112. Masson, P. R., Bayoumi, T. and Samiei, H. (1998). International evidence on the determinants of private saving. *World Bank Economic Review*, 12(3), 483-501.

113. Mason, A. and Lee, R. (2007). Transfers, capital, and consumption over the demographic transition, In *Population ageing, intergenerational transfers and the macroeconomy*, R. Clark, N. Ogawa, and A. Mason (Ed.), Cheltenham, UK: Edward Elgar, pp. 128 - 162.

114. Miller, R. L. and Benjamin, D. K. (2008). *The economics of macro issues*. Boston, the United States: Pearson Addison Wesley.

115. Minh, N. K. and Long, G. T. (2008). Factor productivity and efficiency of the Vietnamese economy in transition. *Asia-Pacific Development Journal,* 15(1), 93-111.

116. Modigliani, F. (1970). The Life cycle hypothesis of saving and intercountry differences in the saving ratio. In Harrod, R. W., A. Eltis, M. F. Scott and J. N. Wolfe (Ed.), *Induction, growth and trade* (pp. 197 - 225), London: Clarendon/Oxford University Press.

117. Modigliani, F. and Brumberg, R. (1954). Utility analysis and the consumption function: an interpretation of cross-section data. *Post Keynesian Economics*, 388-436.

118. Modigliani, F. and Brumberg, R. (1979). *Utility analysis and aggregate consumption function: an attempt at integration*. Franco Modogliani: MIT Press.

119. Modigliani, F. (1992). *Saving in developing countries: growth, income, and other factors*, in S. G. Rhee and R. P. Chang (Eds.), Pacific Basin Capital Markets Research, Vol. 3, pp. 23-35, Amsterdam, North-Holland.

120. Modigliani, F. and Cao, S.L. (2004). The Chinese saving puzzle and the life cycle hypothesis. *Journal of Economic Literature*, Vol. XLII, 145-170.

121. MoLISA (Ministry of Labour, War Invalids, and Social Affairs, Viet Nam) (2005). *Mot so tinh hinh, so lieu ve nguoi cao tuoi o Vietnam [The current situation and data on the elderly people in Vietnam]*. Unpublished report. Hanoi: MoLISA Department of Social Protection.

122. MoLISA (2008). *Thong ke tinh hinh thuc hien bao hiem xa hoi 2001 - 2007 [Statistics on social insurance in 2001 - 2007]*. Unpublished database. Hanoi: MoLISA.

123. Mukherjee, C. H., White, H. and Wuyts, M. (1998). *Econometrics and data analysis for developing countries*. London & New York: Routledge.

124. Nguyen , L. H. (2009). *An sinh xa hoi Vietnam: Thuc trang va muc tieu chinh sach cho giai doan 2011-2020 [Social protection in Vietnam: Current status and policy objectives for the period 2011-2020]*. Unpublished manuscript. Hanoi: MoLISA.

125. Nurudeen, A. (2012). Saving-economic growth nexus in Nigeria, 1970-2007: Granger causality and co-integration analyses. *Review of Economic and Business Studies*, 3(1), 93-104.

126. Nwakeze, N.M. (2014). The nexus between macroeconomics and demographics: Implications for sustainable development. *The Economic and Social Review*, 45(2), 285-298.

127. OECD (Organisation for Economic Cooperation and Development) (2008). *Pension at a glance: Asia-Pacific Edition 2008*. Paris: OECD.

128. OECD (2018). *Inflation (CPI) (indicator)*. Retrieved from: https://data.oecd.org/price/inflation-cpi.htm

129. Ozcan, K. M., Gunay, A. and Ertac, S. (2003). Determinants of private savings behavior in Turkey. *Applied Economics*, 35, 1405-1416.

130. Pham, T. G. (2009). *Bao hiem xa hoi Vietnam: Thuc trang, thach thuc va khuyen nghi chinh sach [Social insurance in Vietnam: Current status, challenges, and policy recommendations]*. Unpublished manuscript. Hanoi: PAG, UNDP-MoF.

131. Pistaferri, L. (2009). The Life-cycle hypothesis: an assessment of some recent evidence. *Rivista di Polictica Econonomica*, 2, 35-65.

132. Prettner, K. (2012). Population ageing and endogenous economic growth. *Journal of Population Economics*, 26(2), 811-834.

133. Quinlan, C. (2011). *Business research methods.* Andover, Hampshire: South Western Cengage Learning.

134. Ram, R. (1982). Dependency rates and aggregate savings: a new international cross-section study. *American Economic Review,* 72(3), 537-544.

135. Ramesh, J. (2001). Causal relationship between saving, investment and economic growth for India: What does the relation imply? *Munich Personal RePEc Archive paper (40002),* 32(1), 25-39, Munich, Germany.

136. Ricardo, D. (1846). *Essays on the funding system - David Ricardo.* The works of David Ricardo (McCulloch Ed.).

137. Romm, A. T. (2005). The relationship between savings and growth in South Africa: An empirical study. *South African Journal of Economics*, 73(2), 171-189.

138. Sahoo, P., Nataraj, G. and Kamaiah, B. (2001). Savings and economic growth in India: the long-run nexus. *Savings and development,* 25(1), 67-80.

139. Sajid, G. M. and Sarfraz, M. (2008). Savings and economic growth in Pakistan: An issue of causality. *Pakistan Economic and Social Review,* 46(1), 17-36.

140. Saltz, I. S. (1999). An examination of causal relationship between savings and growth in the Third World. *Journal of Economics and Finance,* 23(1), 90-98.

141. Sandilands, R. J. and Chandra, R. (2003). Does investment cause growth: A test of endogenenous demand - driven theory of growth applied to India 1950 - 1996? In S. Neri (Ed.), *Old and new growth theories: An assessment,* Cheltenham: Edward Elgar, pp. 244-265.

142. Saunders, M., Lewis, P. and Thornhill, A. (2012). *Research methods for business students*, 6th Ed., Harlow, England: Pearson Education.

143. Schmidt-Hebbel, K. and Serven, L. (2000). Does income inequality raise aggregate saving? *Journal of Development Economics*, 61(2), 417-446.

144. Seater, J. J. (1993). Ricardian equivalence. *Journal of Economic Literature,* 31(1), 142-190.

145. Sibanda, N. (2009). *Quantitative Research - Quantitative Seminar 18Aug09.* Retrieved from: http://www.victoria.ac.nz/postgradlife/downloads/quantitative%20seminar18Aug09.pd

146. Sinha, D. and Sinha, T. (1998). Cart before the horse? The saving-growth nexus in Mexico. *Economics Letters,* 61, 43-47.

147. Sjafii, A., Shahadan, F., Selvaratnam, D. P., and Shofiyah, F. (2015). The changes in age structural of population and domestic savings: The period of demographic transition in Indonesia. *The 6th Kuala Lumpur International Business, Economics and Law Conference (KLIBEL),* Vol. 3, Kuala Lumpur, Malaysia.

148. Thanakwang, K. and Soonthorndhada, K. (2007). Determinants of economic security among Thai elderly: Evidence from a cross-sectional national survey, *Asia Journal of Global Studies,* 1, 35-49.

149. Thanoon, M.A.M. and Baharumshah, A.Z. (2005). What happened to savings during the financial crisis - A dynamic panel analysis of five Asian countries? *Econ Change,* 38, 257-275.

150. The World Economic Forum (WEF) (2015). *The global competitiveness report 2015 - 2016: Full data edition*, the Global Competitiveness and Risks Team.

151. Thornton, J. (2001). Age structure and the personal savings rate in the United States, 1956 - 1995. *Southern Economic Journal*, 68(1), 166-170.

152. Tom, B. and Murat, U. (2017). Vietnam: The next Asian Tiger? *Annual conference of New Zealand Association of Economics*, Victoria University's Rutherford House, Wellington, July.

153. Tripathy, N. (2011). Causal relationship between macro-economic indicators and stock market in India. *Asian Journal of Finance and Accounting,* 3(1), 208 - 226.

154. United Nations (2010b). *World population prospects. The 2010 revision: Demographic profiles*. New York: Department of Economic and Social Affairs, Population Division.

155. United Nations (2012b). *World population prospects. The 2012 revision: Demographic profiles.* New York: Department of Economic and Social Affairs, Population Division.

156. United Nations (2015b). *World population prospects: The 2015 revision: Demographic profiles.* New York: Department of Economic and Social Affairs, Population Division.

157. United Nations Population Fund [UNFPA] (2011). *The ageing population in Vietnam: Current status, prognosis, and possible policy response.* Hanoi: UNFPA.

158. Long, G. T. and Toan, P. N. (2015). *Impact of changes to population age structure on Vietnam's economic growth and policy recommendations*. Ministry of Planning and Investment (MPI), Vietnam.

159. Van Donge, J. K, White, H. and Nghia, L. X (1999). *Fostering High Growth in a Low Income Country: Programme Aid to Vietnam*. Stockholm: Sida.

160. Vietnam Social Security (2008). *Vietnam: An overview on social insurance and social health insurance schemes.* Unpublished manuscript. Hanoi: VSS.

161. Vietnam Social Security (2016). *Vietnam: An overview on social insurance and social health insurance schemes*. Unpublished manuscript. Hanoi: VSS.

162. Waithima, A. K. (2009). The egg or the chick first, saving or GDP growth: Case for Kenya. *KCA Journal of Business Management*, 1(1), 1-10.

163. Wilson, S.J. (2000). The savings rate debate: Does the dependency hypothesis hold for Australia and Canada? *Australian Economic History Review,* 40(2), 199-218.

164. World Bank (1993). *The East Asian miracle: Economic growth and public policy*. Policy Research Report.

165. World Bank (1990). *Vietnam: Stabilization and Structural Reforms*. Washington: The World Bank.

166. World Bank (2001b). *Vietnam Development Report 2002: Implementing Reforms for Faster Growth and Poverty Reduction*. Hanoi: Vietnam Development Information Center.

167. World Bank (2007). *Vietnam development report 2008: Social protection*. Hanoi: World Bank Viet Nam.

168. World Health Organization (2006). Working together for health - The World health report 2006. *World Health Organization*, vol. 19. Retrieved from http://www.who.int/whr/2006/whr06_en.pdf.

169. Yasin, J. (2008). Demographic structure and private savings: Some evidence from emerging markets. *African Review of Money Finance and Banking*, 7-21.

170. Zhu. C. (2011). Savings and current account balance: A demographic transition perspective. *Modern economy*, 2(5), 1-73.

APPENDIX 1: Variance Decompositions for Model 1

Variance Decomposition of PSR:

Period	S.E.	PSR	YDR	ODR	LFE	SIF
1	1.366488	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.729150	62.82666	0.124267	35.28418	0.258232	1.506663
3	2.578732	29.68377	7.632528	60.26935	1.721608	0.692749
4	3.731295	18.03878	20.49500	57.91081	2.798584	0.756822
5	5.215562	9.802725	28.38686	57.87444	2.832910	1.103067
6	7.001959	5.544225	36.23707	54.86404	2.326678	1.027987
7	8.823376	3.884841	41.51777	51.78440	1.840031	0.972960
8	10.67718	3.297344	44.87962	49.60404	1.426478	0.792516
9	12.55496	3.440525	47.64582	47.24270	1.067912	0.603042
10	14.28880	4.071269	49.41116	45.19619	0.837749	0.483628

APPENDIX 2: Variance Decompositions for Model 2

Variance Decomposition of LogRPS:

Period	S.E.	LogRPS	GDPgr	LogRGDPper	IFR
1	0.028506	100.0000	0.000000	0.000000	0.000000
2	0.058538	86.48097	0.138088	12.97020	0.410744
3	0.077427	69.66421	22.38170	7.701857	0.252235
4	0.088522	65.73877	27.62776	6.043516	0.589948
5	0.098532	62.86613	31.04766	4.914271	1.171936
6	0.105229	62.98812	30.91947	5.031170	1.061240
7	0.111290	64.63807	29.36256	5.026958	0.972413
8	0.114211	65.67631	28.10275	5.289701	0.931238
9	0.118367	67.16745	26.73770	5.203291	0.891558
10	0.124742	68.25230	25.73858	5.204695	0.804426
11	0.132818	68.55890	25.68093	5.048433	0.711739
12	0.141350	68.90772	25.45829	4.895942	0.738039
13	0.150362	69.43649	25.14656	4.635247	0.781699
14	0.158588	70.11871	24.57898	4.462772	0.839540
15	0.166363	70.67715	24.20847	4.194886	0.919495
16	0.173535	71.04050	24.02334	3.932552	1.003612
17	0.180209	71.22703	24.04704	3.704280	1.021653
18	0.186559	71.36212	24.05934	3.525640	1.052894
19	0.192866	71.54018	23.99655	3.375037	1.088234
20	0.198791	71.78525	23.83611	3.266672	1.111963