Demographic Changes and Pension Finances in Vietnam

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DEMOGRAPHIC CHANGES AND THE LONG-TERM PENSION FINANCES IN VIETNAM: A STOCHASTIC ACTUARIAL ASSESSMENT

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ABSTRACT

This paper aims to provide a long-term financial vision for the Vietnamese pension scheme using stochastic modeling for key variables under an actuarial framework. In particular, we project the pension fund balances in order to see whether the scheme will be financially sustainable. The median values of the status-quo projections show that the pension fund will be depleted in about 2052 with a 90-percent confidence interval range of 8 years. The estimated results from our sensitivity tests show that the retirement age, the indexation method for pension benefits, and the contribution rate are all crucial determinants of the pension fund balance in the long term. At the same time, some factors, including coverage rates, administrative costs, the long-term fertility rate, and the rate of return on pension fund assets play less important roles in determining the fund's balance.

Keywords: aging, stochastic projections, pension finances, Vietnam

1. INTRODUCTION

Demographic changes have significant impacts on the social and economic performances of countries, regions, and the whole world. Recently, the most observable demographic change involves a rapidly aging population, meaning that the proportion of elderly people in the total population is sharply increasing. In the developed and high-performing developing economies, this situation results from important demographic trends: declining fertility rates, declining mortality rates, and increasing life expectancies. Population aging requires extensive public expenditures for the aged on pensions and health care, and therefore influences pension funds, government budgets, and eventually the long-term fiscal sustainability of governments.

The aging population problem becomes more serious if it is associated with a pay-as-you-go (PAYG) pension scheme. A number of empirical analyses indicate that these two issues are potential threats to the financial stability of pension funds and government budgets in almost all economies in the world. For OECD countries, studies on aging, such as Hagemann and Nicoletti (1989), Dang et al. (2001), and OECD (2005), find that most of these countries will face the problems of declining investment, saving, economic growth, and rapidly increasing public expenditures under aging societies and PAYG pension schemes. Similar issues are also challenging transitional and developing economies, especially in the East-Asian region, in which a huge population is aging as a result of the economic miracle and social improvements. Many studies, including Friedman et al. (1996), Heller (1997, 1998), and UNESCAP (2005), also indicate that the PAYG pension schemes in these countries will also be facing fiscal imbalances in the near future.

The medium-variant population projections by United Nations (2007a) show that Vietnam is still a young economy with about 7.6 percent of the total population aged 60 and over in 2005, but it will face the same issues of aging as other countries in the coming decades. Recent demographic changes show that life expectancy at birth increased from 68 in 1995 to 71 in 2007, and fertility rates declined from 2.8 children per woman in 1995 to 1.9 in 2007 (International Database–IDB, 2008). The aforementioned population projections also indicate that the elderly population will increase significantly, reaching 26.1 percent in 2050, and the total dependency ratio will be mostly driven by the elderly dependency ratio. Furthermore, previous studies on the current publicly-managed PAYG scheme in Vietnam also show that the scheme will face financial instability and generational inequity if there are no systematic policy reforms. For instance, Nguyen (2004) shows that on average the amount contributed by a laborer over 30 years will only be able to pay for retirement benefits for 6-8 years, while the average life expectancy at retirement is about 15 years. Giang (2004, 2008a) and Nguyen (2006) find that the pension fund will be financially depleted in about 40 years under the current regulations.

The number of studies on the long-term status of the Vietnamese pension scheme has increased over the past decade, but these studies have limitations due to the deterministic estimation techniques. The common drawbacks of such techniques are presented in a number of studies, such as Foster (1994), Bongaarts and Bulatao (2000), and the American Academy of Actuaries (2005). This paper will mitigate the limitations of the previous studies by using stochastic estimates of key variables under an actuarial framework. In particular, the paper will provide estimates showing different long-term financial prospects for the Vietnamese pension scheme. We will also present the results after modifying a number of parameters to show the critical factors of the scheme's financial stability.

The remainder of the paper is organized as follows. Section 2 presents an overview of the Vietnamese pension scheme with an emphasis on key regulations for contributions and benefits. In Section 3, we provide a brief summary of the relevant studies, in which we emphasize their projection methods and main findings. The analytical framework, data, and assumptions are presented in Section 4, while Section 5 discusses our findings and policy implications. Some remarks in the last section will conclude the paper.

In general, the median values of the baseline projections show that the pension fund will be depleted in about 2052 with a 90-percent confidence interval range of 8 years. The estimated results from our sensitivity tests show that the retirement age, the indexation method for pension benefits, and the contribution rate are all crucial determinants of the pension fund balance in the long term. At the same time, some factors, including population coverage rates, administrative costs, the long-term fertility rate, and the rate of return on pension fund assets play less important roles in determining the fund's balance.

2. THE VIETNAMESE PENSION SCHEME AT A GLANCE

The pension scheme is a component of the social insurance system, which has been in operation since the early 1960s. Prior to 1995, the pension scheme, which provided a non-contributory defined benefit, covered only the employees in the state sector, and it was managed by different public agencies under the supervision of the government. In that scheme, the benefit levels for retirement were defined by the number of working years and the reference wage (usually, it was the wage of the last year prior to retirement). The benefits were paid by the social insurance fund, which was funded by contributions from employers and government subsidies. The fund was managed and guaranteed by the government. For about thirty years, the scheme significantly contributed to the income and living standards of the insured people.

However, dramatic changes in the economy and society with the growing private sector resulting from the *Doi moi* (renovation) programs in 1986 forced the government to reform the scheme. The reform led to the establishment of a publicly-managed pay-as-you-go defined-benefit (PAYG DB) scheme in 1995. Vietnam Social Security (VSS) is responsible for administration of this scheme under the guarantees of the government. Due to this reform, the current pension scheme has two kinds of beneficiaries, i.e. pre-1995 and post-1995 pensioners. The former's benefits are paid directly from the government budget, while the latter's benefits are entitled to and paid by the VSS fund. All current contributors are entitled with the VSS.

Though participation in the scheme is mandatory for all employees of both the state and non-state sectors in Vietnam under some certain conditions, the actual coverage rate of the scheme is very low. According to MOLISA (2006), the coverage rate of the scheme was only about 15 percent of labor force in 2005 (or about 9 percent of the whole population in Vietnam), in which 60 percent were from the state sector (which represented only 10 percent of the labor force), and the remaining 40 percent were from the non-state sector (which accounted for 90 percent of the labor force). The average compliance rate was only 72 percent in 2004 (Nguyen, 2006).

For the pension and survivorship, an employee contributes 5 percent of monthly salary, while an employer contributes 11 percent of payroll. From 2010, the contribution rates of both employees and employers will increase by 1 percentage point every two years until they reach 8 percent and 14 percent, respectively. In 2005, the average contribution was VND 258,000 (about $US 17) per capita per month, based on the minimum wage of VND 450,000, and the average length of service of the current contributors was about 13.5 years (MOLISA, 2006).

A retirement pension is normally paid to men and women at the age of 60 and 55, respectively, who have at least 20 years of contributions. Pension benefit formulas vary depending on the number of years of contributions. Up to the 15th year of contributions, the pension accrual rate is 3 percent, and is then 2 percent for males and 3 percent for females for each additional year. Conversely, the pension accrual rate will be reduced by 1 percent for each year of early retirement. If contributions have been paid for in excess of 30 years for men and 25 years for women, the retiree can receive an additional lump sum payment of half a month's average salary for each year of the excess. The maximum replacement rate is 75 percent. If the total number of contribution years is less than 20, retirees can only receive a lump sum payment of 1.5 times the average monthly salary for each year of contributions. There is no floor or ceiling for pensionable earnings. The reference earnings for estimating pension benefits is calculated as the average wage of the last 10 years prior to retirement for contributors who have been lifetime employees of the state sector, or the average wage of the whole working and contributing time for other contributors. Recently, the average replacement rate was 69 percent, and the average retirement age for males and females was 57 and 52, respectively (VSS, 2004). The dependency ratio of the scheme was about 5.8 percent in 2005, meaning that 1 pensioner was covered by 17 contributors.

Most of the accumulated pension fund assets have been lent to or invested in government-guaranteed sources, including state-owned commercial banks, government budget, treasury bonds, or the Development Assistance Fund (DAF). These assets usually earn lower average rates of return than the average market rates for bank deposit (Nguyen, 2006; Giang, 2008b).

3. A REVIEW OF RELEVANT STUDIES

Since the early 1990s, instead of using traditional deterministic (or scenario-based) modeling, researchers have been interested in using stochastic modeling to evaluate the long-term financial capacity of social security schemes, particularly in OECD countries. Ronald Lee, Shirad Tuljapurkar and others have produced a series of studies to discuss the impacts of demographic changes on the long-term finances of the U.S. social security system. In Lee and Tujapurkar (1998a), they make a population forecast for the period 1994-2070 by creating stochastic forecasts for mortality and fertility, and using a deterministic forecast for net immigration. For the economic variables, they obtain most of the assumptions from the Social Security Administration (SSA) deterministic forecasts, but they do make stochastic forecasts for the productivity growth rates and interest rates, which follow independent AR(1) processes. In another paper (Lee and Tuljapurkar, 1998b), they also use stochastic forecasts for these variables, but the productivity growth rate follows an ARMA constrained mean (ARMA-CM) model, while the interest rate follows an AR(1). In these two papers, the authors also examine how much these variables contribute to the uncertainty of financial forecasts by alternatively allowing these variables to be deterministic or stochastic.

Also, to see only the impacts of demographic changes on the U.S. Old Age, Survivor, and Disability Insurance (OASDI) Trust Funds, Tuljapukar and Lee (2000) make stochastic population forecasts with stochastic mortality and fertility, and deterministic net immigration, while taking values of economic variables, such as the inflation rate, real interest rate, productivity growth rate, and labor force participation rate from the Trustees' 1995 report. They find substantial differences in possible future trajectories of the fund, and then suggest using stochastic forecasts with supplementary methods to examine uncertainty. In a similar work for stochastic projections of the Social Security Trust Fund, Lee *et al*. (2003) also make stochastic forecasts for real wage growth, the interest rate, and equity returns using a vector autoregression. They then examine several plans for achieving long-term solvency by raising the normal retirement age, increasing payroll taxes, and investing some portion of the fund in the stock market. Further examining the impacts of net immigration in the social security fund, Lee *et al*. (2004) make stochastic forecasts for this variable, and the results show that stochastic net immigration makes only little difference to the probability distribution of the old-age dependency ratio, and thus a small difference in trust fund projections.

In developing their own long-term actuarial model to evaluate the Social Security Administration (SSA)'s 75-year projections of the Trust Funds, the Congressional Budget Office (2001) makes stochastic forecasts for demographic variables (including mortality, fertility, and immigration) and economic variables (including real wage growth, unemployment, inflation, real interest rate, disability incidence rate, and disability termination rate). For instance, they estimate immigration and fertility with an ARMA(4,1) model, and real wage growth and mortality improvements with AR(1) processes. To examine the simulated results, they use both Monte Carlo techniques and bootstrap simulations in order to generate a probability distribution for future outcomes.

Among a handful of papers discussing the long-term pension fund balance with stochastic methods in other OECD countries, Fehr and Habermann (2004) discuss the sustainability of the German pension system under demographic uncertainty during 2001–2050. The paper makes stochastic forecasts for fertility and mortality, but uses deterministic net immigration, to obtain stochastic population forecasts, while economic variables are estimated by using an overlapping generation model with three sectors, i.e. household, production, and government. They find that demographic changes have significant impacts on the benefit levels in the long-term. The paper then looks for the influences of changes in contribution rates and replacements rates on the financial balance of the system, in which generational equity is also in focus. Børlum (2004) uses the same methodology, but takes net immigration to be stochastic, and finds also that the demographic uncertainty will have substantial influences on the long-term benefit levels of different participating cohorts in the Danish PAYG DB pension system during the 2000–2050 simulation period.

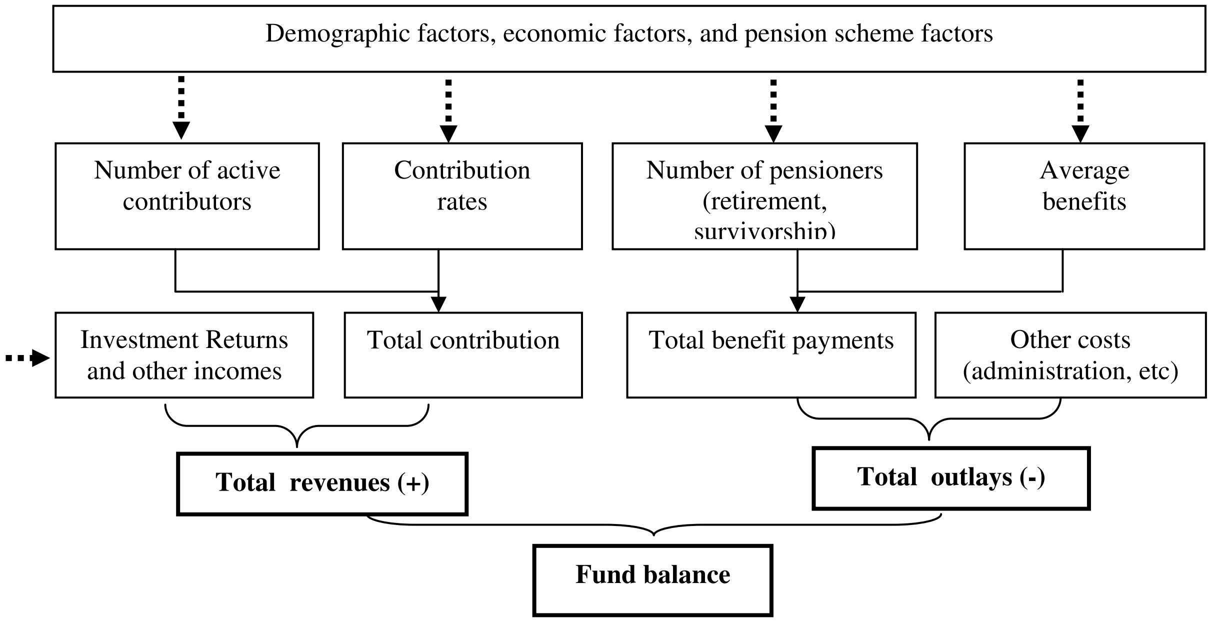
The paper by Kitamura *et al*. (2005) uses the Asset-Liability Model (ALM) with stochastic simulation to analyze the Japanese Public Employees' Pension Scheme. Among various variables in the model, they make stochastic forecasts for the growth rate of prices, growth rate of wages, and rate of investment return of the pension reserve fund in order to evaluate the appropriateness of an indexation rule, which affects future benefit levels and financial conditions of the scheme.

4. ANALYTICAL FRAMEWORK, DATA, AND ASSUMPTIONS

4.1. Projections for Pension Fund

To assess the long-term financial capacity of the pension fund, we need to make projections for the related indicators of the scheme, including demographic factors (such as population and active labor force), macroeconomic factors (such as inflation and wage growth), and pension scheme indicators (such as active contributors and pensioners). The general projection flows are illustrated in Figure 1. In this paper, we will apply stochastic estimates for some key variables in order to provide estimates for the pension fund balances in the period 2005-2105.

Figure 1. Projection Methodology for the Pension Fund Balance

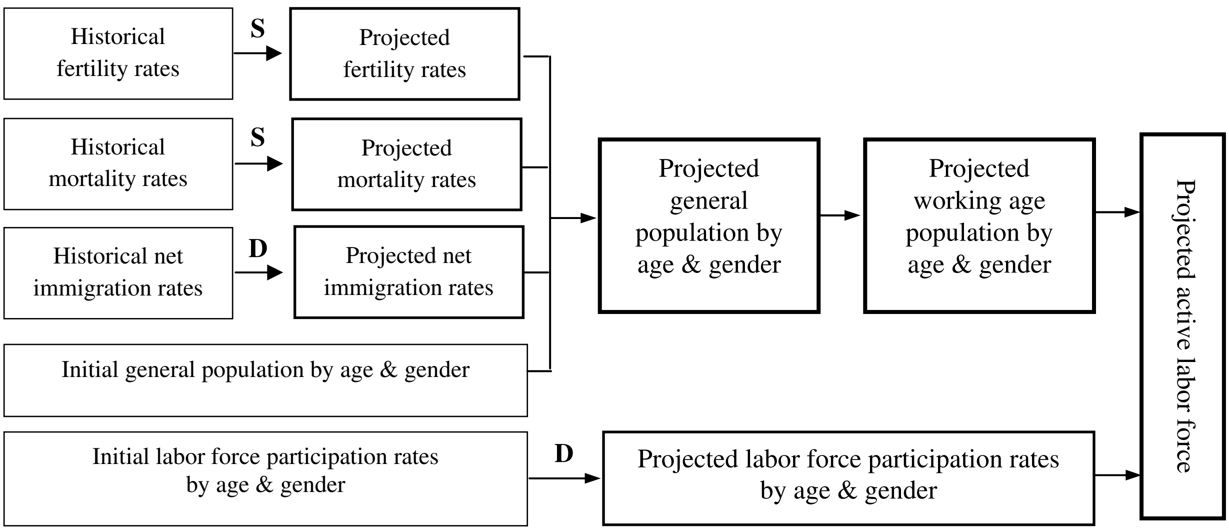


Source: Own modifications using International Labor Office – ILO (1998).

4.2. Projections for Population and Labor Market

Our projections for population and the labor market are illustrated in Figure 2. The development of population projections depends on three major factors: fertility rates, mortality rates, and net immigration rates.

Figure 2. Projection Methodology for Population and Active Labor Force



Note: S: stochastic; D: deterministic.
Source: Own modifications using ILO (1998).

The population projections are based on an iterative procedure with an initial year. To project the population in subsequent years, we combine the population of the previous year with the projected rates of mortality, fertility, and net immigration for each age. Population projections can be expressed as follows:

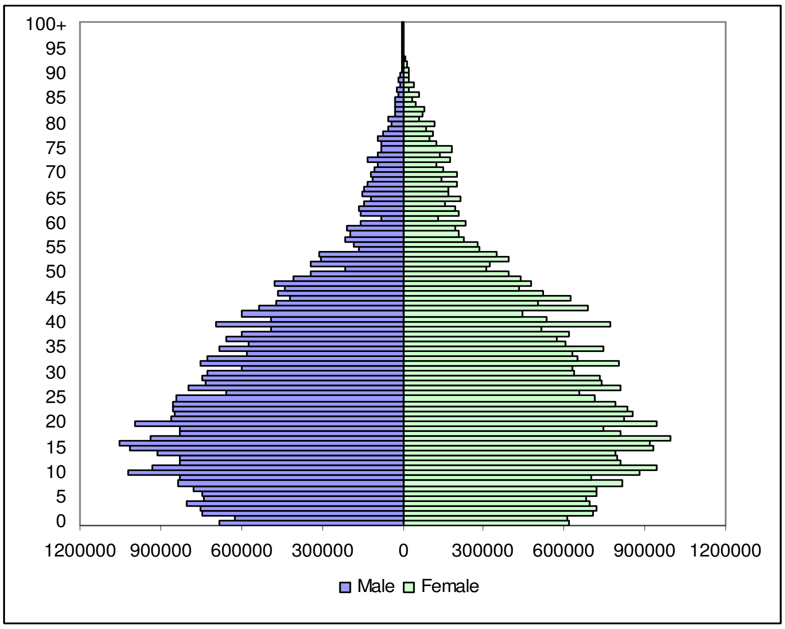
$$POP_{t+1} = L_t POP_t + MIG_t POP_t, \tag{1}$$

where *POP* is an *n x 1* vector of gender-specific population totals calculated by age for *n* ages; *MIG* is an *n x 1* vector of net immigration rates by age; *t* represents the projection year; and *L* is the *n x n* Leslie Matrix:

$$L_t = \begin{bmatrix} 0 & 0 & \ldots & f_{x,t} & \ldots & 0 \\ 1-m_{0,t} & 0 & 0 & \ldots & \ldots & 0 \\ 0 & 1-m_{1,t} & 0 & 0 & \ldots & 0 \\ \ldots & \ldots & \ldots & \ldots & \ldots & \ldots \\ 0 & 0 & \ldots & \ldots & 0 & 1-m_{n,t} \end{bmatrix}, \tag{2}$$

where *f(x,t)* and *m(x,t)* respectively represent the gender-specific fertility rates and central death rates for people age *x* during the year *t*.

Figure 3. Distribution of Vietnamese Population, 2005



Source: Own calculations using IDB (2008) and VHLSS 2004.

Our base-year for population projections is 2005, and the data are obtained from IDB (2008). The data are available by gender and five-year age groups between 0 and 99, and for the sum of individuals aged 100 and over. For projections, we expand the population data in 2005 from 5-year age groups to 1-year age groups using the population pattern by age and gender from the Vietnam Household Living Standards Survey (VHLSS) in 2004. This survey provides representative population data for all regions and areas of Vietnam. Figure 3 presents the population pyramid by age and gender for Vietnam in 2005.

In the case of migration, as the data for net international migration by age and gender in Vietnam are rare and not available to date, we use the Japanese population's net immigration structure as proxy for Vietnam. The data show that net immigration has not had significant impacts on the size of Japan's population, which also has been the case for Vietnam since the 1980's to date. The data are obtained from the Statistics Bureau of Japan's Ministry of Public Management, Home Affairs, Posts and Telecommunications (Okita et al., 2008).

Both mortality and fertility rates are projected using the Lee-Carter method, which has been described in a number of studies (see, for instance, Lee and Carter 1992; Lee 1993, 2000; Lee and Tuljapukar 1994, 1998; and Lee and Miller 2001). The method for mortality uses the historical age-sex breakdown of central death rates by single year of age, and uses the notion that mortality can be decomposed into age-specific and time-specific components. In general, the model for mortality forecasts can be presented as follows:

$$log[m(x,t)] = a(x)+k(t)b(x)+\varepsilon(x,t), \quad (3)$$

where $m(x,t)$ is the central death rate of a person aged x in the year t; $a(x)$ represents time-invariant general age pattern across the mortality schedule; $b(x)$ reflects the time-invariant relative speed that various ages respond to the time-varying trend in mortality, which is presented by $k(t)$; and $\varepsilon(x,t)$ is the error in this approximation to the actual age schedule.

In estimating these models, standard regression techniques cannot be used, because none of these terms are observable. Instead, a singular value decomposition (SVD) technique[1] is used, and it leads to setting $a(x)$ equal to the time average of $log[m(x,t)]$ over the historical data, and using the matrix of deviations, $log[m(x,t)]-a(x)$, in the SVD routine. The estimates are derived from constraints that the sum of $k(t)$ terms over t equals 0 and the sum of $b(x)$ terms over x equals 1. In other words, SVD can help us to transform the tasks of forecasting $log[m(x,t)]$ into forecasting $k(t)$ and the error $\varepsilon(x,t)$.

Similarly, the model for estimating fertility can also be expressed as follows:

$$log[f(x,t)]=c(x)+l(t)d(x)+e(x,t), \quad (4)$$

where $f(x,t)$ is fertility of women aged x in the year t; $c(x)$ is an addictive age-specific constant, which reflects the general age pattern of fertility; $l(t)$ is a period-specific index of the general level of fertility; $d(x)$ reflects the responsiveness of fertility at age x to the variations in the general level; and $e(x,t)$ represents any remaining residual of this approximation.

The key to forecast these age-sex variables is to assume that the age-specific components of the model will remain constant in the future. After fitting an appropriate model, 1000 Monte Carlo simulations are produced using the specified model, in order to obtain a probability distribution over mortality and fertility.

In this paper, we use yearly data of mortality rates for the Vietnamese population by five-year age groups, in which data for the year 1999 are obtained from Lopez et al. (2000), while those for the period 2000-2005 are obtained from WHO (2008). The former provides mortality rates for all ages between 0 and 84, and the sum of individuals aged 85 and over, while the latter provides mortality rates for all ages between 0 and 99, and the sum of individuals aged 100 and over. We use the Coale and Guo (1989) method to extend data for the year 1999 to get consistent data with those of WHO. Then, for the sake of simplicity, we assume that all individual ages have the same mortality rates as the average rate of their respective age groups, in order to get historical mortality rates by age.

[1] The SVD theorem states that any n x p matrix (namely, matrix **A**) can be factored as $\mathbf{A}_{nxp}=\mathbf{U}_{nxn}\mathbf{S}_{nxp}\mathbf{V}^{\mathbf{T}}_{pxp}$ where $\mathbf{U}_{nxn}$ is an n x n orthogonal matrix, and $\mathbf{V}_{pxp}$ is a p x p orthogonal matrix, and $\mathbf{S}_{nxp}$ is an n x p matrix with singular values of **A** on the main diagonal, and zeros elsewhere.

For fertility projections, we also use annual data for the period 1990-2005, which are obtained from the IDB. This dataset provides historical fertility rates of all the females aged 15-49 by five-year age groups. Also for the sake of simplicity, we assume that all individual ages have the same fertility rates as the average rate of their respective age groups, in order to get historical fertility rates by age. The data show that the total fertility rate (TFR) in Vietnam has experienced a decreasing trend over the past two decades, from 3.65 in 1990 to 1.94 in 2005. We assume that the long-term total fertility rate will fluctuate around 1.85, which is the same as the assumed rate for the medium-variant projections of the United Nations (2007a). Also, to estimate the number of newly-born children by gender, we assume that the average historical birth rate, which was 1.06 boys per girl during 1990-2005, will remain for the whole projection period.

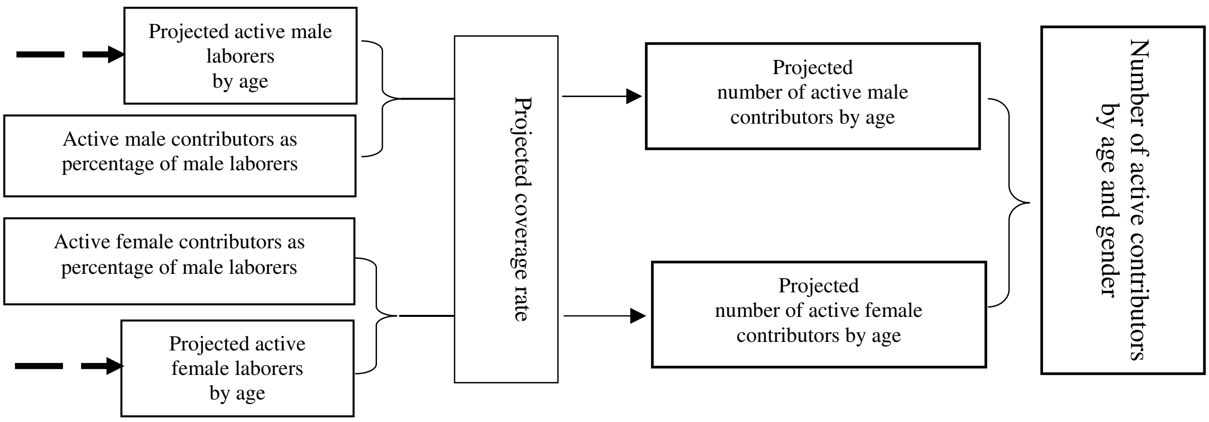
With the projected total population described above, we can get the projected working-age population, i.e. the 15 to 59 year-old population. We assume that the total labor force participation rates by age and gender in 2005 will remain the same for the whole projection period. The projected rates of labor force participation and the projected working-age population will produce the projected active laborers by age and gender, which in turn are important for estimating the number of contributors for the pension scheme. Labor force participation rates are available from yearly surveys on labor and employment during 1996-2005 by the Ministry of Labor, War Invalids, and Social Affairs, Vietnam (MOLISA).

4.3. Projections for Active Contributors and Pensioners

4.3.1. Current and New Active Contributors

The projected number of active contributors will be calculated using the projected active labor force. Although active contributors from state and non-state sectors still have different treatments under the current regulations, we will not consider any differences between these people in our projections. This is a reasonable assumption in the long term, as the Vietnamese government is currently undertaking a variety of policy measures to close the gaps, particularly for wages, between the two sectors.

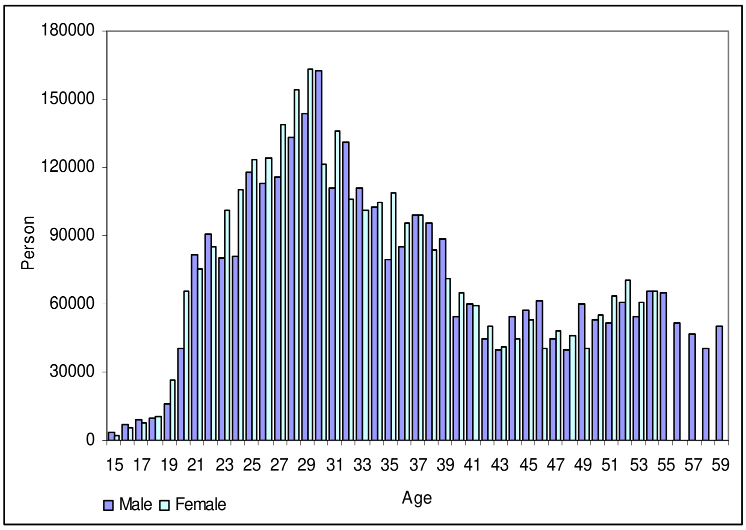
Figure 4. Projection Methodology for Active Contributors



Source: Own modifications using ILO (1998).

Figure 4 illustrates our projection methodology for the number of active contributors. We will project the number of active contributors by age and gender using the historical data on the percentages of active laborers participating in the pension scheme by age and gender. Data on the current active contributors, provided by MOLISA (2006), are presented by gender in 5-year age groups. For the projection purposes, we use the representative data from VHLSS 2004 to adjust the current active contributors by single age and gender.

Figure 5. Distribution of Active Contributors by Age and Gender, 2005

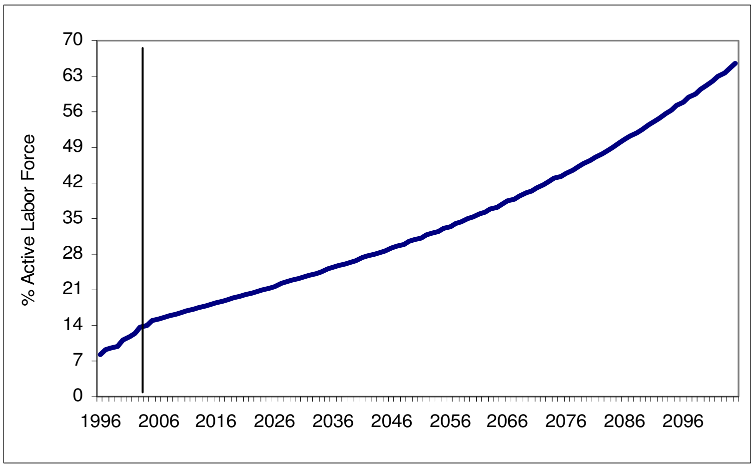


Source: Own calculations using MOLISA (2006) and VHLSS 2004.

Figure 5 shows the age distribution for male and female active contributors in 2005. Such a distribution was inherited from the fact that many pre-1995 scheme's contributors transferred their status to the post-1995 scheme when the VSS was established.

Over the past decade, the coverage rate of the pension scheme, which is measured by percentage of the labor force participating in the scheme, gradually increased from 8.4 percent in 1996 to about 15 percent in 2005. Under the current regulations of the Social Insurance Law, the coverage rate is expected to increase further. Moreover, coverage should increase as the urban population share grows (Sin, 2005). Therefore, we will use the urbanization projections by United Nations (2007b) to estimate the growth of coverage rates for the Vietnamese pension scheme. Since the data are presented in 5-year intervals from 2005 to 2050, we recalculate to get yearly growth rates, and assume that the urbanization growth rates for the period 2050-2105 will be the same as the average rate of 2045-2050.

Figure 6. Historical and Projected Coverage Rates, 1996-2105



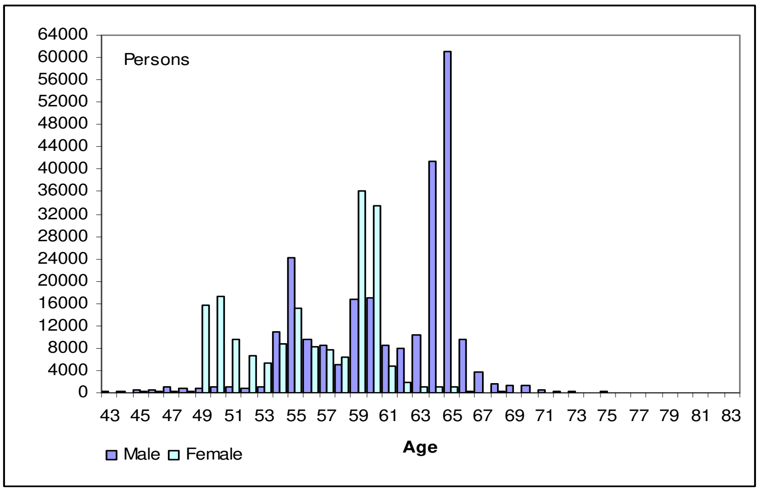
Source: Own calculations using VSS (2004), MOLISA (2006), and United Nations (2007b).

Figure 6 shows the historical and projected coverage rates of the Vietnamese pension scheme in 1996-2105. We assume the coverage rate will be about 66 percent of the projected active labor force at the end of the projection period.

4.3.2.Current and New Pensioners

For the current pensioners, we will use stochastically projected mortality rates for the general population to estimate the number of people remaining over time from the 2005 base. Even though it is commonly recognized that pension recipients may have lower mortality rates and higher life expectancy than the average population because they usually have better healthcare treatment and other social services, our assumption is necessary because historical data on mortality rates for the pensioners by age and gender are not available. We only consider pensioners belonging to the VSS (or post-1995 scheme). We will not consider pre-1995 pensioners, as they belong to the government system, and their benefits are paid by the government budget, which is separate from the VSS pension fund.

Figure 7. Distribution of the Current Pensioners by Age and Gender, 2005



Source: Own calculations using MOLISA (2006) and VHLSS 2004

Figure 7 shows the age distribution of the current male and female pensioners in 2005. The distribution shape results from the situation that some people contributed in both the pre-1995 and post-1995 periods. Most of the pensioners were at the normal retirement ages, but there were also a number of early pensioners.

For projections of new pensioners, it would not be reasonable to assume that individuals will contribute fully from the time they enter the labor force to the time they reach the full retirement ages, and thus we assume that male and female contributors on average will retire at age 57 and 51, respectively, based on the data for current pensioners. Such retirement ages are hereafter referred to as the assumed retirement ages. We estimate the number of new pensioners using the projected number of active contributors over time. As historical data for retirement rates by age and gender are not available to date, we will estimate the number of new pensioners at the assumed retirement ages as percentages of the active contributors in the previous year at the pre-retirement ages, and assume that these percentages will remain over the projection period. In addition, the existing data show that the average length of service of male and female participants were 33.75 and 31.25 years, respectively, which in turn provides respective replacement rates of 70.5 percent and 68.5 percent.

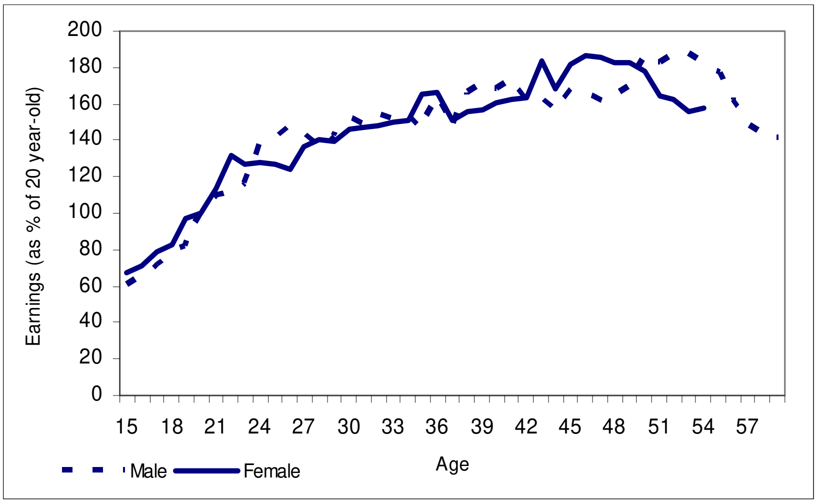
4.4. Projections for Macroeconomic Variables

There are many relevant macroeconomic variables that need to be considered in the long-term financial projections for the pension scheme. In this paper, we take the following variables to be stochastic: (i) inflation rate, (ii) real interest rate, and (iii) real wage growth. We assume that these variables are independently and identically distributed (i.i.d) with log-normal distributions, in which means and variances are estimated from their respective historical patterns as shown in Table 1.

Table 1. Historical Values for Time-series Data

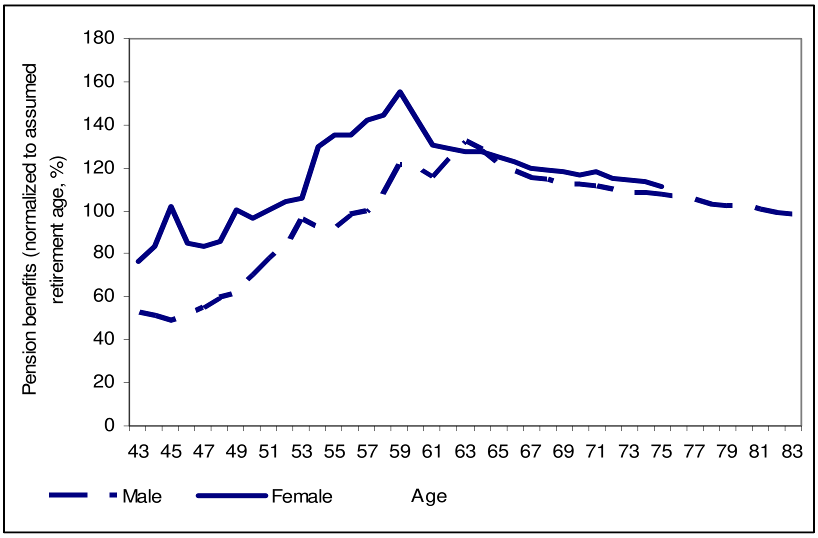
Variable	*Time Period*	*Arithmetic Mean*	*Standard Deviation*	*Source*
Inflation (headline CPI)	1994 - 2005	2.64%	3.44%	IMF International Financial Statistics (various years)
Real investment return for pension fund assets	1996 - 2005	3.35%	3.73%	MOLISA (2006) and IMF International Financial Statistics (various years)
Real wage growth	1992 - 2005	5.20%	1.20%	IMF Country Statistics for Vietnam (various years)

Figure 8. Average Contribution Wage of the Current Contributors by Age, 2005



Source: Own calculations using MOLISA (2006) and VHLSS 2004

Figure 9. Average Benefit of the Current Pensioners by Age, 2005



Source: Own calculations using MOLISA (2006) and VHLSS 2004.

For the projections, we assume that both contributors' wages and pensioners' benefits will be adjusted by the projected nominal wage growth rates, which are the sum of the projected real wage growth rates and the projected inflation rates. Figure 8 presents the by-age wage pattern of the current contributors as percentages of respective male and female wages at age 20, while Figure 9 shows the normalized benefits of the current pensioners as percentages of respective male and female pensioners' benefits at their assumed retirement ages.

4.5. Projections for Pension Fund Balance

As presented in Figure 1, the pension fund balance depends on total revenues and total expenditures. In this paper, we assume that total revenues only include revenues from contributions and investment returns, while total expenditures only include expenditures for retirement, survivorship, and administration.

Revenues

Revenues in year t (Rev_t) can be defined as follows:

$$\begin{aligned} Rev_t &= contributions_t + investment\ returns_t \\ &= number\ of\ contributors_t * average\ wage_t * contribution\ rate_t + \\ &+ fund_{t-1} * (1+r_t), \end{aligned} \tag{5}$$

in which r_t is the projected rate of return on investments in year t.

Expenditures

Expenditures in year t (Exp_t) can be defined as follows:

$$\begin{aligned} Exp_t &= Retirement_t + survivorship_t + administrative\ costs_t = \\ &= number\ of\ retirees_t * average\ benefit_t + survivorship_t + administrative\ costs_t \\ &= number\ of\ retirees_t * average\ reference\ wage_t * average\ replacement\ rate + \\ &+ survivorship_t + administrative\ costs_t \end{aligned} \tag{6}$$

As mentioned above, the benefit formula is varied for beneficiaries from different economic sectors, since it refers to different reference wages, which are used to estimate pension benefits. The dataset, however, does not include detailed information on the relationship between average compensation and the average reference wage of the contributors by age and gender, and thus it would be reasonable to assume that average reference wages for males and females are proportional to their respective average compensation at the time of retirement. In practice, the actual difference between these indicators gradually reduced from about 15 percent in 1998 to 5.7 percent in 2002,[2] and we therefore assume that the average reference wage is about 90 percent of the average compensation at the time of retirement throughout the projection period. In addition, the average replacement rates for male and female contributors in 2005 will be used, and they are also assumed to be unchanged during the projection period.

A further issue is that the benefits of dependants or survivors (e.g. children, spouses, or parents) will entail lump-sum or monthly payments. It is infeasible, however, to estimate these benefits with existing data. For the present purposes, these payments are assumed to represent about 20 percent of total retirement benefits in each year, which is in line with the historical situation.

[2] These figures are respectively from Holzmann et al. (2000), and own estimation from VSS (2004).

As regulated, the total administration costs are equal to 4 percent of the total contributions each year. We assume that this rate will remain until 2020, and then decrease to 2 percent afterwards, as this represents the government's current intentions.

4.6. Sensitivity Analysis

In order to examine how the pension fund balance will be changed when relevant variables change, we will conduct sensitivity analyses as well. Table 2 summarizes our sensitivity tests.

Table 2. Sensitivity Tests

Test	*Variable*	*Baseline Value*	*Modified Value*
1	Inflation	Mean value is 2.64%	Stochastic forecast values are reduced by 1 percentage point
2	Real wage growth	Mean value is 5.20%	Stochastic forecast values are reduced by 1 percentage point
3	Real returns on pension fund assets	Mean value is 3.35%	Stochastic forecast values are reduced by 1 percentage point
4	Coverage rates	Continuous rise in coverage rates up to 66% of labor force in 2105	Coverage Rates remain at their 2005 value of 15% throughout the projection period
5	Retirement ages	Men retire at 57, Women at 51	(1) Men retire at 58, Women at 52 (Higher Retirement Age) (2) Men retire at 56, Women at 50 (Lower Retirement Age)
6	Administrative costs	4% of contributions until 2020, then 2% thereafter	Always 4% of total contributions
7	Cost-of-Living-Adjustment (COLA)	COLA for benefit payments is nominal wage growth	(1) COLA for benefit payments is inflation rate. (2) COLA for benefit payments is inflation rate plus one half of real wage growth. (3) COLA for benefit payments is nominal wage minus 1 percentage point.
8	Contribution rates	Currently 16%, but adjust upward to 22% by 2014 and thereafter	Always stay at 16%
9	Long-term total fertility rates	Expected to be 1.85	Assume to be at replacement rate of 2.1

As inflation and real wage growth play key roles in adjusting pension benefits and contributions, in the first and second tests, we will consider how the pension fund balance will be influenced when stochastic forecast values of each variable are reduced by 1 percentage point.

In the third test, the assumption that the stochastic forecast values for the pension fund returns are 1 percentage point less will also be examined to see more clearly about the role of investment returns.

Coverage rates are usually considered as an important factor in balancing the pension fund. Thus, in the fourth test, we will compare our projected coverage rate increases to a coverage rate that stays at the current level (15 percent of the labor force).

There have also been a number of debates about the current normal retirement ages. As the assumed retirement ages remain for the whole projection period, we will conduct two analyses in the fifth test. The first scenario, namely higher retirement ages, assumes that male and female contributors will retire at 58 and 52 years old, respectively. Conversely, the second scenario, namely lower retirement ages, assumes that male and female contributors will retire at 56 and 50 years old, respectively.

In the sixth test, we consider the role of administrative costs by comparing a scenario in which administrative costs always stay at 4 percent of each year's total contributions.

Regarding indexation of pension benefits, we will examine in the seventh test how the pension fund balance will respond to a scenario in which pension benefits are indexed to inflation, instead of nominal wage growth.

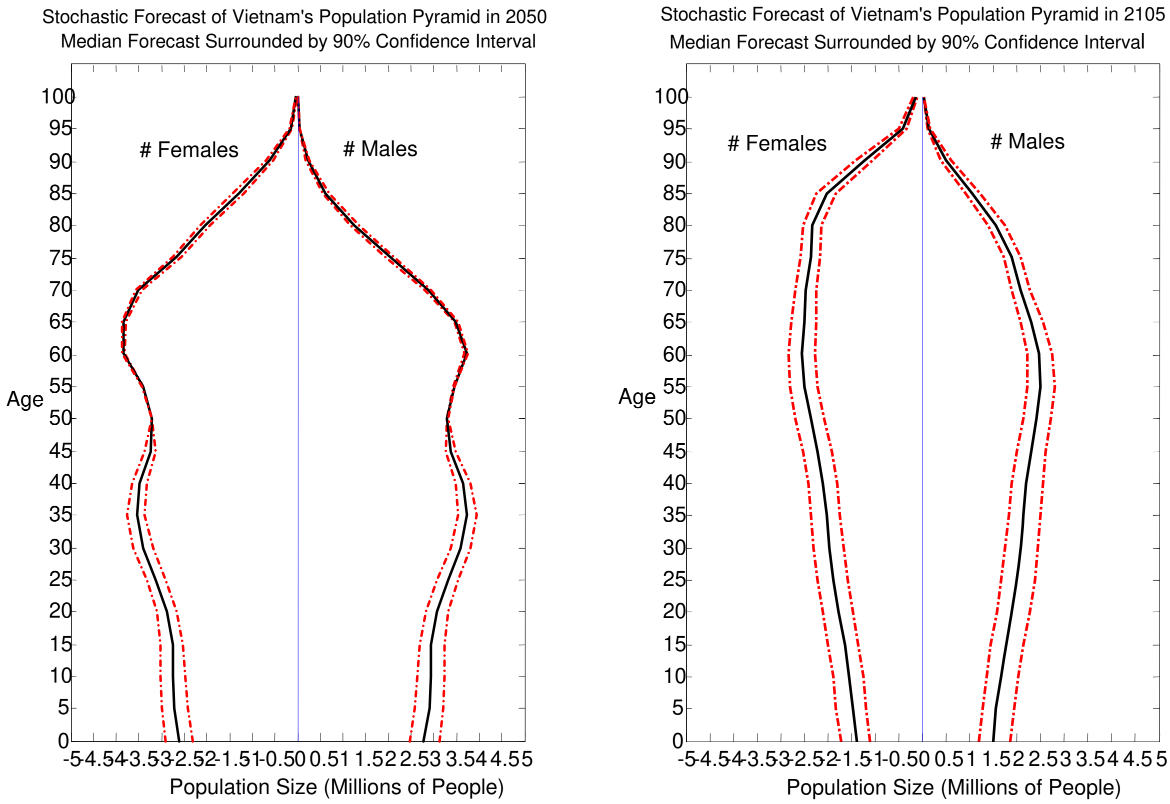
In the eighth test, we will also examine the impacts of contribution rates on the pension fund balance. In our test, we assume that the total contribution rate will stay at 16 percent for the whole projection period.

Lastly, as fertility rates play an important role in demographic changes, we will compare our estimates with an assumption that the long-term total fertility rate fluctuates around 2.1, which is higher than our baseline value of 1.85.

5. ANALYSIS OF FINDINGS

5.1. Projected Population

Figure 10. Projected Population, 2050 and 2105

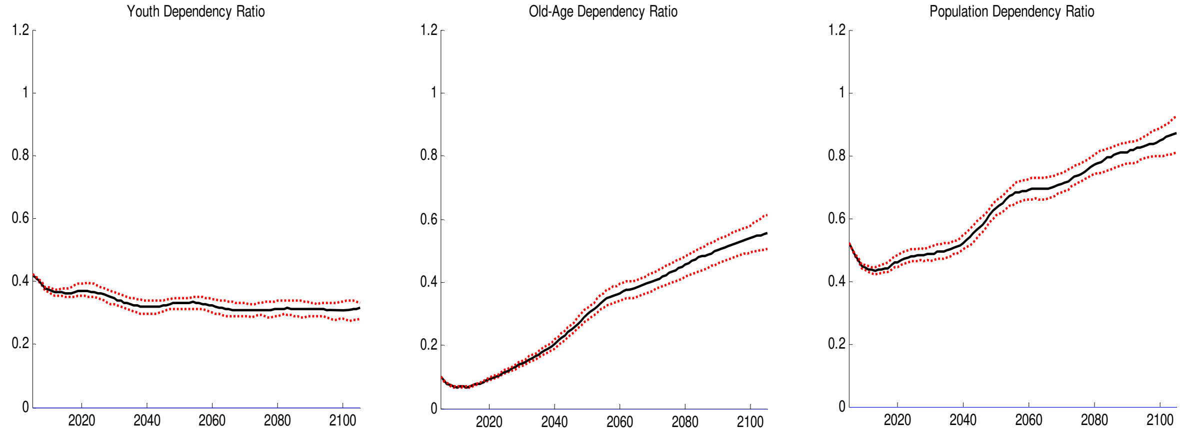


Source: Own calculations.

Figure 10 presents results from the stochastic population projection for Vietnam in 2050 and 2105. The median forecasts are surrounded by a 90 percent confidence interval. The aging process can be seen with these two population pyramids, as the number of children will experience dramatic declines, while the number of elderly people, especially oldest people (aged 80 and over), will increase substantially.

The aging population can also be observed with three important dependency ratios: (i) the youth dependency ratio, which is estimated by the number of children (aged 0-14) divided by the number of working age people (aged 15-59); (ii) the elderly dependency ratio, which is measured the number of elderly (aged 60 and over) divided by the number of working-age people, and (iii) the population dependency ratio, which is measured by the sum of the aforementioned dependency ratios.

Figure 11. Projected Dependency Ratios, 2005-2105

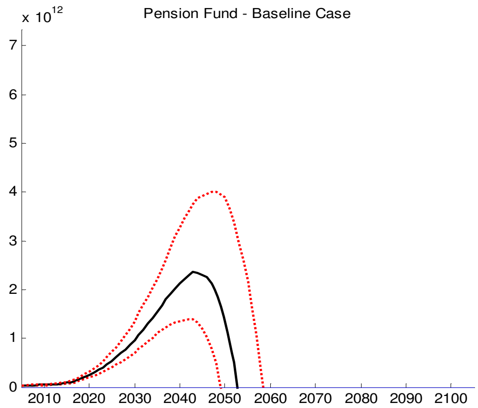


Source: Own calculations.

Figure 11, which shows the median projections surrounded by a 90 percent confidence interval, indicates that the population dependency ratio will be mostly driven by the elderly dependency ratio. In other words, the growth rate of youth will be dominated by the growth rate of elderly population in the coming decades, especially from 2020 onwards. The youth dependency ratio can actually be expected to decrease throughout the projection period. This has important implications for any social and economic policies related to demography.

5.2. Projection Results for the Pension Fund Balance: Baseline Scenario

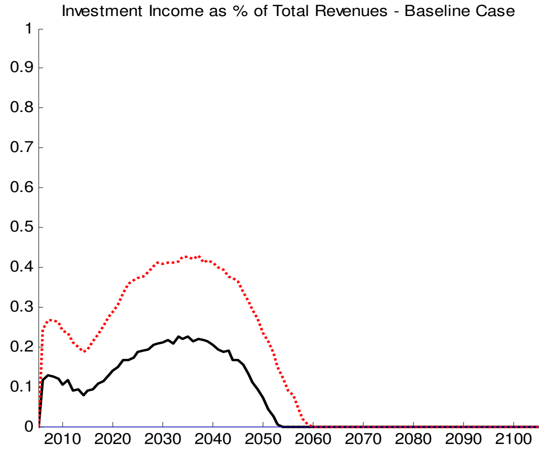
Figure 12. Projected Pension Fund, 2005-2105: Baseline Case



Source: Own calculations.

Figure 12 presents the baseline projected pension fund with median values, which are surrounded by a 90 percent confidence interval. The median values show that the pension fund size will peak at about VND 2.5 trillion in 2046, and then decrease rapidly to zero in 2052. In other words, the pension fund will be depleted in 2052 under current regulations. Within the bound of the 90 percent confidence interval, we can see that such depletion can happen as early as in 2048, and as late as in 2056. This finding is also consistent with some previous studies on the deterministic projections for the long-term pension fund balance in Vietnam, such as Giang (2004, 2008), Castel and Rama (2005), and Nguyen (2006). It means that, without further reform considerations, the Vietnamese pension scheme will face a variety of financial difficulties, which in turn result in generational imbalances between participating cohorts.

Figure 13. Projected Investment Income as a Percentage of the Projected Revenues, 2005-2105: Baseline Case

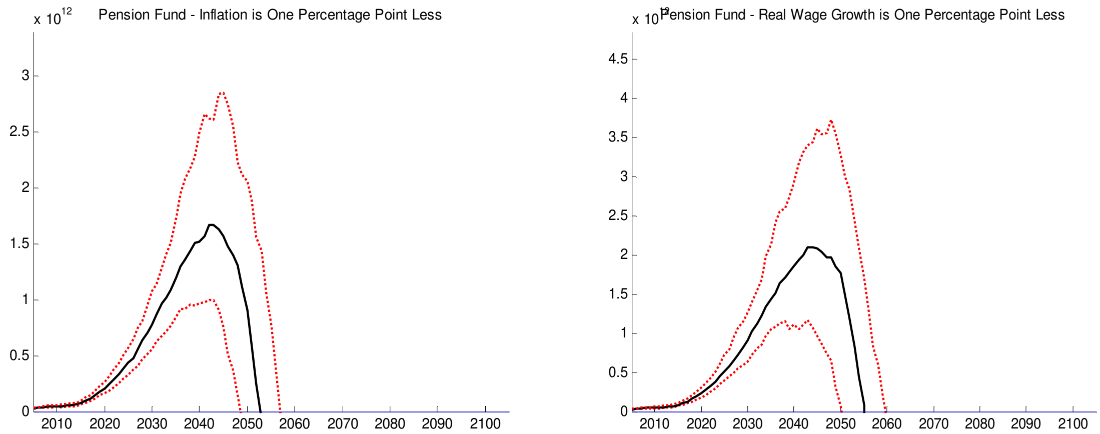


Source: Own calculations.

Figure 13, which shows the median projections surrounded by a 90 percent confidence interval, indicates that investment income will play a small role in the total revenues of the pension fund, as its peak will be about 24 percent of the total revenues in the early 2030s. In other words, participant contributions will be the main driving force for pension fund revenues during the projection period.

5.3. Projection Results for the Pension Fund Balance: Sensitivity Scenarios

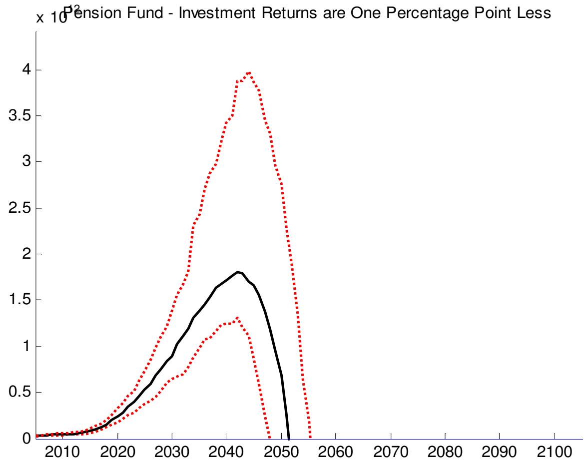
Figure 14. Pension Fund under Lower Inflation and Real Wage Growth, 2005-2105



Source: Own calculations.

Figure 14 presents the stochastic projections for the pension fund balance surrounded by a 90-percent confidence interval in the case that the stochastic forecast values of the inflation rate and real wage growth are reduced by 1 percentage point. The median values imply that that the pension fund status will not be significantly improved in either case. Lower inflation has almost no effect, presumably because there will be proportional reductions in contributions and benefits. Meanwhile, lower real wage growth extends the life of the fund about two years. Essentially, both inflation and real wage growth affect contributions and pension benefits in similar ways, such that the net effect is small.

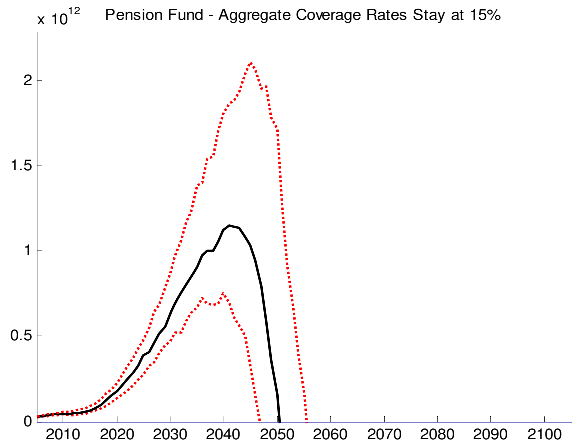
Figure 15. Pension Fund under Lower Rates of Returns, 2005-2105



Source: Own calculations.

When the stochastic forecast values of rate of returns are 1 percentage point less than those in the baseline projections, the balance of fund will not be changed substantially, as shown in Figure 15. The median values of projections imply that the fund will be zero in 2051, which is only one year earlier than the baseline projections. The estimates within a 90-percent confidence interval also indicate that the fund depletion will happen in as early as 2047, and 2055 at the latest. The pension fund is not particularly sensitive to investment returns because contributions are the main source of revenues.

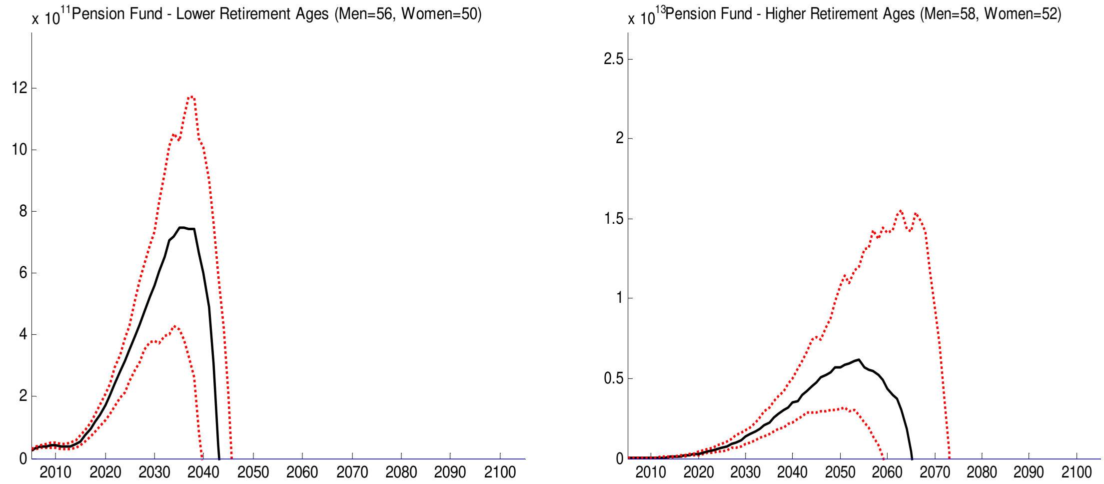
Figure 16. Pension Fund under Constant Coverage Rates, 2005-2105



Source: Own calculations.

Our estimates under the assumption that coverage rates will remain constant at 15 percent also provide similar results, which are presented in Figure 16. The median forecast values show that the pension fund depletion will occur in 2050, which is slightly sooner than the baseline projections. Higher coverage rates can help to slightly extend the duration of the pension fund as more contributions flow into the pension fund, but eventually this will mean more benefit payments as well, such that the effect is short lived. Nonetheless, this result is important because the effect is even more short lived than may be generally thought.

Figure 17. Pension Fund under Lower and Higher Retirement Ages, 2005-2105

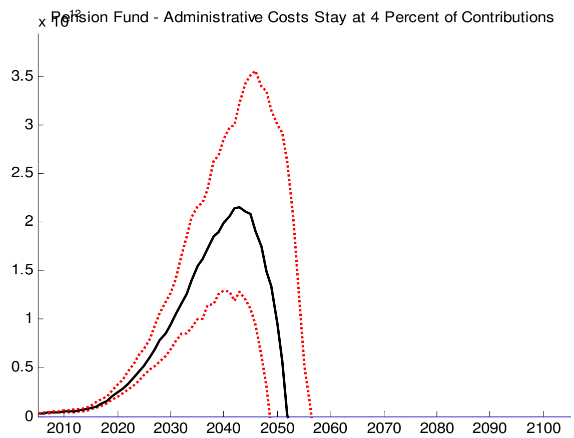


Source: Own calculations.

Figure 17 presents our estimated results under 1-year lower/higher retirement ages in comparison with the assumed retirement ages. The left panel shows the estimated results from a scenario of lower retirement ages (56 and 50 for males and females, respectively), while the right panel shows those from a scenario of higher retirement ages (58 and 52 for males and females, respectively). In comparison with the baseline projections, the median values of these projections show that the pension fund balance will get worse under the former scenario, while it will be significantly improved under the latter scenario. Indeed, we are finding the first case of a parameter that plays a particularly important role in the solvency of the pension fund.

Under lower retirement ages, the median forecast values indicate that the pension fund balance will be depleted in about 2043, which is about 9 years earlier than the baseline scenario. Estimates with a 90-percent confidence interval for this scenario show that the fund will become zero in as early as 2040, and 2046 at the latest. Conversely, the right panel shows that higher retirement ages will help to maintain the pension fund solvency for about 13 more years in comparison with the baseline case. The 90-percent confidence interval values now cover a wider range, from 2060 to 2072. All these estimates imply that the dominance of early retirement will become a great challenge for maintaining the long-term financial balance of the Vietnamese pension scheme.

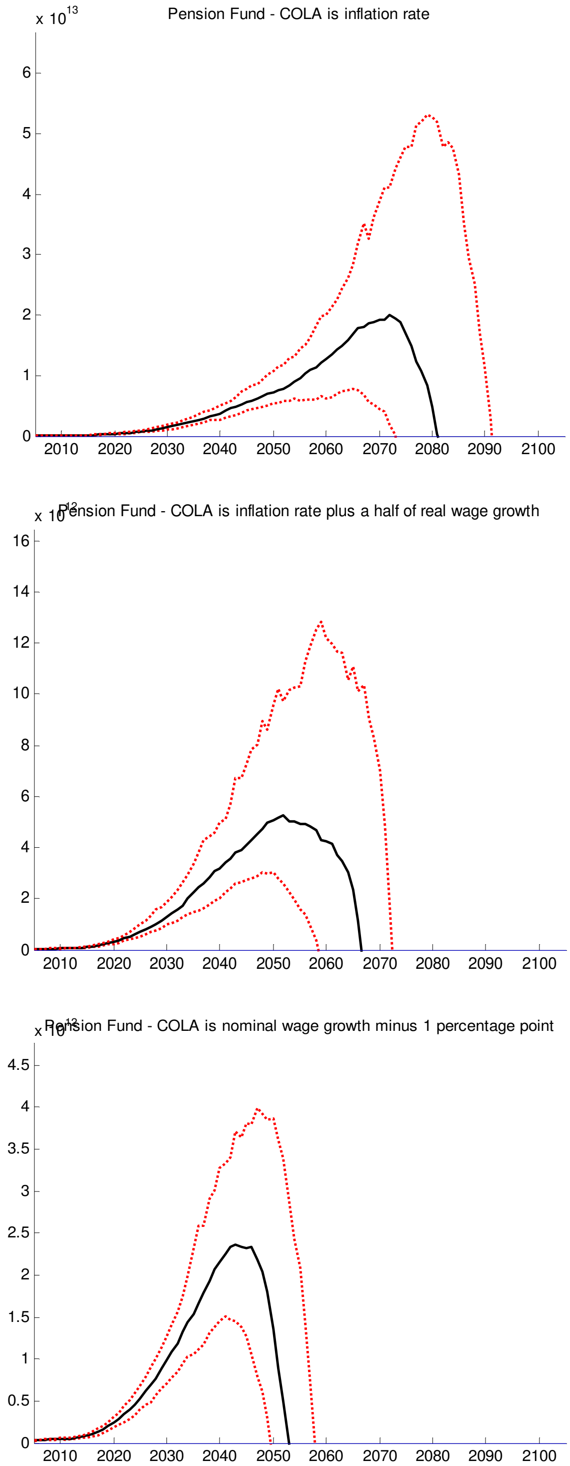
Figure 18. Pension Fund under Constant Administrative Costs, 2005-2105



Source: Own calculations.

Our estimated results in Figure 18 are found in the case that administrative costs will stay at 4 percent for the whole projection period. The median forecast values of the projections indicate that the pension fund will be depleted in 2051, which is just a year earlier than the baseline case. This means that, given other factors, the current administrative costs will not be determinant factor of the pension fund balance.

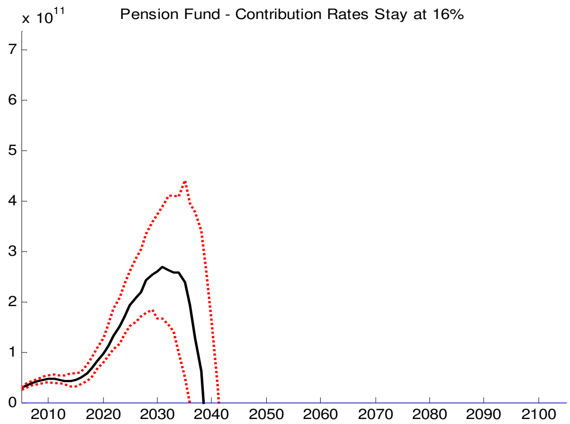
Figure 19. Changes in Pension Fund Indexation, 2005-2105



Source: Own calculations.

Figure 19 presents the results for three different cost-of-living adjustment (COLA) changes. The most upper figure shows stochastic projections for the pension fund balance interval when the COLA for pension benefits are indexed to inflation, instead of nominal wage growth. In comparison with the baseline estimates, the median forecast values in this case show that the pension fund will stay solvent for about 29 more years, i.e., it will be depleted in 2081. The 90-percent confidence interval values now range from 2074 to 2091. The middle figure shows the case when the COLA is equal to inflation rate plus one half of real wage growth. The pension fund would stay solvent for about 15 more years, i.e. it would be depleted in 2067. The 90-percent confidence interval values now range from 2058 to 2073. The last figure shows the results when changing the COLA to 1 percentage point less than the nominal wage growth. The median forecast values show that the pension fund will stay solvent until 2054, which is only two more years than will the fund in the baseline scenario. Modifying the COLA downward can substantially improve the solvency of the pension fund. With such a large impact, it is worthwhile to note that for the case of the United States, Pfau (2006) finds that among a variety of different ways to reduce pension benefits, a decrease in cost-of-living adjustments does provide an effective path to reform with minimal poverty increases for the elderly.

Figure 20. Pension Fund under Constant Contribution Rates, 2005-2105



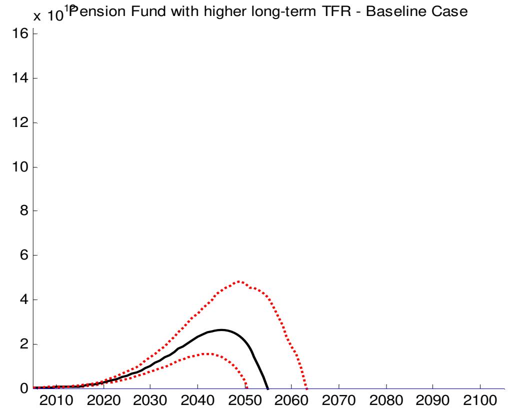
Source: Own calculations.

We also find an important role for the contribution rate in maintaining the pension fund balance. Figure 20 shows the estimated results for the pension fund balance when the contribution rate is kept constant at 16 percent. The median forecast values indicate that the pension fund will be depleted in about 2038, which is 14 years sooner than in the baseline projections. The 90-percent confidence interval values show a more narrow range, from 2036 to 2041. The estimates imply that contribution rates will become an important factor to maintain the pension fund balance. It does not mean, however, that the government can continue increasing the contribution rates, as we can expect disincentive effects for working and increased contribution evasion when social security taxes are too high.

5.4. Pension Fund Balance under Higher Long-term Total Fertility Rate

In order to see how demographic changes will influence the long-term pension fund balance, we assume that the long-term total fertility rate (TFR) for the Vietnamese population will fluctuate around 2.1, while other factors will be kept the same as those in aforementioned population projections.

Figure 21. Projected Pension Fund and Investment Income under Higher Long-term TFR, 2005-2105



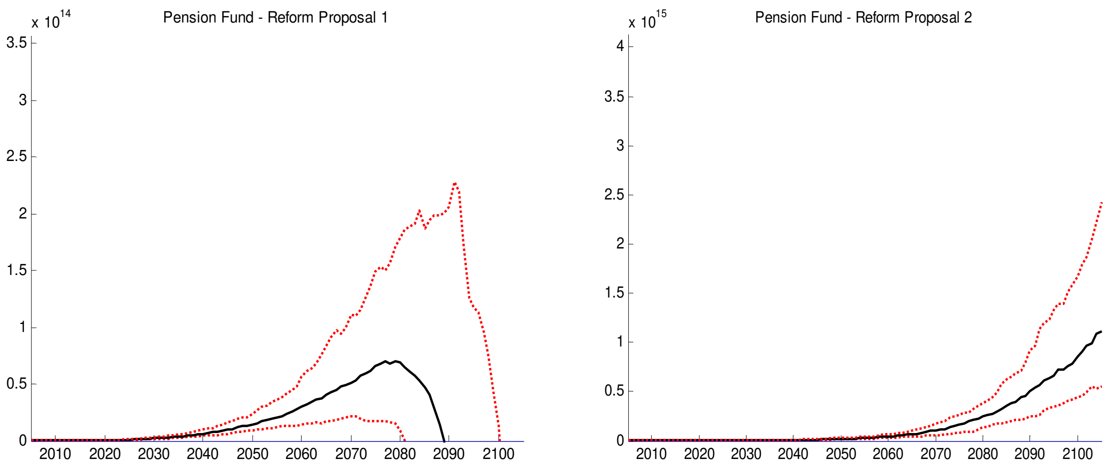
Source: Own calculations.

Figure 21 presents the estimated results for the pension fund balance when Vietnam has a higher long-term TFR. The median forecast values indicate that the pension fund will be depleted in about 2055, which is 3 years later than in the baseline projections under the lower long-term TFR assumption. The 90-percent confidence interval values show a wider range (about 13 years, from 2050 to 2063) than that of the baseline projections. Though the improvements are slight, higher fertility does extend the solvency of the pension fund by providing a larger contribution base.

5.5. Projection Results for the Pension Fund Balance: Reform Proposals

The estimated results from the baseline and sensitivity scenarios show that contribution rates, retirement ages, and indexation methods for pension benefits will be very important factors determining the long-term balance of the pension fund, while the other factors will not play a significant role. Under assumptions that Vietnam continues the current pension scheme and contribution rates will remain as regulated in the current Social Insurance Law, we will provide two proposals for maintaining the pension fund balance over a longer term: (i) the assumed retirement ages for males and females will increase to the normal retirement ages (60 and 55 for males and females, respectively), and (ii) the assumed retirement ages will increase as in (i) and the cost-of-living adjustments for pension benefits will be indexed to inflation.

Figure 22. Reform Proposals, 2005-2105



Source: Own calculations.

Our results for the two reform proposals are presented in Figure 22. For the first proposal, the median forecast values show that the pension fund balance will be substantially improved in comparison with the baseline case. For the median forecast, the fund will be depleted in 2088, which is 36 more years than in the baseline scenario. Under the second proposal, the pension fund will be sustainable and even accumulate large surpluses over the projection period.

6. CONCLUDING REMARKS

In this paper, we applied stochastic estimation techniques to some key variables related to population and macroeconomy in order to provide a long-term vision for the financial status of the Vietnamese pension scheme. The estimated results show that the pension fund will be depleted in about 2052 with a 90-percent confidence interval range of 8 years. Sensitivity tests indicate that the long-term pension fund balance will depend significantly on contribution rates, retirement ages, and indexation methods for pension benefits, while it will not depend much on coverage rates, administrative costs, the rate of return on investments, and fertility rates. Our reform proposals imply that increases in retirement ages and inflation indexation for the pension benefits will help to substantially improve the pension fund balance over the long run. With these results, we recommend that Vietnam reform the current pension scheme as soon as possible in order to maintain its long-term financial stability.

Although this paper could mitigate some limitations of the previous studies which used deterministic estimation techniques, it cannot avoid some limitations. First, due to the short length of Vietnamese historical data, the projections in this paper depend on a variety of strong assumptions. Second, the paper did not estimate financial gains and losses between participating generations of the scheme, which are useful for indicating whether the current pension scheme can maintain a generational balance under a stochastic environment. We hope to address these limitations in subsequent research.

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